EuroWD 2026

Institute of Science and Technology Austria

24th European Workshop on White Dwarfs

Institute of Science and Technology Austria
August 3-7, 2026

Conference Program & Abstract Booklet

Welcome!

Dear colleagues,

It is our great pleasure to welcome you to the **24th European Workshop on White Dwarfs**.

Since the first EuroWD meeting more than five decades ago, the conference has grown steadily alongside the field itself, bringing together more than 200 researchers from around the world for this year's workshop. White dwarf research continues to evolve at an extraordinary pace, driven by new facilities on the ground and in space, increasingly sophisticated theoretical models and numerical simulations, powerful new computational methods that are enabling us to extract new insights from an ever-growing volume of data, and unexpected discoveries that are reshaping our understanding. Together, these advances are creating unprecedented opportunities for discovery, making this a particularly exciting moment to be working in our field.

This year's scientific programme reflects both the breadth and vitality of our community. Over the coming week, we will hear about topics spanning the full diversity of white dwarf research, from stellar interiors and atmospheres to magnetism, accretion, binary evolution, stellar pulsations, planetary systems, transients, and compact binaries. We hope the meeting provides an opportunity not only to learn about the latest results, but also to discover connections between different areas of research and to exchange ideas across traditional boundaries.

One of the strengths of the EuroWD series has always been its collaborative atmosphere. Despite the impressive growth, it has retained the spirit of a close-knit community, bringing together researchers from many backgrounds and at all career stages, and creating opportunities for discussion that often continue well beyond the conference itself. We hope this year's meeting continues that tradition.

We wish you an enjoyable and stimulating workshop.

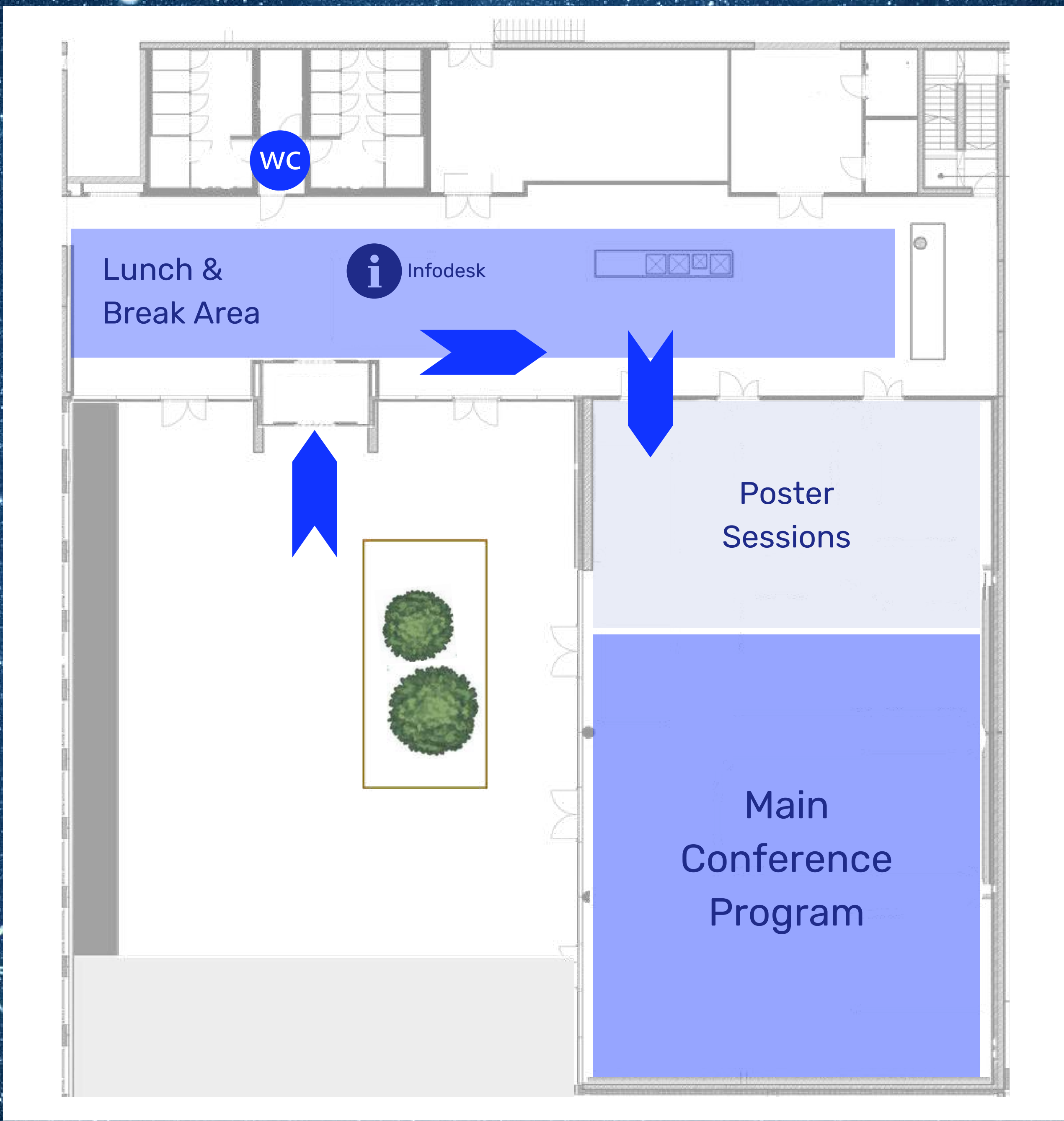
The Scientific Organizing Committee

Content

Campus Map

Institute of Science and Technology Austria

Floorplan
Moonstone Seminar Center



Social Program

WELCOME EVENING

Sunday, August 2, 2026

From 7:00 pm to 11:00 pm we will meet at Badeschiff Wien. This informal gathering offers participants an opportunity to meet colleagues and fellow attendees before the start of the conference program. Located on the Danube Canal, the venue provides a relaxed setting for networking and conversation. Each participant will receive one complimentary welcome drink voucher upon arrival. Additional beverages can be purchased directly at the venue and may be paid for by credit or debit card.

CONFERENCE DINNER

Tuesday, August 4, 2026

The Conference Dinner will take place in the 19th district of Vienna, at Weingut Feuerwehr Wagner. Shuttle buses will be provided from the conference venue to the dinner location. Guests will enjoy a diverse buffet featuring a selection of traditional Austrian delicacies.

SOCIAL ACTIVITY

Thursday, August 6, 2026

Starting at 6:00 pm, participants will enjoy a guided tour of Stift Klosterneuburg, one of the region's most important historical and cultural landmarks, followed by a small wine tasting.

Conference Program

Time	Monday 03 Aug 2026	Tuesday 04 Aug 2026	Wednesday 05 Aug 2026	Thursday 06 Aug 2026	Friday 07 Aug 2026
08:30	bus departure in Vienna	bus departure in Vienna	bus departure in Vienna	bus departure in Vienna	bus departure in Vienna
09:15	coffee				
09:30	welcome remarks	S2.1 Advances in WD Modeling	S3.1 WDs in PCEBs	S4.1 CVs and Accreting WDs	S5.1 Hypervelocity Supernova Survivors + ELMs
09:45	S1.1 WD Populations				
10:45-11:30	coffee break (45 min)	group photo + coffee (45 min)	coffee break (45 min)	coffee break (45 min)	coffee break (45 min)
11:30	S1.2 Clusters, Wide Binaries + IFMR	S2.2 WD Magnetism	S3.2 WD Population Synthesis	S4.2 WD Debris	S5.2 WD Supernova Connections
12:30					concluding remarks
12:45-13:45	lunch (1 hr)				
13:45	poster session (45 min)	S2.3 WD Magnetism	poster session (45 min)	S4.3 WD Transits and Direct Imaging	
14:00					bus departure
14:30	S1.3 Large Spectroscopic Surveys		S3.3 Rare Accreting WDs		
15:15		coffee break (45 min)			
15:30-16:00	coffee break (30 min)		bus to Vienna / Schwedenplatz	coffee break (30 min)	
16:00	S1.4 Asteroseismology + Hot WDs	S2.4 Q branch + Massive WDs	early afternoon	S4.4 WD Debris	
17:15	bus to Vienna / Schwedenplatz	bus departure		bus departure	
		conference dinner		social activity	

Conference Program

Day 1, Monday, August 3, 2026

Time	Session	Author	Title
09:15	Coffee		
09:30	Welcome remarks		
09:45	**Session 1.1 WD Population**	**Mairi O'Brien**	White dwarfs within 13 pc: Insights from HST near-UV spectroscopy
10:00		**Akash Vani**	Dead Stars Tell the Tale: Using Main-Sequence Stars, Giants, and White Dwarfs to Reconstruct the Milky Way's History
10:15		**Emily Roberts**	Simulating all-sky and part-sky 100pc white dwarf samples
10:30		**Gracyn Jewett**	The Upper Mass Limit and Merger Fraction of Ultra-massive White Dwarfs
10:45	Coffee break 45 minutes		
11:30	**Session 1.2 Clusters, Wide Binaries + IFMR**	**David Miller**	New constraints and open questions in the cluster white dwarf initial-final mass relation
11:45		**María Jesús Flores Moraga**	Refining the Low-Mass End of the IFMR with Gravitational Redshifts in WD + Subgiant Binaries
12.00		**Stefan Arseneau**	Constraints on White Dwarf Stellar Structure with Gravitational Redshifts
12:15		**Aina Ferreri Burjachs**	Low-mass white dwarfs in wide binaries: uncovering hierarchical triples and alternative formation channels
12:30		**Alexander Venner**	Digging Deeper for Dog Stars: The Search for Hidden Nearby White Dwarfs in Multi-star Systems
12:45	Lunch 1 hour		
13:45	Poster session 45 minutes		
14:30	**Session 1.3 Large Spectroscopic Surveys**	**Andrew Swan**	The DESI DR1 white dwarf catalogue
14:45		**James Munday**	Classifying white dwarfs from multi-object spectroscopy surveys with machine learning
15:00		**Sicheng Yu**	Measuring white dwarf parameters using noisy spectra
15:15		**Xander Byrne**	Big-data methods for polluted white dwarfs: past, present, and future
15:30	Coffee break 30 minutes		
16:00	**Session 1.4 Astero-seismology + Hot WDs**	**Steven Savery**	XCov31: Concurrent Multi-wavelength Photometry of the DAV G29-38
16:15		**Kaylee Grace**	The Blue Edge of the Helium White Dwarf Instability Strip
16:30		**Paulina Sowicka**	Pulsations and Abundances of PG 1159 Stars: New Observational Constraints on the GW Vir Instability Strip
16:45		**Tiara Battich**	Formation of trans-iron elements in H-deficient WDs precursors
17:00		**Semih Filiz**	Spectral Analysis of the Largest Far-Ultraviolet Sample of Hot, Hydrogen-Rich White Dwarfs

Day 2, Tuesday, August 4, 2026

Time	Session	Author	Title
09:15	Coffee		
09:30	**Session 2.1 Advances in WD Modeling**	**Evan Bauer**	Building and Testing New White Dwarf Physics Capabilities at LLNL
09:45		**Antoine Bédard**	A new generation of STELUM white dwarf cooling models
10:00		**Bart Dunlap**	Inconsistencies in White Dwarf Balmer Lines
10:15		**Piotr Kowalski**	Revising Chemical Equilibrium in Atmospheres of Cool White Dwarfs
10:30		**Jackson White**	A New Approach to Modeling Quasi-H2+ in DA White Dwarf Stars
10:45	Group photo + Coffee break 45 minutes		
11:30	**Session 2.2 WD Magnetism**	**Larissa Luciano Amorim**	Investigating the Origin of Magnetic Fields in White Dwarfs through Rotational and Physical Correlations
11:45		**Michael Stroet**	Are seemingly constant magnetic white dwarfs rapidly rotating?
12.00		**Aayush Desai**	Fast, Massive, Magnetic: Our ZTF Search for White Dwarf Merger Remnants
12:15		**Abbigail Elms**	A unified view of Balmer emission line white dwarfs
12:30		**Adam Moss**	Insights into the Origin of Magnetism from the SDSS 100 pc Sample
12:45	Lunch 1 hour		
13:45	**Session 2.3 WD Magnetism**	**Maria Camisassa**	A Long-Lived, Deep-Seated Main-Sequence Magnetic Field Emerging in the White Dwarf Phase
14:00		**Lukas Einramhof**	Magneto-archeology of white dwarfs
14:15		**Matias Castro-Tapia**	Is a Crystallization-driven Convection Dynamo Plausible for explaining Magnetic White Dwarfs?
14:30		**Rafael Fuentes**	Stirring White Dwarfs via Compositional Convection, Crystallization-driven dynamos and Accretion-driven Convection
14:45		**Valentin Skoutnev**	Magnetized Thermohaline Convection in Accreting and Crystallizing White Dwarfs
15:00		**Ana Carolina Antonini Santa Rosa**	Evolution and Formation of Ultramassive White Dwarf Stars
15:15	Coffee break 45 minutes		
16:00	**Session 2.4 Q branch + Massive WDs**	**Henry Sanford-Crane**	Demographic Dissection of the Gaia Q-Branch Reveals the Crystallization Delay in Massive White Dwarfs
16:15		**Lou Baya Ould Rouis**	White Dwarf Merger Remnants with Cooling Delays on the Q Branch Lack Strong Magnetism
16:30		**Nicholas Rui**	Forging neon-distilling white dwarfs in the stellar engulfments of helium white dwarfs
16:45		**Camila Damia Rincón**	Evolutionary models for carbon-rich white dwarfs
17:00		**Max Pritzkuleit**	From helium white dwarf mergers to helium giants - The intermediate-mass stripped star impostors
17:15	Bus departure to conference dinner		

Day 3, Wednesday, August 5, 2026

Time	Session	Author	Title
09:15	Coffee		
09:30	**Session 3.1 WDs in PCEBs**	**Steffani Grondin**	The First Population of White Dwarf+Main-Sequence Binaries in Star Clusters: A New Window into Common Envelope Evolution
09:45		**Andrija Zupic**	Variability analysis and SED modeling of WDMS binaries using multi-survey data
10:00		**Amalie Yates**	Long-term eclipse time variations in white dwarf binaries
10:15		**David Wilson**	Hidden white dwarfs in the nearest Post Common Envelope Binaries
10:30		**Steven Parsons**	White dwarfs in close binaries with substellar companions
10:45	Coffee break 45 minutes		
11:30	**Session 3.2 WD Population Synthesis**	**Katie Breivik**	Simulating the population of white dwarf - main sequence binaries with COSMIC-METISSE
11:45		**Cheyanne Shariat**	A global view of post-interaction white dwarf-main sequence binaries
12.00		**Alex Duran-Reyes**	Stability Limits for Binary Mass Transfer in low- and intermediate-mass stars with MESA
12:15		**Natsuko Yamaguchi**	Population demographics of post-interaction WDMS binaries from Gaia
12:30		**Alejandro Santos-García**	A Self-Consistent Population Synthesis Study of White Dwarf–Brown Dwarf Binaries
12:45	Lunch 1 hour		
13:45	Poster session 45 minutes		
14:30	**Session 3.3 Rare Accreting WDs**	**William Weitian Yu**	Constraining the Formation Channels of AM CVn Stars
14:45		**Iris de Ruiter**	A New Population of Coherent Radio Emitters: White Dwarf Binaries
15:00		**Geoffrey Mo**	Exotic white dwarfs in the core of 47 Tuc revealed by a HST UV time-domain survey
15:15		**Andrei Cristea**	J2008, you still speak in riddles': a peculiar white dwarf merger remnant with a half-ring of circumstellar material
15:30	Bus departure to Vienna		

Day 4, Thursday, August 6, 2026

Time	Session	Author	Title
09:15	Coffee		
09:30	**Session 4.1 CVs and Accreting WDs**	**Anna Francesca Pala**	Accreting white dwarfs as probes of compact binary evolution
09:45		**Santiago Hernández Díaz**	Unveiling the period-bounce population of Cataclysmic Variables Spectroscopic and time-domain follow-up of eROSITA-selected candidates
10:00		**Soumyadeep Bhattacharjee**	Thermally Inflated Accretors: Insights from Young White Dwarf Binaries
10:15		**Irin Babu Vathachira**	WRLOF Accretion in WD–AGB Binaries
10:30		**Param Rekhi**	Barium Dwarfs in Disguise: s-process Enrichment in Gaia MS+WD Binaries
10:45	Coffee break 45 minutes		
11:30	**Session 4.2 WD Debris**	**Snehalata Sahu**	Frequency and composition of planetary debris around young white dwarfs: Insights from HST/COS snapshot survey
11:45		**Xabier Pérez Couto**	Reconstructing the kinematic history of polluted white dwarfs: stellar flybys and molecular cloud encounters
12.00		**Jamie Williams**	A white dwarf accreting a second-generation planet
12:15		**Rudy Morales**	Infrared Excess and Metal Pollution in White Dwarfs from HETDEX
12:30		**Tim Cunningham**	JWST Time-Domain View of Planetary Debris: Tracking Disk Variability and Accretion in G29-38
12:45	Lunch 1 hour		
13:45	**Session 4.3 WD Transits and Direct Imaging**	**Jan van Roestel**	Disappearing white dwarfs; a systematic search for transiting and eclipsing white dwarfs with ZTF
14:00		**Akshay Robert**	A complete characterisation of the transiting debris disk at WD1054–226
14:15		**Aaron Householder**	Bigger than the Whole Star: Transiting Planets around White Dwarfs from ZTF
14:30		**Laura Rogers**	A Panoramic View of Rapid Dust Production by Disintegrating Asteroids around a White Dwarf
14:45		**Sergio Humberto Ramirez Ramirez**	WD Planetary Systems Through the Looking Gas
15:00		**Felipe Lagos-Vilches**	Observational Constraints on the Incidence of Substellar Companions to Young Massive White Dwarfs with VLT/ERIS
15:15		**Sabrina Poulsen**	A Probable Planet Detected via IR excess around WD 0644+025
15:30	Coffee break 30 minutes		
16:00	**Session 4.4 WD Debris**	**Hiba tu Noor**	Tracking Accretion Rate Changes at Polluted White Dwarfs
16:15		**Wenjun Chen**	3D Convection Corrections in Metal-Polluted White Dwarfs
16:30		**Érika Le Bourdais**	Same Stars, Different Model: A Cross-Model Comparison of Polluted White Dwarf Atmosphere Characterization
16:45		**Stefano Bagnulo**	Magnetically guided accretion and extremely slow rotation in a metal-enriched white dwarf
17:00		**Dang Pham**	The Effects of Magnetic Accretion on the Spatial Extent of White Dwarf Pollution

Day 5, Friday, August 7, 2026

Time	Session	Author	Title
09:15	Coffee		
09:30	**Session 5.1 Hypervelocity Supernova Survivors + ELMs**	**Kareem El-Badry**	Hypervelocity white dwarfs as messengers from thermonuclear supernovae
09:45		**Aakash Bhat**	A New High-Velocity LP 40-365 Type Star And The Fault In Our Type Iax Supernova Deflagration Models
10:00		**Mark Hollands**	Spectral analyses of double-detonation supernova survivors
10:15		**Ruediger Pakmor**	Connecting hypervelocity stars with exploding white dwarfs via numerical simulations
10:30		**Gabriela da Rosa**	Investigating the origin of the lowest-mass white dwarf stars
10:45	Coffee break 45 minutes		
11:30	**Session 5.2 WD Supernova Connections**	**Giovanni Stimamiglio**	3D MHD Simulations of Double ONe White Dwarf Mergers
11:45		**Na'ama Hallakoun**	IK Pegasi and the Double-merger Path to Type Ia Supernovae
12.00		**Stephania Hernandez**	Building Double-Detonation Supernovae: The Evolutionary Pathway of WD+sdB Binaries
12:15		**Dan Maoz**	The Galaxy's double white dwarf merger rate: four measurements
12:30	Concluding remarks		

Talk Abstracts

White dwarfs within 13 pc: Insights from HST near-UV spectroscopy

Mairi O'Brien[1], P.-E. Tremblay[1], B.T. Gaensicke[1], D. Koester[2], M.A. Hollands[1], S. Sahu[1], A. Bedard[1], A.M. Buchan[1], T. Cunningham[3], J.H. Debes[4], J.J. Hermes[5], P.M. Kowalski[6]

[1] *Department of Physics, University of Warwick*
[2] *Institut für Theoretische Physik und Astrophysik, University of Kiel*
[3] *Center for Astrophysics, Harvard & Smithsonian*
[4] *ESA for AURA, The Space Telescope Science Institute*
[5] *Department of Astronomy & Institute for Astrophysical Research, Boston University*
[6] *Institute of Energy Technologies – Theory and Computation of Energy Materials (IET-3), Forschungszentrum Julich GmbH*

I will present a multi-wavelength analysis of the 43 confirmed white dwarfs within 13 pc. By combining flux-calibrated near-UV spectroscopy from HST STIS (PID 14076) with ground-based optical spectra, and Gaia, 2MASS and WISE photometry, I have employed a hybrid fitting method to derive atmospheric parameters for this volume-limited sample. I report a systematic discrepancy in cool H-atmosphere white dwarfs (Teff <10 000 K), where the inclusion of flux-calibrated STIS spectra results in effective temperatures 2 – 6 per cent larger than those derived from optical and infrared photometry. For seven stars in the sample, UV spectra revealed metal pollution or carbon features that were not detectable in optical spectra. Through testing the hydrogen and carbon content of DQ and DC white dwarfs, I found no measurable difference in hydrogen, but lower carbon in DCs. I will discuss the metal pollution rates, binarity, and variability of the sample.

Finally, I will highlight how our upcoming JWST Cycle 5 program (PID 10131) will complement this work, enabling further tests of model systematics and opacity issues by observing the 13 pc sample in the near- and mid-infrared.

Simulating all-sky and part-sky 100pc White Dwarf samples

Emily Roberts[1], Pier-Emmanuel Tremblay[1], Silvia Toonen[2]

[1]Department of Physics, University of Warwick, Coventry CV4 7AL, UK
Emily.Roberts.1@warwick.ac.uk
[2]Anton Pannekoek Institute for Astronomy, University of Amsterdam, 1090 GE Amsterdam, The Netherlands

Using Gaia data alongside large-scale multi-object spectroscopic follow up surveys such as DESI, WEAVE, 4MOST etc, it is possible to build representative, minimally biased samples of the local white dwarf population. We have built a simulation of the local population and compare it to volume limited 100pc samples to assess completeness, star formation histories and the effects of part-sky/all-sky surveys. We find that even samples with no medium-resolution spectroscopy coverage can constrain the local star formation history with high accuracy. Additionally, part-sky samples still reflect a full population, making them useful for constraining Galactic parameters.
Improving our simulations (which previously only looked at single white dwarfs) we now account for binary evolution (mass transfer, mergers, low mass white dwarfs) using the SeBa code. Another previous difficulty in exploring the whole white dwarf population is Gaia's on-sky resolution limit: objects that have an angular separation of <~0.4 arcseconds are fitted as a single object, altering the observed mass distribution and implying white dwarfs of unphysical masses or evolution histories. By including these features, we are better prepared for future data releases such as Gaia DR4, and can better investigate parameters of the white dwarf population such as the mass distribution

The Upper Mass Limit and Merger Fraction of Ultra-massive White Dwarfs

Gracyn Jewett[1], Mukremin Kilic[1], Pierre Bergeron[2], Warren R. Brown[3], Alex Gleason[1]

[1]University of Oklahoma, [2]Université de Montréal, [3]Center for Astrophysics Harvard & Smithsonian

We performed a spectroscopic survey of all known white dwarfs with M > 1.3 Msol and T > 11,000K identified through Gaia DR3 astrometry from the Gentile-Fusillo et al. 2021 catalogue.
Of the 293 white dwarf candidates in this catalog that met our criteria, 259 of these had no optical spectroscopy available in the literature and no spectral classification. We have obtained spectroscopic follow up on 95% of our sample and have constrained the atmospheric composition and mass for each object. For a selection of magnetic white dwarfs, we used offset dipole models to constrain the magnetic field strength and geometry and calculate the magnetic fraction as a function of mass. Because our temperature criteria overlaps with the ZZ Ceti instability strip, we find a new selection of ultra-massive pulsators candidates which we are obtaining time-series photometric follow up. Through low-resolution spectroscopy, we found an empirical upper limit to white dwarf mass and provide a precise merger rate for white dwarfs close to the Chandrasekhar limit by searching for merger remanent characteristics (magnetism, unusual atmospheric composition, kinematics, and rapid rotation rates). We will present the details and results of our survey in this talk.

Session 1.2 | Clusters, Wide Binaries + IFMR

New constraints and open questions in the cluster white dwarf initial-final mass relation

David Miller, Jeremy Heyl

University of British Columbia

In recent years, Gaia has driven major progress in the empirical white dwarf initial-final mass relation (IFMR). We present results from a series of recent and ongoing studies aimed at improving the cluster-based empirical WD IFMR, including construction of the most comprehensive open cluster WD IFMR to date, analysis of previously unexamined cluster WD candidates from large spectroscopic surveys, and targeted work on the progenitor mass gap around 2 to 2.7M⊙ highlighted by the expanded sample. This progenitor mass range is especially important because it may contain a non-monotonic feature in the IFMR linked to the onset of carbon star formation. Together, these efforts have substantially expanded both the Gaia-based and overall cluster WD samples and yielded the first spectroscopically confirmed cluster-member WDs within this gap. We discuss the implications of these results and the ongoing challenges in further improving the empirical WD IFMR.

Refining the Low-Mass End of the IFMR with Gravitational Redshifts in WD + Subgiant Binaries

María Jesús Flores Moraga

Pontificia Universidad Católica de Chile

The initial-to-final mass relation (IFMR) constrains late-stage stellar evolution by tracing mass-loss processes that are challenging to observe directly. Semi-empirical determinations of the IFMR require both the WD mass and the progenitor's zero-age main-sequence mass, the latter inferred indirectly. Most IFMR studies rely on open clusters (OCs), whose populations are biased toward young and massive stars, limiting the low-mass regime constraints. Wide binary (WB) systems offer a powerful alternative as they represent the smallest analogs of OCs, spanning a broader range of masses. In particular, WD + subgiant (SG) systems allow for precise age estimates via isochrone fitting. Using a subset of the WD + SG sample from Barrientos & Chanam´e (2021), we reduce uncertainties in mass determinations, typically on the order of 0.1 M⊙. For this purpose, we derive masses for five WDs combining gravitational redshift (VGR) with u(SDSS) + griz(PanSTARRS) photometric radii. We measure VGR) from new UVES spectra by fitting Balmer line centroids with both S´ersic profiles and atmospheric models, then correcting for the companion radial velocity. We achieve average uncertainties below 0.05 M⊙ refining the IFMR at the low-mass end. By August, the sample will exceed 20 WDs observed with UVES, strengthening its observational constraints.

Session 1.2 | Clusters, Wide Binaries + IFMR

Constraints on White Dwarf Stellar Structure with Gravitational Redshifts

Stefan M. Arseneau

Boston University

Variations in white dwarf structure produce detectable signals in gravitational redshift. For a 0.6 solar mass white dwarf, variations in the thickness of the hydrogen layer produce detectable signals in the star's gravitational redshift on the order of 1 km/s. For the most massive white dwarfs, models assuming a carbon-oxygen core predict gravitational redshifts which are smaller by ~3 km/s than those predicted from assuming an oxygen-neon core. Therefore, gravitational redshift measurements can be used as largely model-independent probes of white dwarf stellar structure. In this talk, I present efforts to measure the thickness of the white dwarf hydrogen layer via gravitational redshift measurements by combining direct gravitational redshift measurements from wide binary systems with statistical radial velocity measurements of individual white dwarfs. In addition, I will present ongoing efforts to use a gravitational redshift measurement for an ultramassive (~1.2 solar masses) white dwarf to measure its core composition.

Low-mass white dwarfs in wide binaries: uncovering hierarchical triples and alternative formation channels

Aina Ferreri Burjachs, Alberto Rebassa Mansergas, Roberto Raddi

Universitat Politècnica de Catalunya (UPC)

Single-star evolution does not predict the formation of white dwarfs of masses lower than ~0.55 Msun, since they would require longer than the Hubble time to evolve off the main sequence. Nevertheless, low-mass white dwarfs are frequently observed and are generally thought to originate from binary interactions that truncate stellar evolution. Using the Gaia archive, we have identified common proper-motion pairs consisting of a low-mass white dwarf and a non-degenerate companion. The separations of these systems are typically too large for the low-mass white dwarfs to have formed through common-envelope evolution. A plausible explanation is therefore that the white dwarfs belong to unresolved close binaries within hierarchical triple systems. We obtained follow-up spectroscopy for a sample of about 100 of such white dwarfs and found that up to one quarter shows signatures consistent with hierarchical triple configurations. The remaining 75%~ may be unidentified triple systems due to observational biases or genuine binaries, suggesting that additional, previously unexplored evolutionary pathways can contribute to the formation of low-mass white dwarfs in wide systems. In this contribution we provide an updated census of hierarchical triple system candidates as well as evidence for a population of wide binaries hosting low-mass white dwarfs. Both findings offer important constraints for population-synthesis models aimed at understanding the formation channels and Galactic occurrence of these systems.

Session 1.2 | Clusters, Wide Binaries + IFMR

Digging Deeper for Dog Stars: The Search for Hidden Nearby White Dwarfs in Multi-star Systems

Alexander Venner

Max Planck Institute for Astronomy

The Gaia mission has revealed the local white dwarf population as never before, bringing the census of nearby white dwarfs near to completeness. The last remaining “pocket of resistance” is white dwarfs in close binaries, a sample that is known to be substantially incomplete and require dedicated observations for detection. I present results from an ongoing effort to assemble a census of white dwarf companions to solar-type stars within the 40 parsec volume. Combining Gaia with ground-based spectroscopy and high-contrast imaging, we detect new local white dwarfs in so-called “Sirius-like systems”, the first majority-complete sample of its kind beyond 10 parsecs. Highlights include a white dwarf companion serendipitously observed by JWST, and new white dwarfs with precise dynamical masses. Beyond completing the white dwarf census, these systems present novel tests of white dwarf models by providing combined independent age and mass estimates, and allow for new understanding of how the calamitous evolution of white dwarf progenitors impacts their broader systems.

Session 1.3 | Large Spectroscopic Surveys

The DESI DR1 white dwarf catalogue

Andrew Swan, Boris Gansicke, Paula Izquierdo

University of Warwick

The first data release from the Dark Energy Spectroscopic Instrument has yielded the largest sample of spectroscopically-confirmed white dwarfs, observed in an almost-unbiased, magnitude-limited survey. Our catalogue contains 44 000 white dwarfs, around two-thirds of which are newly identified, all with spectral classifications and stellar parameters from model-fitting. Highlights include many new planetary systems and interacting binaries, plus some rare and exotic objects. I will give a brief overview of the catalogue, tips on how to get the most from it, and some of the early results.

Classifying white dwarfs from multi-object spectroscopy surveys with machine learning

James Munday

University of Potsdam

Tens to hundreds of thousands of white dwarf spectra are anticipated from multi-object spectroscopy (MOS) surveys in the next decade. While one could spend months visually classifying spectral types in a large sample, a complete by-eye classification is both inefficient and unnecessary for most white dwarf applications. I will present the results of a machine learning approach to classify DESI DR1 spectra enhanced with Pan-STARRS photometry, where DA, DB,
DC and DZ white dwarfs are identified at a near-100% efficiency in milliseconds.
I will also highlight how machine learning and dimensionality reduction techniques can augment traditional methods to enable rapid, targeted analysis of new MOS data releases. Highly spectroscopically variable sources are easily detectable with our methods, which led to the discovery of new 'double-faced' white dwarfs. Finally, I will demonstrate that many double white dwarf binaries can be reliably identified using machine learning and Pan-STARRS photometry alone. On top of new binary detection, this method serves as an ideal means to clean a white dwarf sample of stellar binaries when inferring single star population statistics.

Session 1.3 | Large Spectroscopic Surveys

Measuring white dwarf parameters using noisy spectra

Sicheng Yu, Vitaly Neustroev

Space Physics and Astronomy Research Unit, University of Oulu

The Gaia era has dramatically expanded the census of known white dwarfs (WDs) to over one million. In parallel, large-scale spectral surveys have provided spectroscopic confirmation for tens of thousands of these objects. While high-resolution spectral observations continue to provide "gold-standard" parameters for approximately 1000 objects (the SPY survey), the vast majority of available WD spectra originate from lower signal-to-noise-ratio surveys. Traditional profile-fitting methods often struggle with these data due to noise-driven degeneracies, leading to significant uncertainties in the estimation of fundamental parameters such as effective temperature and surface gravity. We present an alternative approach to characterize DA WDs by measuring specific line parameters over profile fitting. Our method utilizes the equivalent widths (EWs) of Balmer absorption lines and their respective ratios, integrated with color information from Gaia DR3 photometry. However, no distance estimate is needed. By establishing a relation between Balmer line EW behavior, color indices, and atmospheric models, we provide a more accurate constraint on the atmospheric parameters than traditional methods. Applying this framework to SDSS and LAMOST datasets, we are constructing a comprehensive database of WD atmospheric parameters. Our results allow for maximizing the scientific return of large-scale spectroscopic campaigns in the era of big data astronomy.

Big-data methods for polluted white dwarfs: past, present, and future

Xander Byrne

Institute of Astronomy, University of Cambridge

With enormous spectroscopic surveys coming online, the opportunity for polluted white dwarfs to reveal exoplanet compositions has never been greater. This bounty, however, introduces a new challenge: how can we find and analyse polluted white dwarfs automatically? Among the biggest of big-data astronomy to date is Gaia DR3, with 350k WDs among its 2b stars; I discuss and compare different methods for identifying metal pollution in this huge dataset. More recently, 4MOST, WEAVE and SDSS-V have followed DESI into first light, their spectra containing more detailed signals of metal pollution and WD spectral evolution. I present some work outlining how medium-resolution spectroscopic datasets like these can be sorted into spectral types, applying an early machine learning method to the DESI EDR. Finally, I will present some preliminary results from cecilia v2, a neural network interpolator for fitting the abundances of high-resolution polluted WD spectra.

Session 1.4 | Asteroseismology + Hot WDs

XCov31: Concurrent Multi-wavelength Photometry of the DAV G29-38

Steven Z. Savery, Kaylee E. Grace, and Judi L. Provencal

University of Delaware and Mt. Cuba Astronomical Observatory

From October 11th through November 6th, 44 telescopes took part in the XCov31 campaign to observe G29-38 concurrently in optical and infrared wavelengths. Our aim was to determine how G29-38's debris disk reprocesses the pulsations, with the goal of characterizing the disk composition and structure. The optical photometry provides for the identification of G29-38's pulsation frequencies used to probe the infrared observations. We have identified 73 unique parent frequencies and 28 combination frequencies in the optical G29-38 light curve. Of these 101 frequencies, we matched 13 to frequencies detected in the SDSS i', r', and z photometry, and matched an additional 4 to frequencies detected in the K long photometry. We detected 6 frequencies in the K band photometry that do not match any frequencies observed in the optical.

At K band wavelengths, the debris disk provides about 50 percent of the total flux. Finding distinct frequencies in the K band that are not seen in the optical observations is unexpected and points to an origin in the disk. We will present a progress report on the ongoing analysis of this unique data set.

The Blue Edge of the Helium White Dwarf Instability Strip

Kaylee Grace, Judith L. Provencal

University of Delaware & Mt. Cuba Astronomical Observatory

The empirical blue edge of the helium atmosphere white dwarf (DB) instability strip in the temperature/log g plane provides a benchmark that can be used to constrain theoretical assumptions of convective parameters. The blue edge was previously defined by PG 0112+104 (31,300 K). In 2017, K2 observations confirmed that PG 0112+104 is a pulsator and must lie within the instability strip, leaving the empirical location of the blue edge unconstrained (Hermes et al. 2017). We received HST Cycle 30 time to obtain COS observations of seven DBs near the blue edge, including PG 0112+104, with the goals of establishing the blue edge's location and exploring the

nature of the hot DBs inhabiting the "DB gap." We present a first look at the spectra, line identifications, Teff, log g, and chemical abundance estimates. The final results of this study will be useful to 1) calibrate mixing length theory, 2) validate 3D hydrodynamical simulations, 3) constrain contributions of different driving mechanisms initiating pulsations, and 4) improve our understanding of mixing and diffusion in white dwarf atmospheres.

Session 1.4 | Asteroseismology + Hot WDs

Pulsations and Abundances of PG 1159 Stars: New Observational Constraints on the GW Vir Instability Strip

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PG 1159 stars are hot, hydrogen-deficient pre-white dwarfs and the main progenitors of hydrogen-deficient white dwarfs. A subset of them pulsates, but the GW Vir instability strip is not pure - not all stars within its borders show pulsations. An observed dichotomy between all nitrogen-rich PG 1159 stars being pulsators, while nitrogen-poor ones mostly do not pulsate, suggests a link between pulsational instability and evolutionary history, but recent observations have shown that this picture is more complex than originally thought.
We present results from recent time-series photometric observations of PG 1159 stars, including new pulsating stars, and discuss how these results refine the observed instability strip and test the nitrogen dichotomy scenario. Among the new results, we report on the asteroseismic analysis of a GW Vir pulsator discovered in Kepler data. We also present preliminary results from a spectroscopic program targeting atmospheric parameters and surface abundances including helium, carbon, and nitrogen, for a sample of PG 1159 stars with previously insufficient spectroscopic data. Together, these new photometric and spectroscopic results contribute to a more complete observational picture of the GW Vir instability strip and provide new constraints on the evolutionary histories of PG 1159 stars.

Formation of trans-iron elements in H-deficient WDs precursors

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One of the main evolutionary channels for the formation of hydrogen-deficient WDs is the occurrence of a very late thermal pulse (VLTP) after the star departs from the AGB. Interestingly, the conditions of VLTPs (violent H burning in the hot He- and C-rich interior) are those required for the occurrence of the intermediate neutron-capture process. In this work, we present detailed nucleosynthesis calculations during VLTP events in hot pre-WDs, using the recently developed Astrophysical Nucleosynthesis Tool (ANT) to explore the formation of trans-iron elements in these precursors of H-deficient WDs.

Session 1.4 | Asteroseismology + Hot WDs

Spectral Analysis of the Largest Far-Ultraviolet Sample of Hot, Hydrogen-Rich White Dwarfs

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University of Heidelberg
University of Tübingen

Hydrogen-rich white dwarfs (WDs) dominate the WD population, yet their youngest and hottest members (Teff ≥ 50 kK) are intrinsically rare due to their short evolutionary timescales. As a result, our understanding of the physical processes governing these early cooling stages remains limited by low-number statistics.
Within the HST large program 17112, we obtained 85 far-UV spectra of hot, H-rich WDs. This unique dataset enables robust determinations of effective temperatures and metal abundances from fully metal line-blanketed, non-local thermodynamic equilibrium model atmospheres. The sample includes 7 close and 5 wide binary systems, as well as 9 central stars of planetary nebulae and 3 objects exhibiting the ultra-high excitation (UHE) phenomenon. We present first results on how metal abundance patterns evolve along the early WD cooling sequence, providing new observational constraints on diffusion theory. We further explore the impact of binary evolution and the UHE phenomenon on atmospheric composition.

Session 2.1 | Advances in WD Modeling

Building and Testing New White Dwarf Physics Capabilities at LLNL

Evan Bauer

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Modeling white dwarfs requires several plasma physics inputs: opacities, equations of state, and transport coefficients. Theoretical and experimental plasma physics capabilities at Lawrence Livermore National Laboratory (LLNL) offer great promise for advancing available modeling inputs in these areas. This talk will describe ongoing efforts to translate existing lab capabilities into useable stellar modeling tools to improve the physical fidelity of white dwarf models. In particular, we are developing EOS capabilities in the challenging "warm dense matter" regime where current white dwarf models often must fall back on unreliable interpolation and extrapolation. These new EOS capabilities have been validated against high-pressure experiments at LLNL, and will enable far more robust modeling of the physics of white dwarf structure at low temperature and intermediate density.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344

A new generation of STELUM white dwarf cooling models

Antoine Bédard

University of Warwick

White dwarf cooling models form the bedrock of cosmochronology, where these stellar remnants are used to date stellar populations and reconstruct the Galactic formation history.

In this talk, I will introduce the latest generation of white dwarf cooling models computed with the STELUM stellar evolution code. I will briefly highlight key physical improvements, notably regarding the core and envelope compositions, the crystallisation process, the conductive and radiative opacities, and the surface boundary condition. I will then discuss some key results, including the implications of our new models for white dwarf age dating.

I will also present comparisons with the previous publicly available STELUM grid (Bédard et al. 2020, ApJ, 901, 93) and with other widely used stellar evolution codes (BASTI, LPCODE, MESA). Our new cooling models will be made available to the community to continue supporting broad use in cosmochronology and other applications.

Session 2.1 | Advances in WD Modeling

Inconsistencies in White Dwarf Balmer Lines

Bart H. Dunlap

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Models of spectral line shapes, and hydrogen Balmer lines in particular, are crucial ingredients in determining the mass and temperature of white dwarf stars. This is true regardless of method: in the spectroscopic method, fits to the lines lead directly to temperature and surface gravity; in the photometric method, Balmer line fits determine the model fluxes used to calibrate the photometric system. However, both white dwarfs (Fuchs 2017) and laboratory plasmas (Schaeuble et al. 2019) produce Balmer series lines that cannot be fit simultaneously with the same model conditions. Furthermore, recent ensemble gravitational redshift determinations of DAs (Arseneau et al. 2025) point to unmodeled asymmetries in theoretical Balmer line profiles and highlight the increasing level of model fidelity required for precision analyses. Here we add to previous observational and laboratory measurements to examine these model line profile inconsistencies. We also explore the impact of varying the input model profiles, and of artificially introducing profile inaccuracies, on parameters determined from the resulting synthetic spectra.

Revising Chemical Equilibrium in Atmospheres of Cool White Dwarfs

Piotr M. Kowalski

Institute of Energy Technologies – Theory and Computation of Energy Materials (IET-3)

Extensive datasets coming from large surveys, e.g., the Gaia mission, revealed subtle misfits between models and the data. In some recent studies, these have been linked to inadequate treatment of chemical equilibrium, namely incorrect prediction of number of free electrons, often determined by the abundances of trace species such as H-, H3 +, C, C2 [1,2]. With the state-of-the-art quantum-mechanical calculations we have reevaluated chemical potentials and abundances of various species important for accurate description of chemical equilibrium in the extreme, helium-rich atmospheres. In particular, we discuss the revision of the ionization equilibrium in dense helium and its impact on modeling of stars with trace amounts of carbon, including atmospheres of suspected ghost population with undetectable carbon abundance [2].

[1] Kowalski, A&A 708, A26 (2026)
[2] Tremblay, New Astron. Rev. 99, 101705 (2024)

Session 2.1 | Advances in WD Modeling

A New Approach to Modeling Quasi-H2+ in DA White Dwarf Stars

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Deficiencies in line broadening theory have been proposed as a possible explanation for unresolved discrepancies in ultraviolet (UV) and optical spectroscopic fits to hydrogen-atmosphere white dwarf (WD) spectra and laboratory opacity experiments at WD photosphere conditions. A critical source of line broadening in the hydrogen Lyman series is quasi-H+ 2 — a type of quasi-molecule, or unbound close atomic collision, involving a neutral hydrogen atom and a bare proton. Quasi-H+ 2 , and other quasi-molecules, are challenging to implement in traditional atomic line broadening codes because of the transient molecular structure that forms. In this talk we will present a novel simulation-based approach to calculating quasi-molecular line shapes, compare our new calculations to the previously used Unified Line Broadening Theory (ULBT), and

demonstrate that our new method allows us to remove some of the line shape approximations that the ULBT relies on. Finally, we will compare model spectra with our new quasi-H+ 2 Lyman-series line shapes to model spectra with ULBT line shapes and observed UV spectra.

Investigating the Origin of Magnetic Fields in White Dwarfs through Rotational and Physical Correlations

Larissa Luciano Amorim, S. O. Kepler

UFGRS

The origin of magnetic fields in white dwarfs remains one of the most debated topics in stellar evolution, with competing scenarios involving fossil fields, binary mergers, and internal dynamos during crystallization. To provide new observational constraints on these mechanisms, I have compiled a substantial sample of over 100 magnetic white dwarfs with precisely measured rotation periods and magnetic field strengths. By cross-matching these data with Gaia astrometry and evolutionary models, I analyze potential correlations between rotation and fundamental stellar parameters, including mass, effective temperature, and cooling age. This large-scale statistical approach aims to determine whether magnetic properties evolve with age or are primarily determined by the star's formation history.

Session 2.2 | WD Magnetism

Are seemingly constant magnetic white dwarfs rapidly rotating?

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Many white dwarfs (WDs) have strong magnetic fields, the origin of which remains unclear. Rotation, which in magnetic WDs can be probed through variability in circular polarisation measurements, appears to play a role in the formation of these fields. In particular, magnetic WDs have been found to rotate faster on average than nonmagnetic WDs.

At the same time, many strongly magnetic WDs show an apparent constant signal of circular polarisation. This can be interpreted in three different ways: the stars may rotate extremely slowly, the magnetic axis may be aligned with the rotation axis, or the stars may in fact rotate extremely rapidly, with periods shorter than the typical exposure time of polarimetric measurements.

We have explored the possibility that these constant magnetic WDs are actually rotating rapidly through analysis of several series of high-time-resolution measurements of circular polarisation for many magnetic and non-magnetic WDs. I will present the results of this study and discuss their implications for the theories on the origin and evolution of magnetic fields in white dwarfs.

Fast, Massive, Magnetic: Our ZTF Search for White Dwarf Merger Remnants

Aayush Desai, Ilaria Caiazzo

Institute of Science and Technology Austria (ISTA)

White dwarf (WD) mergers are among the most promising channels for producing the massive, rapidly rotating, and strongly magnetized WDs. They are therefore key laboratories for understanding magnetic-field generation, angular-momentum evolution, binary evolution, and the fate of compact stellar remnants. This is a timely moment to study these systems: time-domain surveys such as ZTF and ATLAS, together with upcoming Gaia and LSST data, are rapidly expanding the sample of variable WDs and revealing candidates whose short-period modulation may betray a merger origin. In this talk, I will present current results from our search for merger remnants in ZTF and what open questions remain about their demographics, magnetic-field structure, and long-term evolution. I will then focus on ZTFJ1901+1458, a cornerstone merger remnant. With a 6.94-minute rotation period, a surface magnetic field of hundreds of MG, and a mass of 1.3M⊙, J1901 is a textbook merger-remnant testbed. New X-ray observations suggest that it may also belong to an emerging subclass of isolated, soft X-ray-emitting merger remnants interacting with circumstellar material. Together, these systems offer a new window into the magnetic afterlives of double white dwarf mergers.

Session 2.2 | WD Magnetism

A unified view of Balmer emission line white dwarfs

Abbigail Elms

University of Warwick

The complex interplay between magnetic fields, stellar rotation and atmospheric activity in single white dwarfs remains an important but poorly understood field. A small population of hydrogen-dominated atmosphere white dwarfs that exhibit variable photometric flux, Balmer line emission, and magnetism in most cases, offer unique insight into these processes. These are classified as DAHe and DAe white dwarfs. We report the first detection of magnetism in the DAe white dwarf WD J165335.21–100116.33 using time-resolved spectropolarimetry obtained with FORS2, demonstrating that even systems lacking visible Zeeman splitting can host weak, variable magnetic fields. Combined with previous work, these results reveal a consistent phenomenology for DAHe and DAe white dwarfs: periodic variability, antiphase modulation between photometric flux and Balmer emission, and magnetic field variations linked to rotational phase. It is likely that a magnetically active, temperature-inverted spot/region is producing an optically thin chromospheric emission region in these systems, however the origin of this physical mechanism and why it appears at a specific stage of white dwarf cooling remains unclear.

Insights into the Origin of Magnetism from the SDSS 100 pc Sample

Adam Moss[1], Mukremin Kilic[2], Pierre Bergeron[3], Warren R. Brown[4], Gracyn Jewett[2], Marcel A. Agüeros[5], Maria Camisassa[6], Anthony Burrow[7]

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Recent volume-limited samples of magnetic white dwarfs have revealed a complex origin of magnetism. Multiple formation mechanisms are required, as no single scenario can explain the observed trends across stellar parameters. To further understand the evolution of these fields, identifying more magnetic objects is critical for improving the sample statistics and clarifying the observed trends. Spectroscopic surveys are powerful for this, as they can observe fainter objects at greater distances, producing a more complete view of the population within a large volume. I will discuss the SDSS 100 pc sample of magnetic white dwarfs, which is the largest volume-limited sample of such objects to date. Analysis of this sample yields statistically significant evidence of two populations, and a clustering model yields the location of these populations in parameter space. Young systems possess strong fields, indicative of mergers, while older systems likely come from single-star evolution, as their fields are significantly weaker. Among older objects, the incidence of magnetism increases over time, indicating a slow emergence of the field at the surface. When comparing the emergence times for a crystallization-induced dynamo and a core-convective dynamo, the core dynamo reproduces the observed cooling ages for many more systems, favoring the fossil scenario.

Session 2.3 | WD Magnetism

A Long-Lived, Deep-Seated Main-Sequence Magnetic Field Emerging in the White Dwarf Phase

Camisassa, M.[1], Castro-Tapia, M.[2], Fuentes, J. R.[3], Zhang, S.[2], Schreiber, M. R.[4], Rebassa-Mansergas, A.[1], Torres, S.[1], Raddi, R.[1], Dominguez, I.[5]

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White dwarf stars represent the final evolutionary stage of stars with initial masses lower than ~10 solar masses. As such, their study provides valuable information on the properties of mainsequence, red giant, and asymptotic giant branch (AGB) stars. Recent analyses of volume-limited samples of magnetic white dwarfs indicate that the incidence of magnetism increases with both stellar age and mass. In this presentation, I show that these observational trends, as well as the inferred magnetic field strengths, are consistent with the emergence of a long-lived, deep-seated magnetic field. We propose that this field is originated by dynamo action within the convective cores of main-sequence stars. Under specific assumptions, we track the evolution of this magnetic field through the red giant and AGB phases and model its subsequent emergence during the white dwarf phase. We demonstrate that a magnetic field of order 50 kG, generated in the convective cores of main sequence stars and preserved within the stellar interior throughout later evolutionary stages, can naturally emerge at the white dwarf surface with strengths and timescales consistent with current observational constraints.

Magneto-archeology of white dwarfs

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The late emergence of magnetic fields in intermediate-mass white dwarfs is a longstanding open question. It has been particularly difficult to tackle because of the lack of observations inside white dwarf progenitors that could be directly linked to the white dwarf stage. However, recent asteroseismic detections of magnetic fields in the cores of red giants - the region that survives to form the white dwarf - changes the picture: we can now constrain internal magnetic fields along stellar evolution. We revisit the fossil field scenario, under which large-scale stable magnetic fields evolve on nuclear timescales, adding observational asteroseismic constraints from red giants. We evolve internal magnetic fields in intermediate-mass stars from the red giant branch through white dwarf cooling, accounting for advection by changes in stellar structure and diffusion of fields on evolutionary timescales. We find that we can simultaneously explain observations on white dwarf surfaces and in red giant cores, as long as the magnetic field during the red giant branch extends beyond the hydrogen burning shell. Our work connects observed magnetic fields from red giants to white dwarfs for the first time, demonstrating that fossil field evolution can explain the late emergence of magnetic fields on white dwarfs.

Session 2.3 | WD Magnetism

Is a Crystallization-driven Convection Dynamo Plausible for explaining Magnetic White Dwarfs?

Matias Castro-Tapia[1], J. R. Fuentes[2], Andrew Cumming[1], Shu Zhang[1], Maria Camisassa[3]

[1]McGill University, [2]California Institute of Technology, [3]Universitat Politècnica de Catalunya

As white dwarfs (WDs) cool, their dense interiors crystallize from the core outward. This phase change releases latent heat, slowing cooling, and creates compositional differences between solid and liquid regions. The resulting buoyancy instability drives convection, which may generate magnetic fields via a dynamo.
Using mixing-length theory, evolutionary models, and hydrodynamic simulations, we find two convection regimes in carbon-oxygen WDs: an initial short-lived overturning phase followed by a thermohaline-like mixing phase. The overturning stage can briefly sustain a dynamo capable of producing megagauss-order magnetic fields inside the star. We study the evolution of such magnetic fields and compare our results with observations of magnetic WDs. We find that the crystallization-driven dynamo can only explain WDs with magnetic fields below 4 megagauss for masses between 0.5 and 1 M⊙.
For ultramassive white dwarfs ($\gtrsim$ 1.1 M⊙), we explore oxygen-neon cores with sodium and magnesium impurities. We find that accounting for at least a third species in the phase transition modifies the convective properties during crystallization. Consequently, the overturning convection lasts one to two orders of magnitude longer, and the mixing zone can extend beyond ~ 80% of the WD mass coordinate, potentially favoring a crystallization-driven dynamo in magnetic ultramassive WDs.

Stirring White Dwarfs via Compositional Convection, Crystallization-driven dynamos and Accretion-driven Convection

Rafael Fuentes[1], Matias Castro-Tapia[2], Jim Fuller[1], Marcus King[1], Andrew Cumming[2]

[1]California Institute of Technology, [2]McGill University

Thermohaline mixing plays an important role in several contexts involving white dwarfs (WDs). In this talk, I will focus on two problems. First, I will discuss how, in isolated, cooling WDs, thermohaline convection triggered during core crystallization could help transport magnetic fields from the deep interior toward the outer layers on timescales much shorter than those associated with ohmic diDusion, providing a possible explanation for the rapid emergence of magnetic fields at the stellar surface. Second, I will discuss how, in accreting WDs, thermohaline convection can dilute the atmospheric abundance of heavy elements by mixing them over a larger mass beneath the surface. I will present a simple analytic model that describes the propagation of a thermohaline front driven by accretion and its eDect on the evolution of the surface abundance of heavy elements.

Session 2.3 | WD Magnetism

Magnetized Thermohaline Convection in Accreting and Crystallizing White Dwarfs

Valentin Skoutnev

Columbia University

Thermohaline convection in white dwarfs can develop on their surface during accretion events or in their interior during crystalization. A major uncertainty is the feedback between the thermohaline convection and preexisting (fossil or dynamo-generated) magnetic fields. This talk will present new theory and simulations of magnetized thermohaline convection that examine how more realistic,
non-uniform magnetic fields can suppress thermohaline instability. We determine the conditions for magnetic suppression, evaluate them for typical white dwarfs parameters, and discuss implications for polluted and crystallizing white dwarfs.

Evolution and Formation of Ultramassive White Dwarf Stars

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Instituto de Física, Universidade Federal do Rio Grande do Sul

While the literature is rich in fully evolutionary models for white dwarfs with Mwd≤1M⊙, the number of works dedicated to ultramassive WDs resulting from complete previous evolution is scarce. This is due to the high computational cost of following the numerous thermal pulses that Super Asymptotic Giant Branch (SAGB) stars are expected to undergo, and the computational difficulties encountered at the end of this phase. Existing evolutionary UMWD models either entirely skip the TP-SAGB stage or inscribe the core characteristics of a TP-SAGB model into a WD structure at the start of the cooling track. In this work, we calculate a significant number of thermal pulses before employing high mass-loss rates to ensure that our models reach the WD cooling curve. Using MESA v24.03.1, we calculate a new grid of fully evolutionary WD models, starting from progenitors with 6≤ Mzams≤ 9 M⊙ and Z=0.02. As a result, we find WDs with masses ranging from 0.927 to 1.313 M⊙ , and CO (Mwd≤ 1. 015 M⊙) or ONe (Mwd ≥ 1.088 M⊙) cores. For Mwd≤ 1. 088 M⊙, our models are H-rich, whereas for masses larger than this, they are more representative of H-deficient WDs.

Demographic Dissection of the Gaia Q-Branch Reveals the Crystallization Delay in Massive White Dwarfs

Henry Sanford-Crane, James McDonald

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The Gaia white dwarf color–magnitude diagram (CMD) contains a prominent overdensity near $MG\approx 13$known as the Q-branch, widely interpreted as a cooling bottleneck associated with core crystallization. However, the physical interpretation of this feature has been limited by population mixing: the Gaia CMD blends white dwarfs from different Galactic components into a single locus, erasing the age ordering required to measure the crystallization delay. I present an empirical kinematic decomposition of the Gaia DR3 white dwarf population using tangential velocities, vertical actions, and atmospheric composition as age-sensitive diagnostics. This approach isolates young thin-disk, mature thin-disk, and thick-disk cohorts with distinct age distributions. The resulting CMDs reveal that the Q-branch is not a universal cooling phase but a population-dependent residence-time enhancement: young white dwarfs enter the crystallization plateau, older thin-disk stars exit it, and thick-disk stars have largely cooled past it. Using kernel-density ridge extraction, I measure a systematic vertical offset of $\Delta MG=0.211$mag between the young and mature thin-disk cooling sequences. Comparison with Montréal cooling tracks implies a crystallization-induced cooling delay of 0.2–0.4Gyr, corresponding to an energy release of (2–4)×1046erg. These results demonstrate that demographic dissection is essential for interpreting the Gaia CMD and provide a direct, model-independent measurement of the crystallization energy budget.

Session 2.4 | Q branch + Massive WDs

White Dwarf Merger Remnants with Cooling Delays on the Q Branch Lack Strong Magnetism

Lou Baya Ould Rouis, JJ Hermes; Joseph A. Guidry; Sihao Cheng; Mukremin Kilic; Olivier Vincent; Pierre Bergeron; Simon Blouin; Adam Moss; Isaac D. Lopez; Gracyn Jewett

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I will discuss the results of a volume-complete (to 100 pc) study of the Q branch ultra-massive white dwarfs discovered with Gaia, which exhibit unexpected high (multi-Gyr) cooling delays, whose exact origin and formation channel remain uncertain. We find significant di!erences in atmospheric composition and rotation rates as a function of tangential velocity in this sample. In particular, white dwarfs with the longest cooling delays show neither strong magnetism nor detectable short-period rotational variability, as opposed to expectations for double-degenerate merger remnants. This suggests that either these white dwarfs arise from a formation channel with no strong magnetism induced, or that the magnetism produced from the merger decays over Gyr timescales. Our follow-up photometry has also discovered pulsations in the second and third DAQ white dwarfs, including one hotter than 15,500 K, which possibly extends the boundaries of the DAV instability strip for white dwarfs with thin hydrogen layers. These results provide new constraints on the origin of anomalous Q branch white dwarfs with high cooling delays.

Forging neon-distilling white dwarfs in the stellar engulfments of helium white dwarfs

Nicholas Rui[1], Jim Fuller[2]

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Once carbon–oxygen white dwarfs cool sufficiently, they crystallize from the inside out. If the white dwarf is rich enough in 22Ne, these crystallized solids are buoyant and rapidly rise, efficiently liberating po tential energy which may halt the cooling of the white dwarf or power magnetic phenomena. Although this 22Ne distillation process may explain the cooling anomaly in Qbranch white dwarfs and anomalous emission lines in DAHe white dwarfs, its operation demands unusually high 22Ne abundances not generically predicted by isolated stellar evolution. We show that the engulfments of helium white dwarfs by both main-sequence and red giant stars can result in carbon–oxygen white dwarfs with 22Ne abundances high enough to distill 22Ne. This enhancement occurs because carbon dredged up following an especially energetic and off-center helium flash c an b e processed into 2 2Ne by s ubsequent hydrogen s hell burning and helium shell burning. 22Ne-distilling white dwarfs from these merger channels are predicted to be somewhat more massive than typical white dwarfs (up to $\simeq$ 0.7M⊙) and may have anomalous rotation rates, consistent with DAHe white dwarfs. These binary formation channels for 22Ne-rich white dwarfs reveal new connections between binary interactions and white dwarf cooling phenomena.

Session 2.4 | Q branch + Massive WDs

Evolutionary models for carbon-rich white dwarfs

Camila Damia Rincón, María Camisassa; Santiago Torres; Leandro Althaus

Universitat Politècnica de Catalunya

DAQ white dwarfs are a recently discovered spectral class characterized by hydrogen-dominated atmospheres that display carbon lines, and intriguingly low helium abundances. Their high space velocities and large masses suggest a merger origin. Since their first discovery, the number of known DAQ objects has increased, and it has been hypothesized that they may be related to warm DQ white dwarfs, differing mainly in the amount of hydrogen present in their atmospheres. The aim of this work is to address the current lack of evolutionary models for these peculiar objects.

Forging neon-distilling white dwarfs in the stellar engulfments of helium white dwarfs

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The merging of two helium white dwarfs is the favoured scenario for the formation of helium-rich hot subdwarfs (He-sdOs). While most He-sdOs evolve directly towards the white dwarf cooling branch, those more massive than 0.7 M⊙ ascend the helium giant branch, ending as a single white dwarf. During this stage, they reach a sufficient luminosity to be observed in neighbouring galaxies, mimicing the colour magnitude diagram location of intermediate-mass hot subdwarfs stripped in binaries.

In my talk, I will present the results from our detailed spectroscopic and photometric analysis of objects located on the ascending helium giant branch. HST/STIS spectra reveal metallicities ranging from sub-solar to super-solar. One is metal-rich, showing a strong enrichment in what we interpret to be neon-22. This is thus observational evidence that the merger of two metal-rich helium white dwarfs can produce and excess of neon-22, which may produce a significant cooling delay during the white dwarf phase.

Session 3.1 | Q branch + Massive WDs

The First Population of White Dwarf+Main-Sequence Binaries in Star Clusters: A New Window into Common Envelope Evolution

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Close white dwarf binaries are the progenitors of a range of phenomena, including cataclysmic variables, Type Ia supernovae, and gravitational wave mergers. Common envelope (CE) evolution is a primary formation channel for these systems, but remains poorly constrained, largely due to a lack of observational links between post-CE parameters and pre-CE initial conditions. Star clusters help overcome this challenge by providing independent age constraints on CE onset, yet until recently, only two detached white dwarf+main sequence (WD+MS) post-CE binaries in clusters were known. In this talk, I will present our growing census of WD+MS post-CE binaries in Milky Way star clusters. I will fi rst describe our sample of nearly 100 WD+MS candidates across 50 star clusters, identifi ed using supervised machine learning on large photometric surveys and, more recently, Gaia XP spectra. I will then present results from our multi-wavelength spectroscopic campaigns with the Gemini, Lick, and Keck Observatories, along with the Hubble Space Telescope, highlighting discoveries of ultra-massive WD binaries, cataclysmic variables, and more. Our population of post-CE binaries in clusters will provide the fi rst systematic observational constraints on CE evolution and off er new insights into the physics behind compact object binary evolution across cosmic time.

Variability analysis and SED modeling of WDMS binaries using multi-survey data

Andrija Zupic, Minia Manteiga Outeiro, Nadejda Blagorodnova, Xabier Pérez Couto

Universidade da Coruña, Universitat de Barcelona

White dwarf-main sequence (WDMS) binaries are key for studying mass transfer and low-mass binary evolution. We conduct a comprehensive time-domain study of 993 WDMS candidates recently identified from Gaia BP/RP spectra by Pérez-Couto et al. (2025). Leveraging archival photometry from 12 major surveys (including ZTF, TESS, and Gaia), we performed a systematic period search from 4 minutes to 10 days using Lomb-Scargle and Phase Dispersion Minimization. Combining statistical filtering with thorough visual inspection of phase-folded light curves, we successfully recovered known periods and identified numerous newly determined orbital periods. To refine physical parameters, we incorporated SPHEREx near- to mid-infrared data and performed two-body VOSA SED fitting, yielding robust stellar temperatures and radii. We then computed orbital separations and Roche lobe filling factors (f), classifying the systems into detached (f < 0.6), tight (0.6 f < 0.9), near-contact (0.9 f < 1.0), and overflowing≤≤ (f 1.0) configurations.≥ Finally, we present a catalog of these WDMS binaries with their newly determined properties, comparing their orbital period distribution to the historically large SDSS sample.

Session 3.1 | Q branch + Massive WDs

Long-term eclipse time variations in white dwarf binaries

Amalie Yates, Steven Parsons

University of Sheffield

The overwhelming majority of eclipsing white dwarf (WD) binary systems show quasi-periodic variations in eclipse timings on many year timescales. Long-term monitoring of these eclipse time variations (ETVs) in binary systems can reveal significant information about the binary's structure and environment, including the interior structures of the components, and whether a planetary system is present. Currently, the mechanism behind these ETVs is not known, with the main competing theories attributing them to either the presence of one or more circumbinary substellar companions, or the intrinsic complexity of the magnetic field structure of the non-WD component via an Applegate-like mechanism.
Here, we present a comprehensive study of the global properties of the ETVs in 43 WD binaries, the vast majority of which have over a decade of high-speed photometry data. This has allowed us to track the evolution of the ETVs in these systems, and analyse any previously unseen trends. We find a clear difference in the level of observed ETVs depending on the internal structure of the non-WD stellar companion, strongly indicating that an Applegate-like mechanism is the most likely driving force, calling into question previous claims of planetary systems around these binaries.

Hidden white dwarfs in the nearest Post Common Envelope Binaries

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Characterising both volume complete samples of white dwarfs and the population statistics of Post-Common Envelope Binaries are complicated by the existence of a potentially large number of binaries where the white dwarf is too cool to be detected in the optical. Here I will present HST near-ultraviolet spectra of four systems within 20 parsecs where we confirm the presence of cool white dwarf companions to M dwarf stars. I will place these systems in the context of the existing 20 parsec sample, as well as discuss the difficulties of characterising such stars in the near ultraviolet where the companions strongly contribute to the spectrum. I will also discuss the most intriguing of the four systems, G203-47. This system has a 15 day orbital period, placing it in a period gap between two binary populations. X-ray observations with Swift show that the system is not tidally locked, offering a clue to its formation history. Finally, I will discuss the predictions our findings make about additional hidden white dwarfs and future prospects for finding them.

Session 3.1 | Q branch + Massive WDs

White dwarfs in close binaries with substellar companions

Steven Parsons

University of Sheffield

A small but growing number of white dwarfs have been found in close binaries (separations of a few solar radii) with substellar or even planetary mass companions.
In this talk I will present the results of detailed follow up observations of a large sample of such systems. I will show that the increasing number of near-planetary mass companions to white dwarfs poses a significant challenge to our understanding of the formation of these close systems.

I will also show how these systems can act as powerful probes of white dwarf physics; with substellar objects acting as independent clocks to test our understanding of white dwarf cooling and eclipsing systems yielding extremely precise measurements of the fundamental parameters of white dwarfs.

Finally, I will also show how several of these close binaries contain magnetic white dwarfs, with these systems potentially holding the key to explain the missing population of period bounce cataclysmic variables.

Session 3.2 | WD Population Synthesis

Simulating the population of white dwarf - main sequence binaries with COSMIC-METISSE

Rutong Pei, Katie Breivik, Poojan Agrawal

Carnegie Mellon University, Carnegie Mellon University, KU Leuven

The population of binary stars known to contain white dwarfs with main sequence stellar companions (WD-MS) has exploded with Gaia's third data release. Since WD-MS binaries likely encode a single phase of Roche-lobe overflow, this population is an excellent testbed for uncertain binary evolution models. In this talk I will introduce a new binary population synthesis framework, COSMIC-METISSE, that incorporates detailed single star evolution with prescriptions for binary star interactions. I will then discuss recent efforts to simulate the WD-MS binary population with MESA grids which include thermal pulses during the asymptotic giant phase, ultimately aiming to recover the observed joint distribution between WD mass, MS mass, and orbital period. Finally, I will discuss the population of WD-WD binaries that results from simulating the future evolution of the WD-MS population.

A global view of post-interaction white dwarf-main sequence binaries

Cheyanne Shariat, Kareem El-Badry

California Institute of Technology

Common-envelope evolution remains one of the most uncertain phases in binary evolution. Short-period binaries containing a white dwarf (WD) and low-mass main-sequence (MS) star are among the most common types of postcommon-envelope binary (PCEB). We present a uniformly selected sample of detached eclipsing WDMS PCEBs within 200 pc, constructed by selecting unresolved WDMS candidates in the Gaia color–magnitude diagram and searching their ZTF light curves for eclipsing binaries. We identify 39 such systems with orbital periods Porb = 0.1–2 d. The sample's well-defined selection function allows us to model survey completeness and use the sample to constrain intrinsic properties of the local PCEB population, such as their period distribution, mass distribution, space densities, and birth rate. By combining our results with recent Gaia constraints on wider WDMS binaries, we present a global view of post–mass-transfer WDMS binaries spanning orbital periods from ~ 0.1 to 1000 d. Together, these results provide direct empirical constraints on mass transfer outcomes, common envelope evolution, and establish a key benchmark for binarypopulation models.

Session 3.2 | WD Population Synthesis

Stability Limits for Binary Mass Transfer in low- and intermediate-mass stars with MESA

Alex Duran-Reyes, Monica Zorotovic

Universidad de Valparaiso

Mass transfer in close binary stars can proceed in either a stable or unstable regime, fundamentally shaping the properties of the resulting systems. Determining the boundary between these regimes is therefore essential for understanding binary evolution. However, most existing studies rely on simplified assumptions and neglect key physical processes.
In this talk, I will present the first results of a study aimed at constraining the stability of mass transfer, providing new limits on the transition between stable and unstable regimes and exploring their impact on key observables, such as the orbital period–white dwarf mass relation, widely used to interpret post-mass transfer systems. These results are obtained by determining stability boundaries for mass transfer in binaries with initial masses below 8–10 solar masses, expressed in terms of critical mass ratios. Using the stellar evolution code MESA, I perform detailed simulations that incorporate a broad range of physical effects, including the evolutionary phase of the donor, angular momentum loss mechanisms, rotation, mass transfer efficiency and conservativeness, and tidal interactions. These effects are often neglected or treated with simplified prescriptions in previous studies, or considered over a more limited parameter space (typically restricted to progenitor masses below ~ 2 $M_\odot$).

Population demographics of post-interaction WDMS binaries from Gaia

Natsuko Yamaguchi[1], Kareem El-Badry[1], Cheyanne Shariat[1], Sahar Shahaf[2]

[1]*California Institute of Technology*
[2]*MPIA*

Binary mass transfer (MT) is a critical step in the formation of many important and exotic astrophysical phenomena, including gravitational wave sources, millisecond pulsars, and Type Ia supernovae. Despite its importance, the details of how MT affects the orbital and stellar properties of binaries remain poorly understood. Post-interaction binaries containing a WD provide an opportunity to test theoretical MT models. The third data release of the Gaia mission includes astrometric orbits for several thousand WDMS binaries covering a wide range of orbital periods and WD masses, but the complexity of the Gaia selection function has limited efforts to model and interpret the sample. I will describe a comprehensive forward-model of the sample that allows us to infer properties of the intrinsic population, including the post-interaction WD mass distribution and the critical mass ratio for MT stability. I will also describe an ongoing HST program to obtain UV spectra of hot WDs within the sample, which enables characterization of binaries containing low-mass WDs that cannot be robustly selected with astrometry alone. Finally, I will discuss our spectroscopic follow-up of hundreds of binaries in the sample to measure pollution of the MS stars by the WDs' AGB star progenitors.

Session 3.2 | WD Population Synthesis

A Self-Consistent Population Synthesis Study of White Dwarf–Brown Dwarf Binaries

Alejandro Santos-García
Santiago Torres
Alberto Rebassa-Mansergas

Universitat Politècnica de Catalunya (UPC)

We present an updated binary population synthesis framework that, for the first time, includes a self-consistent treatment of both white dwarfs and brown dwarfs to study these binaries. Using synthetic populations together with a compilation of known systems, we investigate their frequency, orbital properties, and observational biases, and assess their detectability with Gaia. We explore how binary interaction processes, in particular common-envelope evolution and stable mass transfer, shape the formation and survival of systems with substellar companions across a wide range of orbital separations. Our models reproduce the observed population within 100 pc, including the period distribution (with a period gap) and the mass and effective temperature distributions, while requiring high common-envelope efficiencies to explain the most compact systems. Our results provide new constraints on the population of white dwarf binaries with brown dwarf companions and highlight their potential as benchmarks for binary evolution models.

Constraining the Formation Channels of AM CVn Stars

William Weitian Yu

Hamburg Observatory, University of Hamburg

AM Canum Venaticorum (AM CVn) stars are a class of helium-rich, ultra-compact accreting binaries consisting of a white dwarf accretor and a semi- or fully degenerate donor, with orbital periods < 70 minutes. They play a pivotal role in modern astrophysics as (1) the end point of close binary evolution, (2) potential progenitors of Type Ia supernovae, and (3) strong gravitational wave sources for the upcoming LISA mission. Nevertheless, the formation channels of AM CVns remain uncertain. Theory suggests they can be constrained through chemical composition of the donor. However, direct observation of the donor is hindered by its intrinsic faintness. Instead, its properties can be inferred from the accretor's atmosphere, enriched by material transferred from the donor. With temperatures ~20000K, the accretor's emission peaks in the ultraviolet. Following the successful analysis of the first system, ZTFJ2252-05, we present HST ultraviolet spectroscopic studies of four additional systems: YZ LMi, Gaia14aae, ZTFJ0407-00, and HP Lib. Together, they form the first sample of AM CVns with quantitatively constrained formation channels. This study provides a key observational benchmark for white dwarf binary evolutionary models and LISA binary population synthesis.

Session 3.3 | Rare Accreting WDs

A New Population of Coherent Radio Emitters: White Dwarf Binaries

Dr. Iris de Ruiter

The University of Sydney, Australia

Recent wide-field radio surveys have revealed a new class of long-period radio transients, exhibiting coherent radio flashes repeating on timescales of minutes to hours. Their progenitors were initially thought to be extremely slow pulsars, but several of these systems have now been identified as white dwarf binaries flaring at the orbital period (e.g. de Ruiter et al. 2025). These sources extend earlier discoveries of non-accreting, pulsar-like white dwarf systems such as AR Scorpii (Marsh et al. 2016) and J191213.72−441045.1 (Pelisoli et al. 2023), which demonstrate that magnetic white dwarfs can power broadband, strongly modulated emission. Together, these discoveries establish white dwarf binaries as a new population of coherent radio emitters and open a new avenue for studying magnetic white dwarf binary evolution.

In this talk, I will present the observational breakthroughs linking long-period radio transients to white dwarf binary progenitors and summarise their radio properties, periodicities, and polarisation. I will discuss how these systems fit with known classes of magnetic binaries, including pre-polars and polars, and what they reveal about magnetic interaction, spin–orbit coupling, and accretion states. Finally, I will outline ongoing and forthcoming projects aimed at constructing the first sample of radio-flaring white dwarf binaries, supported by coordinated radio, optical, and X-ray observations (e.g. Rodriguez et al. 2026).

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Exotic white dwarfs in the core of 47 Tuc revealed by a HST UV time-domain survey

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AM Canum Venaticorum (AM CVn) stars are a class of helium-rich, ultra-compact accreting binaries consisting of a white dwarf accretor and a semi- or fully degenerate donor, with orbital periods < 70 minutes. They play a pivotal role in modern astrophysics as (1) the end point of close binary evolution, (2) potential progenitors of Type Ia supernovae, and (3) strong gravitational wave sources for the upcoming LISA mission. Nevertheless, the formation channels of AM CVns remain uncertain. Theory suggests they can be constrained through chemical composition of the donor. However, direct observation of the donor is hindered by its intrinsic faintness. Instead, its properties can be inferred from the accretor's atmosphere, enriched by material transferred from the donor. With temperatures ~20000K, the accretor's emission peaks in the ultraviolet. Following the successful analysis of the first system, ZTFJ2252-05, we present HST ultraviolet spectroscopic studies of four additional systems: YZ LMi, Gaia14aae, ZTFJ0407-00, and HP Lib. Together, they form the first sample of AM CVns with quantitatively constrained formation channels. This study provides a key observational benchmark for white dwarf binary evolutionary models and LISA binary population synthesis.

J2008, you still speak in riddles': a peculiar white dwarf merger remnant with a half-ring of circumstellar material

Andrei Cristea

Institute of Science and Technology Austria (ISTA)

I will present the periodically variable white dwarf ZTF J2008+4449: a double white dwarf merger remnant showing signs of interaction with circumstellar material. The white dwarf's nature as a merger remnant is supported by its physical properties: hot (35, 500 ± 300 K) and massive (1.12 ± 0.03 M⊙), it rotates rapidly on a period of ≈ 6.6 minutes, and possesses exceptionally strong surface magnetic fields (~ 400 – 600 MG). We exclude the presence of a stellar or substellar companion through deep IR photometry; however, we detect Balmer emission in the white dwarf's optical spectrum and soft X-ray emission akin to those of accreting lowstate polars ((2.3 ± 0.4) × 1029 erg/s) - both tell-tale signs of interaction with circumstellar material. Perhaps equally remarkable is the peculiar variability of the Balmer emission on the white dwarf's spin period. Showing Doppler shifts as high as ≈ 2, 000 km/s, the morphology of the emission line's velocity curve is consistent with the trapping of a half-ring of ionised gas in the white dwarf's magnetosphere. This unique spatial distribution of the ionised gas likely indicates a highly asymmetric magnetic field. Without a companion to source the circumstellar material, the gas may originate from gravitationally bound post-merger ejecta, a tidally disrupted planetary object or a magnetically driven wind.

Accreting white dwarfs as probes of compact binary evolution

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Accreting white dwarfs provide an ideal laboratory for testing the models of binary evolution, as they are numerous, relatively bright, and structurally simple. Nonetheless, several key scientific questions remain wide open: the interplay between the mechanisms of angular momentum loss that drive binary evolution across different orbital period regimes is poorly understood; the evolutionary path towards the most compact systems is unknown; the intimate connection between accreting white dwarfs and Type Ia supernovae, and which pathways lead to a successful explosion, remain elusive. Answering these questions is critical to advancing our understanding of more complex systems, such as black hole and neutron star binaries, and SN Ia progenitors. In this talk, I will present the first results from a large Treasury programme with the Hubble Space Telescope. Using 132 spacecraft orbits, these observations provide accurate temperatures, masses, accretion rates and abundances for a sample of 43 accreting white dwarfs, specifically selected to pinpoint the parameter regimes in which our understanding of compact binary evolution fails most dramatically. These results offer, for the first time, full insight into the evolution of these binaries across the entire orbital period range, providing a critical test for current models of binary evolution.

Unveiling the period-bounce population of Cataclysmic Variables Spectroscopic and time-domain follow-up of eROSITA-selected candidates

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Cataclysmic variables (CVs) are compact binaries in which a white dwarf (WD) accretes from a Roche-lobe-filling low-mass donor. They evolve toward shorter orbital periods (Porb) until reaching a minimum near ~80 min, after which they "bounce back" to longer periods as the donor becomes out of thermal equilibrium or increasingly degenerate. These evolved systems, known as period-bouncers (PBs), are predicted to comprise 40–80% of the CV population, yet only 3–25% have been observationally confirmed. To uncover this missing population, we selected 213 high-likelihood PB candidates by crossmatching the eROSITA X-ray and Gaia WD catalogues and classifying them on a multiwavelength scorecard. We present the results from an ongoing optical spectroscopic follow-up campaign of these objects with SDSS-V, complemented by archival time-domain data from TESS, ZTF, CRTS, ASAS-SN, and ATLAS, together with multiwavelength photometry for SED analysis.

We report the confirmation of 25 new CVs via Balmer emission or outburst activity, including two new PBs confirmed through measurements of Porb and constraints on the donor spectral type. We also identify three systems that may represent PBs approaching detachment after the onset of WD magnetism.

Finally, we present a new diagnostic based on Balmer decrements to distinguish PBs from pre-bounce CVs. We find that all 18 new CVs observed with SDSS-V are consistent with being PBs, potentially increasing the PB population by ~50% and indicating that a substantial fraction of the PB population remains hidden in WD catalogues.

Session 4.1 | CVs and Accreting WDs

Thermally Inflated Accretors: Insights from Young White Dwarf Binaries

Soumyadeep Bhattacharjee

California Institute of Technology

The classical theory of binary mass transfer (MT) suggests that convective AGB donors should undergo unstable mass transfer, leading to common envelope evolution and the formation of compact binaries. However, recent discoveries of AU-scale binaries containing white dwarfs (WDs) challenge this picture, suggesting that MT is more stable than previously thought. Although the MT phase itself is rarely observed, the WD cooling age in post-MT binaries provides a powerful "clock" that allows reconstruction of the underlying MT physics from their present-day properties. My talk will focus on a subclass of binaries hosting very hot (Teff $\gtrsim$ 70, 000 K), young WDs with cooling ages below 1 Myr. Gaia orbital solution of the prototype system Abell 35 shows that the companion – which appears as a giant – is in fact a thermally inflated main-sequence star, expanded in response to a recent episode of rapid accretion. Such inflation can stabilize MT by increasing the accretor's Eddington accretion rate limit. Combining WD-clock with MESA models, I will show that Abell 35
and other systems of its kind represent an early phase in a unified evolutionary model, evolving into blue lurkers and ultimately into the broader population of Gaia WD+MS binaries on Gyr timescales. Linking WD cooling ages to accretor properties thus provides a new framework for understanding the origin of wide WD binaries.

WRLOF Accretion in WD–AGB Binaries

Irin Babu Vathachira[1], Yael Hillman[2], Amit Kashi[3]

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In the past, wind accretion through both Bondi–Hoyle–Lyttleton (BHL) and wind Roche-lobe overflow (WRLOF) mechanisms were studied in white dwarf (WD) systems. For the first time, we perform long-term simulations of consecutive nova eruptions in WD–asymptotic giant branch (AGB) binaries accreting through WRLOF to investigate nova characteristics and WD mass growth. The study considers three initial WD masses of 0.7, 1.0, and 1.25 $M_\odot$, with a 1.12 $M_\odot$, AGB donor, a binary separation of 1500 $R_\odot$,and four accretion efficiencies of 100%, 75%, 50%, and 25%. Our results show significant WD mass growth despite repeated nova eruptions. This growth is enhanced by successive non-ejective nova outbursts that occur during long epochs of high accretion rates, induced by high wind rates at the time, leading to greater mass retention on the WD. Sustained high accretion also causes helium accumulation, eventually triggering helium eruptions. Thus, under WRLOF mechanism, the WD experiences multiple types of eruptions, including regular hydrogen nova eruptions, non-ejective nova outbursts, and helium eruptions, within a single evolving system at different stages of its evolution. Despite these different eruptions on the WD, the WRLOF mechanism remains the most efficient pathway for WD mass growth compared to BHL accretion.

Barium Dwarfs in Disguise: s-process Enrichment in Gaia MS+WD Binaries

Param Rekhi

Weizmann Institute of Science

Thousands of Gaia MS+WD binaries exist at 1 AU separations, ~ providing an exciting laboratory for probing the aftermath of mass transfer from asymptotic giant branch (AGB) stars. We present a unified observational study that connects this enigmatic population to classical Ba stars. Combining Gaia astrometry with GALAH and FEROS spectroscopy, we assemble a sample of 130 MS+WD binaries with measured s-process abundances and dynamically constrained masses and orbits. We find that s-process enrichment depends strongly on metallicity and WD mass, directly tracing AGB nucleosynthesis yields. Strikingly, we detect strong s-process enrichment in eccentric systems, demonstrating that mass transfer can occur without circularizing the orbit or may even contribute to eccentricity growth. These results establish Gaia MS+WD binaries as analogous to classical Ba/CH/CEMP-s systems, extending the known population to shorter periods and higher eccentricities while dramatically increasing the sample size. This connection provides a new empirical framework for constraining binary interaction and post-AGB evolution.

Frequency and composition of planetary debris around young white dwarfs: Insights from HST/COS snapshot survey

Snehalata Sahu, Boris Gaensicke, Detlev Koester, Jamie Williams, Pier-Emmanuel Tremblay

University of Warwick, UK
University of Kiel, Postdam

White dwarf atmospheric pollution provides a powerful probe of the bulk composition and occurrence of exoplanetary debris, offering unique insights into the ultimate fate of planetary systems. In this talk, we will present new results from the HST/COS snapshot survey of 427 hydrogen-atmosphere (DA) white dwarfs. We will first examine the frequency of detected planetary debris as a function of white dwarf parameters, including effective temperature, cooling age, and mass, considering both single stars and wide binary systems. We will also discuss trends with accretion rates derived consistently across the sample by accounting for both diffusion and radiative levitation effects. We will then present a comprehensive compositional analysis based on C/Si abundance ratios across the full sample, with particular focus on systems that also exhibit oxygen and other heavy elements. For these metal-enriched white dwarfs, we derive initial compositional constraints using abundance ratios such as C/O and C/Si to infer the nature of the accreted material, including rare cases that deviate from rocky compositions. These results provide new insights into the frequency and chemical composition of exoplanetary material around young white dwarfs.

Reconstructing the kinematic history of polluted white dwarfs: stellar flybys and molecular cloud encounters

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It is well established that the metals observed in some white dwarf (WD) atmospheres cannot be primordial, with the injection of material from surviving planetary systems being the most widely supported explanation. Alternative sources of pollution involving accretion from the interstellar medium (ISM) were disfavored in the past, mostly based on the absence of spatial correlation between polluted WDs and the densest regions of the ISM. However, those studies relied on small WD samples, limited 2D maps of the ISM, and pre-Gaia kinematic information. In this work, we leverage Gaia DR3 and modern spectroscopic surveys such as SDSS-V and DESI DR1 to select the largest samples of WDs with available radial velocities to date. We trace their orbits back to compare the histories of molecular cloud crossings and stellar encounters between a sample of ~200 polluted WDs and a control sample of ~1000 non-polluted WDs occupying the same region of the Gaia color-magnitude diagram. This analysys also allows us explore for the first time the role that close stellar flybys might play in the current paradigm. We found no statistically significant differences between the two samples, supporting internal dynamical processes as the main channel for metal pollution in WDs.

A white dwarf accreting a second-generation planet

Jamie Williams

University of Warwick

Many white dwarfs accrete the debris of disrupted planetary bodies, detected via metal-enrichment in their atmospheres, dusty or gaseous circumstellar discs, and photometric transits from debris. The composition of accreted debris has been shown to be diverse yet overall closely resembles Solar System bodies. We report the discovery of a white dwarf accreting material that is unlike any Solar System object. The atmosphere of HS0209+0832 is strongly enriched in trans-iron elements including zinc, copper, and niobium-the latter being detected for the first time in a white dwarf-and depleted in the canonical rock-forming elements silicon and iron. The composition of the accreted object is consistent with a second-generation planet, formed from the stellar material ejected during the giant phase. The key abundance signature which differentiates it from a first-generation planet is the high enrichment of s-process elements. Photospheric helium and the absence of terrestrial rock-forming elements implies the white dwarf is accreting the escaped atmosphere of a photo-evaporating giant planet. This is further supported by the detection of a sinusoidal photometric period of 4.4days at an amplitude of 0.12%, which we attribute to a reflection effect or a transiting cometary tail of an evaporating gas giant.

Session 4.2 | WD Debris

Infrared Excess and Metal Pollution in White Dwarfs from HETDEX

Rudy Morales, Barbara Castanheira

Baylor University

White dwarfs showing infrared excess or atmospheric metal pollution offer a powerful window into the survival and evolution of planetary systems beyond the main-sequence stage. In this work, we investigate two related populations identified using data from the Hobby–Eberly Telescope Dark Energy Experiment (HETDEX): white dwarfs with excess infrared emission and metal-polluted DZ white dwarfs. For the infrared excess systems, we combine optical spectroscopy and multiwavelength photometry to determine stellar atmospheric parameters and to assess whether the excess emission arises from unresolved low-mass companions, circumstellar dust, or both. For the metal-polluted white dwarfs, we identify candidates through catalog cross-matching and spectroscopic confirmation, then iteratively fit photometric and spectroscopic data with white dwarf atmosphere models to derive effective temperature, surface gravity, and calcium abundance. Together, these two samples provide complementary views of the circumstellar environments of evolved stars. Infrared excess systems trace surviving companions or dusty debris, while metal-polluted white dwarfs reveal the accretion of disrupted planetary material. These studies help build a more complete picture of the processes that shape planetary system evolution in the final stages of stellar life.

JWST Time-Domain View of Planetary Debris: Tracking Disk Variability and Accretion in G29-38

Tim Cunningham

Harvard & Smithsonian Center for Astrophysics

White dwarfs, the remnants of most stars, show atmospheric metal pollution from disrupted planetary systems, providing a window into exoplanetary composition and dynamics. Frequently accompanied by dusty debris disks, these systems offer a laboratory for real-time studies of the disruption and accretion of exoplanetary material. I will present a multi-wavelength monitoring campaign of the benchmark system G29-38 that, for the first time, jointly constrains its accretion flow and debris-disk structure. Time-resolved JWST NIRSpec and MIRI spectroscopy resolve the mineralogy of the dusty disk, uncover cooler dust components that refine its outer extent, and deliver the first sensitive probe of minute-scale mid-infrared variability, revealing a thermal response of the disk to varying irradiation. These JWST data provide direct, time-dependent constraints on the short-term response to stellar pulsations, constraining the thermal response time of the disk. We will also place these results in the context of complementary X-ray observations, including new Chandra data that offer an ongoing high-energy probe of accretion onto a metal-polluted white dwarf. Together, these observations deliver a time-domain view of a debris disk and its ongoing accretion onto a white dwarf, establishing G29-38 as a cornerstone system for understanding the fate of planetary systems.

Session 4.3 | WD Transits and Direct Imaging

Disappearing white dwarfs; a systematic search for transiting and eclipsing white dwarfs with ZTF

Jan van Roestel, various others, the ZTF team

Institute of Science and Technology Austria (ISTA)

The evolution of a star into a white dwarf (Wa) profoundly reshapes the stellar and planetary architecture, yet the fate of close-in companions remains poorly constrained. Using photometry from the Zwicky Transient Facility (ZTF), we conducted a systematic survey for eclipses and transits of white dwarf stars. I present three key findings: first, we identify numerous M-dwarf and brown dwarf companions but find a notable dearth of transiting Jupiter-mass exoplanets. Second, we report the discovery of WDs undergoing sudden, deep obscurations by circumstellar debris. This includes one white dwarf that vanished for a full year, likely marking a real-time planetesimal disruption event. Finally, we highlight a unique WD exhibiting a 100-day, symmetric, trapezoidal transit. While the nature of the transiting body remains enigmatic, possibilities include a companion with an extensive ring system or a precessing disk. These results demonstrate that WD environments are remarkably dynamic, hosting a diverse population of surviving substellar objects. Looking ahead, Rubin Observatory and the Argus Array will expand this discovery space by an order of magnitude, providing the statistical power to characterise the post-main-sequence evolution of planetary systems.

A complete characterisation of the transiting debris disk at WD1054–226

Akshay Robert, Jay Farihi, Boris Gaensicke, JJ Hermes, Seth Redfield, Andrew Swan

University College London

The white dwarf transit field is currently undergoing explosive growth, transforming from a single object into an era of comparison and characterisa<on. Among these is WD1054–226, a polluted white dwarf with transi<ng debris orbi<ng at a period of 25h in the habitable zone of the star. The discovery light curves reveal myriad transi<ng features, including drilers and transients, but the most striking of these is a complex paKern of individual dimming events occurring at the 65th harmonic of the fundamental orbital period, poten<ally indica<ve of debris clumps or arcs that are gravita<onally confined by a shepherding planet.

In this talk, I will present mul<-wavelength spectroscopy from UVES and Hubble that facilitate a detailed study of the composi<on of the transi<ng planetary material, in addi<on to fast-cadence <me-series spectra that reveal circumstellar gas orbi<ng the star through mul$ple, variable metal lines. I will also present the first infrared light curve of this star that provide new insights into the sizes of the occul<ng structures, in addi<on to new, updated light curves from ULTRACAM that probe the stability of these complex transi<ng features on a baseline of seven years, and enable the first characterisa<on of transit-<ming varia<ons in the orbi<ng disk

Session 4.3 | WD Transits and Direct Imaging

Bigger than the Whole Star: Transiting Planets around White Dwarfs from ZTF

Aaron Householder, Kevin Burdge

MIT

We present results from a systematic box least squares (BLS) transit search applied to over 1.3 billion sources in the Zwicky Transient Facility (ZTF), targeting short-duration eclipses of white dwarfs by substellar companions. Because white dwarfs are comparable in size to Earth, substellar companions are typically larger than the white dwarf, producing total eclipses in which the white dwarf flux drops to zero on timescales of only a few minutes. From this search, we have identified more than 60 candidates with periodic transit-like signals and no infrared excess, indicating that the companions are not stellar and are instead planets or brown dwarfs. We present follow-up highspeed photometry and spectroscopy for multiple candidates that confirm the eclipses and place the companion masses in the planetary regime. These planets likely survived a common envelope phase during their host star's giant branch evolution, and the properties of this population carry important information about late-stage stellar and planetary evolution.

A Panoramic View of Rapid Dust Production by Disintegrating Asteroids around a White Dwarf

Laura Rogers[1], Siyi Xu[1], Soumyadeep Bhattacharjee[2], Simon Blouin[3], Amy Bonsor[4], Kareem El-Badry[2], Bruce Gary[5], Joseph Alexander Guidry[6], JJ Hermes[6], Marc Teng Yen Hon[7], Tom Kaye[8], Saul A Rappaport[9], Andrew Vanderburg[10], Weicheng Zang[11]

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Planetary activity appears common around white dwarfs, with the most dramatic manifestations exhibiting deep, highly variable, irregular transits from actively disintegrating asteroids. However, the physical properties of the transiting material, e.g. grain size distribution, composition, and connection to the debris disk, remain poorly constrained. We present a JWST programme targeting a transiting debris system that has recently entered an exceptionally active phase, enabling a direct view of dust production and evolution. Our observations combine 12 hours of continuous, time-resolved NIRSpec BOTS spectroscopy with MIRI LRS mid-infrared spectroscopy. The near-infrared light curve reveals a complex mixture of grey and chromatic transits that evolve within a single orbit, providing direct evidence for a dynamically changing grain size distribution. Simultaneously, the emergence of a strong infrared excess indicates ongoing dust replenishment, while modelling of the MIRI spectrum shows that the silicate emission feature is best reproduced by olivine-dominated compositions. This mineralogy is consistent with Mg/Si ratios independently inferred from photospheric abundances, establishing a direct link between the circumstellar and accreted debris. These observations provide the first unified constraints on the composition and size distribution of actively disintegrating planetesimals, opening a direct window onto the real-time destruction of exoplanetary material.

Session 4.3 | WD Transits and Direct Imaging

WD Planetary Systems Through the Looking Gas

Sergio Humberto Ramirez Ramirez

The University of Warwick

Planetary systems around white dwarfs are ubiquitous. Over a thousand systems have been identified via three observational indicators: metal-polluted photospheres; infrared excess caused by a circumstellar dust disc; and rarest of all, emission lines from a gaseous debris disc. Of the detected white dwarf planetary systems, only ~20 objects show this observational trifecta. In particular, the gaseous components are hypothesised to be caused by the interaction of the dust disc with embedded planetesimals. We present an analysis of the morphological variations of the gas emission of 18 of these objects from a long-term monitoring campaign. We characterise the orbits of the highly possible embedded planetesimals by (i) obtaining their precessional periods and (ii) mapping the distribution of the gas emission with Doppler Tomography. Our results set effective constrains on the orbital structure of the planetary systems, offering valuable clues on their evolution and dynamics.

Observational Constraints on the Incidence of Substellar Companions to Young Massive White Dwarfs with VLT/ERIS

Felipe Lagos-Vilches[1], Matthias Schreiber[1], Wolfgang Brandner[2], Hans Zinnecker[3], Nicola Gentile-Fusillo[4], Alex Mauch-Soriano[1]

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White dwarfs (WDs) provide a unique opportunity to detect substellar companions and study planetary systems that have survived stellar evolution. As the end products of stars with initial masses below 8 $M_\odot$, and owing to their intrinsically faint nature, WDs offer ideal conditions for high-contrast imaging searches that are otherwise challenging around their main-sequence progenitors. Moreover, many substellar companions are expected to survive post-main-sequence evolution, making WDs excellent laboratories to explore these populations. In this context, we initiated a high-angular-resolution imaging survey targeting 18 massive, young WDs with VLT/ERIS in the H band (1.66 μm). We identify three promising substellar companion candidates, two of which are currently being followed up to confirm common proper motion. If confirmed, these objects would rank among the coolest and lowest-mass companions detected around WDs. These results are particularly relevant in a broader context, as the occurrence and properties of substellar companions around intermediate-mass stars (2.5–8 $M_\odot$) remain poorly constrained, highlighting the importance of WD systems as indirect probes of planetary formation and evolution around more massive stars.

A Probable Planet Detected via IR excess around WD 0644+025

Sabrina Poulsen[1], John Debes[2], Ashley Messier[3], Erika Le Bourdais[4], Carl Melis[5], Misty Cracraft[6], Samuel Boucher[4], Mukremin Kilic[1], Scott Kenyon[7], Mark C. Wyatt[8], Seth Redfield[9], Patrick Dufour[4], Loic Albert[4], Susan E. Mullally[6], William T. Reach[10], Fergal Mullally[11], David A. Golimowski[6]

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By studying planetary systems at the extremes of their survivability, we gain insight into planet architectures, compositions, and the future of our own solar system. Thousands of exoplanets have been confirmed to date, yet only a handful are known to orbit a white dwarf. The MIRI Excesses Around Degenerates (MEAD) survey was a JWST Cycle 2 program designed to address this gap by imaging nearby white dwarfs with MIRI for resolved planetary companions and infrared excesses. In this talk I present MEAD observations of WD 0644+025, an unusually massive white dwarf that shows a 3.6 sigma excess in F1000W and a 7.3 sigma excess in F1500W, the strongest excess in our sample. This excess can be explained by thermal emission from a cold substellar companion or from an atypical circumstellar dust structure. Keck HIRES spectra show persistent metal pollution over decades, implying ongoing delivery of planetary material. WD 0644+025 thus represents a compelling case study in the growing population of white dwarfs with cold infrared excesses, and highlights JWST's ability to probe planetary system remnants inaccessible to prior infrared observatories

Session 4.4 | WD Debris

Tracking Accretion Rate Changes at Polluted White Dwarfs

Hiba tu Noor

University College London (UCL)

Tidally disrupted planetary bodies are the consensus model for photospheric metals and circumstellar disks associated with isolated white dwarfs. Multiple lines of evidence reveal that these disks are dynamic, including infrared variability tracing continual changes in dust mass, and evolving light curves from transiting clouds of debris. These widespread variability indicators imply that the mass flux in the inner disk is variable in time, and thus may eventually result in detectable changes in the stellar accretion rate and corresponding photospheric metal absorption features. Models of stochastic planetesimal delivery predict such variability on timescales of years to decades, yet the multi-epoch spectroscopy needed to test these predictions has, until recently, been virtually non-existent. We have carried out the first systematic search for accretion-rate variability in metal-polluted white dwarfs using new and archival, high-resolution, ground-based optical spectroscopy with baselines of up to two decades. In this talk, I will present the results of this survey, including the first confident detection of accretion rate variability in any such system plus additional candidate detections, and discuss the implications for models of stochastic planetesimal delivery and disk evolution.

3D Convection Corrections in Metal-Polluted White Dwarfs

Wenjun Chen[1], Pier-Emmanuel Tremblay[1], Detlev Koester[2], Antoine Bedard[1]

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Polluted white dwarf atmospheres provide currently the only direct probes of the bulk composition of rocky exoplanets. However, one-dimensional models based on mixinglength theory (MLT) cannot accurately reproduce the detailed line profiles of metals from the pollution, due to their simplified treatment of convection. In this work, we employ three-dimensional (3D) radiation-hydrodynamics simulations to investigate metal line formation in these atmospheres for the first time. By calibrating 3D simulations against the 1D models, we quantify the resulting abundance corrections, demonstrating the importance of 3D effects for accurate spectroscopic analyses.

Same Stars, Different Model: A Cross-Model Comparison of Polluted White Dwarf Atmosphere Characterization

Érika Le Bourdais

Université de Montréal

Two decades after the seminal work of Zuckerman et al. (2007) on GD 362, dozens of polluted white dwarfs have been characterized using high-resolution optical and ultraviolet spectroscopy, enabling detailed studies of the bulk composition of exoplanetary material across the Milky Way. As the field transitions toward population-level analyses of planetary building blocks, an essential issue remains largely unaddressed: the reproducibility of these results. To date, abundance determinations rely primarily on two independent model atmosphere frameworks, namely the Montréal models and the Koester models. Despite their widespread use, no systematic effort has been undertaken to assess whether methodological or theoretical biases exist between them, or to quantify their impact on inferred compositions. In this talk, I will present progress on a large-scale reproducibility study of polluted white dwarf analyses. In particular, I will examine how updated abundance determinations can differ from previous results due to factors such as newly available data, improved techniques for determining atmospheric parameters, and advances in model atmospheres.

Magnetically guided accretion and extremely slow rotation in a metal-enriched white dwarf

Stefano Bagnulo[1], Michael Stroet[1], Colin Folsom[2], Mark Hollands[3], John Landstreet[4], Gavin Ramsay[4]

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Metal-enriched white dwarfs provide direct constraints on the building blocks of rocky exoplanetary systems. Recent work has suggested that magnetic fields may influence how this material is accreted, potentially channelling debris along field lines rather than allowing it to settle uniformly across the stellar surface. We report the discovery of rotational variability in a weakly magnetic DZ white dwarf, revealing a rotation period of about 289 d, by far the longest yet measured for any compact object. The star exhibits clear surface abundance inhomogeneities, with metals concentrated near both magnetic poles, and the observed modulation is consistent with localised metal-rich regions aligned with the magnetic geometry. This result extends the upper end of the white dwarf rotation distribution to timescales of months and confirms that, among magnetic DZ white dwarfs, magnetically guided accretion is common. Although white dwarfs are generally slower rotators than simple evolutionary arguments would predict, the 289 d period of this star is exceptional even in that context. Such extreme slow rotation cannot be explained by magnetic spin-down during the cooling phase, and may instead reflect the combined effect of angular-momentum loss during prior evolution and descent from an unusually slowly rotating progenitor, perhaps a magnetic Ap star.

The Effects of Magnetic Accretion on the Spatial Extent of White Dwarf Pollution

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Many white dwarfs are polluted by metals, which are generally understood to be the accreted remnants of a planetary system. Our understanding of this process is highly model-dependent, and is particularly sensitive to the assumption that the metal concentration is homogeneous throughout the white dwarf's atmosphere. This talk will show that the magnetic fields of a white dwarf will necessarily concentrate the accreted material into a thin beam that covers only a fraction of the surface area of the white dwarf. While convection and diffusive spreading can homogenize the pollution region, these effects will be suppressed for hot or magnetic white dwarfs, leaving only small fractions of the surface polluted. Patchy white dwarfs will exhibit periodically variable pollution signatures and enable constraints on the patch area. However, this variability requires a rare misalignment between the magnetic field and spin poles to be detected. The existing detections of variable pollution signatures require significant convective suppression on these objects. Finally, our model for the magnetic concentration of accretion and the subsequent spreading predicts that many polluted white dwarfs will have difficult-to-detect patchy surfaces. The concentration of material due to the magnetic field will lead to systematic underestimates of the mass accretion rate onto these objects by up to orders of magnitude, with significant impacts on our understanding of the population as a whole.

Session 5.1 | Hypervelocity Supernova Survivors + ELMs

Hypervelocity white dwarfs as messengers from thermonuclear supernovae

Kareem El-Badry

Caltech

The merger of two WDs in a close binary can precipitate the thermonuclear detonation of one or both WDs in a type Ia supernova or related thermonuclear transient. If only one WD is fully detonated, the other can be ejected at high velocity. These runaway WDs are predicted to have velocities up to 3000 km/s and unusual surface abundances that betray their violent past. Observational efforts over the last decade have discovered a heterogeneous menagerie of about 20 objects likely produced through this mechanism. I will describe results from the largest ongoing survey for hypervelocity WDs, constraints on their chemical abundances, birth rate, and launching mechanism, and recent progress in understanding the stellar evolutionary status of the known objects.

A New High-Velocity LP 40-365 Type Star And The Fault In Our Type Iax Supernova Deflagration Models

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Runaway stars of the LP 40-365 class provide a unique window into the physics of "failed" thermonuclear supernovae (Type Iax). Unlike standard Type Ia events, these systems are thought to involve a partial deflagration of a white dwarf, leaving behind a bound, high-velocity remnant. We report the discovery and characterization of a new LP 40-365 type star, identified through a serendipitous search for runaway subdwarfs.

Atmospheric modelling via spectral analysis reveals a neon- and oxygen-dominated composition, consistent with other class members, at a notably higher effective temperature than previously known examples. Kinematic reconstruction indicates a Galactic disk origin approximately 2.8 Myr ago, with an ejection velocity exceeding 600 km/s, sufficient to render the star unbound from the Milky Way. The observed combination of high ejection velocity and extreme elemental abundances presents a significant discrepancy with current theoretical deflagration models. Combined with previous observation, this discovery underscores the necessity for more robust simulations of white dwarf remnants to bridge the gap between observed runaway properties and predictions of Type Iax events.

Session 5.1 | Hypervelocity Supernova Survivors + ELMs

Spectral analyses of double-detonation supernova survivors

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In the D6 scenario, runaway mass-transfer in a double white dwarf system triggers a double-detonation type Ia supernova in the primary. While the primary is destroyed, the companion white dwarf may survive, interacting with the supernova shock, and being ejected at speeds in the range 1000–3000 km/s. The three prototype galactic D6 survivors (Shen et al. 2018) are cool (~8000 K), inflated, and have spectra displaying carbon and oxygen features. While several hotter D6 stars have since been found and spectroscopically analysed (El-Badry et al. 2023; Werner et al. 2024a, 2024b; Hollands et al. 2025), the three prototype objects had remained unexplored in terms of their atmospheric parameters.
Here, I will present our results on the first spectral analyses of D6-1/2/3. I will show how our follow up spectra permit up to 17 elements to be detected, demonstrating some diversity in their atmospheric chemical abundances, and what this may reveal about D6 supernovae. I will also outline our preparations towards analysing larger samples of D6 stars in future surveys, and discuss the improved opacities in our models that enable these complex atmospheres to be analysed in detail.

Connecting hypervelocity stars with exploding white dwarfs via numerical simulations

Ruediger Pakmor

Max Planck Institute for Astrophysics

Type Ia supernovae are spectactular thermonuclear explosions of white dwarfs in binary systems. Both, the nature of their companions and how they ignite and explode is still heavily disputed. This is partly du to the lack of any pre-explosion detection of a progenitor system and the lack of any detection of a surviving companions in supernova remnants of type Ia supernovae. The recent detection of hypervelocity stars, in particular the class of D6 stars and LP40-like stars, has changed this. Both types of objects are thought to be survivors of a binary system that partially exploded as a type Ia supernova. I will show how their existance of D6 stars and LP40-like stars and their properties provide critical new information to constraint progenitor systems and explosion mechanism of type Ia supernovae. In particular, I present 3D explosion simulations of different scenarios for type Ia supernovae. I will discuss which of them can leave hypervelocity stars behind like the objects we already found, which predict objects we have not found yet, and how we can use a more complete census of hypervelocity stars to improve our understanding of type Ia supernovae.

Investigating the origin of the lowest-mass white dwarf stars

Gabriela Oliveira da Rosa

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ELMs are white dwarf stars with masses that are too low ($\lesssim 0.3\ M_\odot$) to be formed through single stellar evolution. Binary interaction seems to play an important role in the formation of ELMs since it can cause the mass-loss required to explain their masses. This raises important questions: Do all low-mass white dwarfs result from binary evolution, or can other evolutionary paths exist? Does the companion always survive the interaction, or can it be destroyed, leaving behind a single low-mass white dwarf?

My PhD research aims to get new insights about these questions, as will be shown in this talk. To achieve this, I have selected a complete volume-limited sample of ELM candidates from the Gaia DR2 ELM candidates catalogue. By cross-matching this sample with archives of spectroscopic data (such as SOAR, ESO, INT, LAMOST) and obtaining ESO's observing time, I have compiled spectra for 90% of the targets. The spectral analysis of these data allows the characterization of the candidates by fitting parameters such as effective temperature and surface gravity, as well as the study ELMs binary fraction by estimating radial velocities.

Session 5.2 | WD Supernova Connections

3D MHD Simulations of Double ONe White Dwarf Mergers

Giovanni Stimamiglio, Rüdiger Pakmor, Stephen Justham, Selma E. de Mink

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Merging double white dwarfs (WDs) are a common endpoint of binary evolution and potential progenitors of Type Ia supernovae, neutron stars, and gravitational wave sources. While simulations of CO and He WD mergers have been widely explored in the literature, more massive double ONe WD mergers remain largely uncharted. The rate of such mergers has been predicted to reach → 1% of the empirical volumetric rate of Type Ia SNe, due to dynamical effects in dense stellar environments like globular clusters.
We present the first 3D magnetohydrodynamic simulations of double ONe WD mergers. Using the moving-mesh code AREPO, we follow the system from pre-coalescence through merger and several hundred rotational periods of the remnant, tracking magnetic field amplification and dynamical impact. We investigate the super-Chandrasekhar mass product, initially supported by di!erential rotation, which evolves under efficient magnetic angular momentum transport driven by dynamo processes. This will eventually lead to contraction and collapse to a neutron star. We assess whether ONe WD merger remnants retain strong magnetic fields up to collapse and produce magnetars. This scenario further positions ONe WD mergers as a compelling channel for fast radio bursts (FRBs) in old stellar populations.

IK Pegasi and the Double-merger Path to Type Ia Supernovae

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[3]*These authors contributed equally.*

Recent Gaia astrometry has revealed thousands of main-sequence + white-dwarf binaries (MS+WD) at separations of ~ 0.1–10 au, including a subset hosting unusually massive ($\gtrsim$ 0.8 $M_\odot$) WDs. We argue that s-process enrichment in the non-degenerate companion provides a powerful diagnostic for identifying WDs that formed via mergers in hierarchical triple systems. For a massive WD, standard single-star evolution requires a massive ($\gtrsim$ 4 $M_\odot$) progenitor, yet such progenitors produce negligible s-process yields. We define IK Peg–type systems as those exhibiting this mass–yield tension: bariumenhanced companions orbiting WDs too massive to have descended from efficient s-process producers. The well-known system IK Peg exemplifies this class. Applying this framework to published spectroscopic data reveals several additional candidates, and we estimate that a few dozen such systems should exist in the current Gaia sample. If these systems trace inner-binary mergers in primordial triples, they represent observable intermediate stages toward eventual Type Ia supernovae via the double-merger pathway, as predicted by recent population-synthesis models.

Building Double-Detonation Supernovae: The Evolutionary Pathway of WD+sdB Binaries

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White dwarf (WD) stars in close binaries with Hot subdwarf B (sdB) companions are promising progenitors of double-detonation supernovae. Systems such as PTF1J2238+7430 provide useful benchmarks for understanding the evolutionary pathways leading to these configurations. We reconstruct the evolutionary history of PTF1J2238+7430 as a representative pathway in which the sdB forms first via stable mass-transfer, followed by the formation of the WD through a common-envelope (CE) phase. Using MESA, we perform detailed binary evolution simulations from the zero-age main-sequence to the present-day configuration, exploring initial masses, orbital periods, and mass-loss fractions, as well as angular momentum transfer, tidal interactions, and gravitational-wave-driven orbital evolution. Our models reproduce the observed system, consisting of a 0.406Ms sdB star and a 0.72Ms WD in a 76.34-minute orbit. The sdB forms through stable Roche-lobe overflow from a 2.7Ms donor, while the WD originates during the CE phase from an initially less massive companion that accreted mass during the stable mass-transfer phase. This study serves as a starting point for ongoing work involving extensive, systematic grids of binary evolution models. We have performed 65,865 simulations, with the goal of characterize the population of viable double-detonation supernova progenitors and placing constraints on their evolutionary channels.

The Galaxy's double white dwarf merger rate: four measurements

Dan Maoz

Tel Aviv University

I present and compare four independent observational estimates of the merger rate of double WDs (DWDs) in the Milky Way, based on: RV-variation-selected DWDs from the SDSS survey; RV-variationselected DWDs from the VLT-SPY survey; eclipsing DWDs from the ZTF survey; and from modeling the number density of likely-merged DWDs on the Gaia color-magnitude diagram. I then compare the measured DWD merger rates to our Galaxy's estimated Type-Ia supernova (SN Ia) rate, and show that the DWD merger rate is up to an order of magnitude higher than the SN Ia rate. This means that, if a sufficient fraction of all DWD mergers lead to a successful SN Ia explosion (e.g. via the D6 scenario, when one of the merging WDs has mass >~ 1 Msun), then DWD mergers could be behind all normal SNe Ia.

Poster Presentations

List of Session A & B

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Alejandra Romero	Census of known ZZ Cetis
Alejandro Hugo Córsico	Asteroseismology of the ultra-massive ZZ Ceti star GD 518
Allyson Woodruff	Estimating the Milky Way Thick Disk Formation History with White Dwarf Ages and Kinematics
Ana Paula Lima	Searching for rotation periods in magnetic white dwarfs
Andrew Dublin	Strategic Improvements to White Dwarf Asteroseismic Fitting in the Gaia Era
Anna Gebhardt	Hot subdwarf stars in the PLATO era: a key window for intermediate stages of stellar evolution
Anwesha Biswas	On some mysteries of the `Red Edge' of the DA instability strip
Barbara Castanheira	Hundreds of Newly Confirmed White Dwarfs from HETDEX
Ciarra Coston	Constraining the Origins of White Dwarf Magnetism
Daniel Mayes	Progress on oxygen opacity experiments for stellar and white dwarf interiors
Elizabeth Jeffery	Deep Observations of the Metal-Rich Open Cluster NGC 6253
Enrique Miguel García Zamora	Retrieving white dwarf-main sequence binary systems in the main sequence using machine learning.
Fran Jiménez-Esteban	Studies of white dwarfs from Gaia and the Virtual Observatory
Gracjan Sienkiewicz	Constraining Surface Magnetic Fields of White Dwarfs using Phase-Resolved Zeeman Spectroscopy
Hagai Bareli	Eccentricity and Formation of White Dwarfs Orbiting Millisecond Pulsars
Iva Krtičková	Theoretical ultraviolet spectra from atmosphere and global wind models of central stars of planetary nebulae

Poster Presentations – Session A

Jayden Blanchard	Laboratory Measurements of Carbon at White Dwarf Photospheric Conditions
Jiří Krtička	New mass-loss rate predictions for central stars of planetary nebulae approaching the Eddington limit
João Gabriel Leite Medeiros	Fitting DAs in DESI DR1
Jonathan Roussy	Bound–Free Opacity of Hydrogen in Strong Magnetic Fields: Implementation in Magnetic White Dwarf Atmosphere Models
Juan Pablo Castro Idarraga	Crystallization of white dwarfs in globular clusters
Karolina Jarosik	The hot white dwarf luminosity function in the era of Gaia data.
Keaton Bell	The Seismic Technique for Accurate White Dwarf Parameters
Klaus Werner	Spectroscopic Survey of Faint Planetary-Nebula Nuclei: Thirty New Hydrogen-Deficient Central Stars
Kurtis Williams	Constraining the Long-Term Stability of Rapid Photometric Variability in Ultra-Massive Magnetic White Dwarfs
Laksh Gupta	Evidence for an excess population of luminous white dwarfs in the atypical Galactic Globular Cluster NGC 2808.
Lennard Kufleitner	Hot subdwarf stars from the Hamburg Quasar Survey
M. Miguel Ocampo	Revisiting astrophysical bounds on continuous spontaneous localization models
Martín Lucio Alberino	Constraining particle physics with synthetic white dwarfs populations
Matti Dorsch	The SALT Survey of He-rich Hot Subdwarfs: New Constraints on WD Mergers
Michael Montgomery	Phase Diagrams and White Dwarf Cooling
Nicola Gentile Fusillo	The 4MOST southern white dwarf survey
Ozcan Caliskan	Tracing Galactic Disk Heating with White Dwarfs: A Combined SDSS–Gaia DR3 Study

Poster Presentations – Session A

Paula Izquierdo	First planetesimals from DESI DR1: 12 highly metal-rich white dwarfs
Pietro Brandli Ignacio	DAV White Dwarf Pulsations: Impact of the Hydrogen Envelope Thickness
Pilar Gil Pons	Effects of Nuclear Reaction Rates on the Formation and Chemical Structure of Ultra-Massive CO White Dwarfs
Roberto Raddi	The WEAVE White Dwarf Survey
S. O. Kepler	Median Rotation/Orbital Period for White Dwarfs is Less than 6 hours
Sebastien Hamel	Equation-of-state and transport properties of Warm Dense mixtures for White Dwarf Envelopes using Machine-Learned Quantum Molecular Dynamics.
Sicheng Yu	Searching for Magnetic White Dwarfs in LAMOST
Snehalata Sahu	Balmer line core fitting in DA white dwarfs: The role of 3D convection and NLTE effects
Sofia Vasieva	Rotation Periods of Isolated Magnetic White Dwarfs from ZTF Time-Domain Photometry
Ted von Hippel	What Can BASE-9 Do For White Dwarf Science?
Thomas Gomez	The Impact of Improved Electron Broadening in White Dwarf Atmospheres
Ulrich Heber	The mass distribution of hot subdwarf stars
Veronica Agaeva	3D Magnetohydrodynamic Simulations of Double White Dwarf Mergers
Vikrant Jadhav	White dwarfs in open clusters and tidal tails as tracers of contamination and stellar interactions
Weligton Nogueira Costa Junior	Visual classification of DESI DR1 White Dwarfs
Yoav Ziv	WHIST: White-dwarf HR-diagram interactive synthesis tool

Poster Presentations – Session B

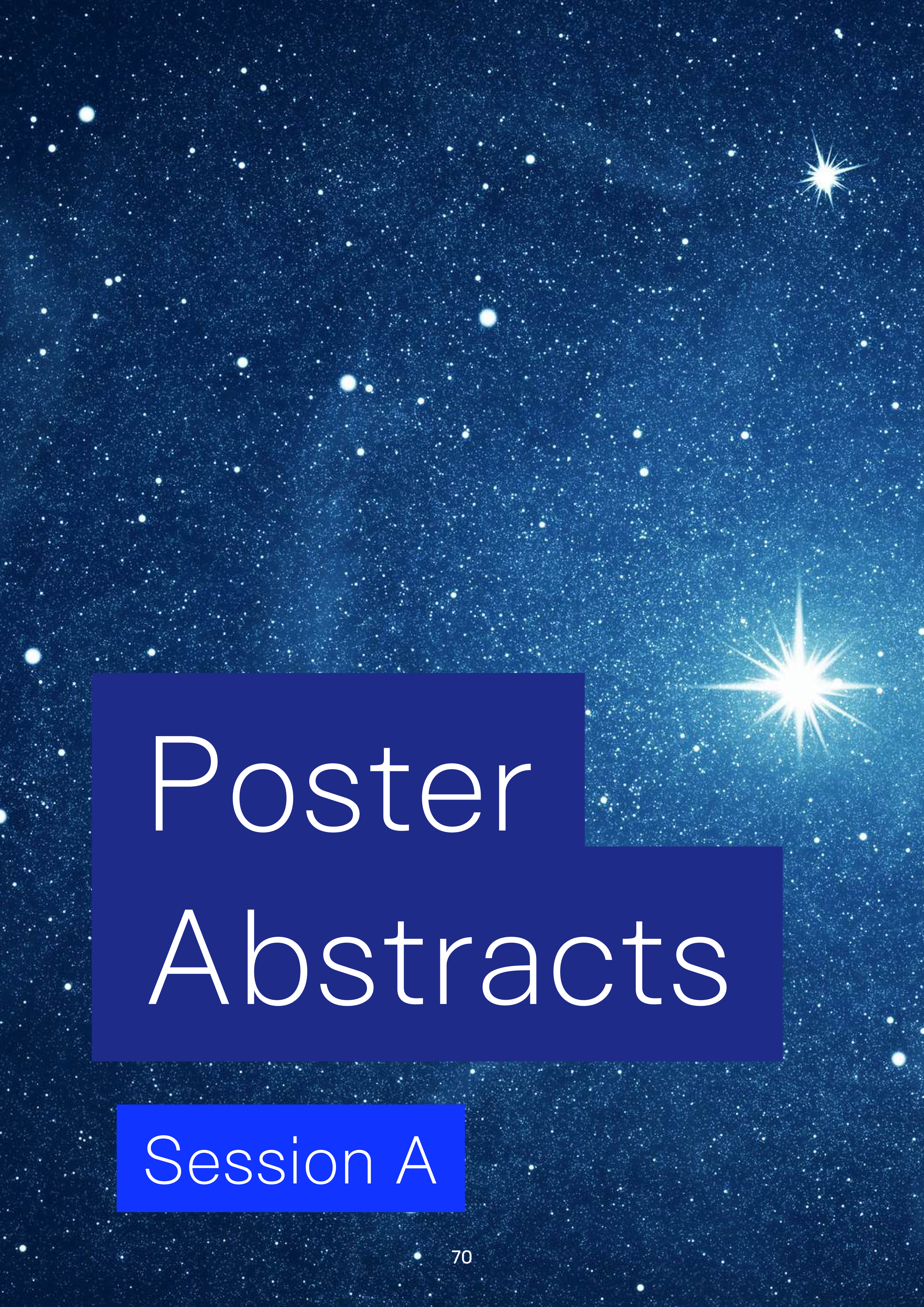
Alex Brown	Characterising the volume-limited sample of eclipsing post-commmon-envelope binaries
Alice Perego	Towards systematic searches for LISA white dwarf binaries with multiband photometry
Andy Buchan	The meaning of Li/Fe: Li enrichment in white dwarfs as evidence of ancient planetary crusts?
Anish Aradhey	Characterizing log g variations in Ellipsoidally Modulated Hot Subdwarf Binaries
Ayaka Okuya	Toward Explaining Infrared Variability in White Dwarf Debris Discs: Modelling Collisions and Phase Changes
Christina Fakiola	On the isotopic yields of thermonuclear explosions in non-accreting White Dwarf progenitors
Connor Rosenthal	Evidence for IR Excess around van Maanen's Star With JWST Imaging and MRS Spectra
Csanád Horváth	Evidence of binarity in long-period radio transients
Daniela Boneva	Different types of variability and accretion processes of the NL system V592 Cas
Edward Sion	The Surface Chemical Abundances of 36 Accreting White Dwarfs in Cataclysmic Variables Above and Below the Period Gap
Edward Snowdon	ZTFJ040627: An unusual spotted eclipsing WD-dM binary
Fabian Mattig	A Future Between Supernova and Accretion-Induced Collapse: Massive White Dwarfs in Close Orbits with Hot Subdwarfs
Fernando Falkenberg	Multi-band Photometry and Polarimetry of five Asynchronous Magnetic Cataclysmic Variables: V1025 Cen, FO Aqr, V2400 Oph, TX Col and EX Hya
Gagik Tovmassian	Evolution of Extremely Long-Period CVs as double-degenerate binaries and AM CVn Precursors
Geoffrey Mo	Cerberus: a new three-armed high-speed CMOS imager for the 200-inch Hale Telescope
Harry Dawson	Hot, Bloated, and Hard to Find: A Survey for Massive Pre-Helium White Dwarfs

Poster Presentations – Session B

Ingrid Pelisoli	What's the deal with radio-emitting white dwarfs?
Irina Voloshina	Photometric observations of new cataclysmic variable TCP J06330104+0303350
Jan Kára	Search for Compact Accreting Binaries with TESS
JJ Hermes	Reprocessed Pulsation Geometry in the Dusty White Dwarf G29-38
Joaquin Meza	Discovery of spiral structure in the accretion disc of a new nova-like
John Debes	Groundbased follow-up of the MEAD Survey Sample
Jordi Isern	Sampling white dwarf interiors via stellar collisions
Joseph Guidry	Transiting Planetary Debris Traces Complex Dynamics in White Dwarf Planetary Systems
Julia Stewart	Identifying Helium Emission-Line Stars with the Condor Array Telescope
Keisuke Isogai	Exploring the accretion disk activity in the white dwarf binary AM CVn stars through superhump and color variations
Leandro Althaus	Extreme mass loss during common envelope evolution: The origin of the double low-mass white dwarf system J2102–4145
Lientur Celedon	Using nova shells as a diagnostic of nova eruptions
Lilia Ferrario	Electron Cyclotron Maser Emission in Magnetic White Dwarfs and Long-Period Radio Transients
Lou Baya Ould Rouis	White Dwarf Gaia Spectra Increase the Sample of Massive Remnant Planetary System Hosts
Manuel Barrientos	Precise Parameters for Two LISA Sources
Matthew Green	An eclipse study of 20 AM CVn binary systems
Megha Das	Modeling Radiative Transfer in Double White Dwarf Mergers in the Era of Time-Domain Surveys
Melanie Santiago	Exploring the Formation of Double White Dwarf Mergers in COMPAS via Type Ia Supernovae

Poster Presentations – Session B

Nicola Gentile Fusillo	The First Double Gaseous Debris Disc: WD J1328-1450 and Emerging Complexities in White Dwarf Discs
Nidhi Mehandiratta	High-cadence spectroscopy and Doppler tomography of AR Scorpii (AR Sco)
Nikita Rawat	SRGA J115215.0–510656: an unusual long-period eclipsing dwarf nova with disc wind signatures
Odette Toloza	Effects of Tidal Forces in WD+AFGK Binary Systems from Gaia and TESS Observations
Rafael Martinez-Brunner	Gas-Dust-Planet Interplay in White Dwarf Debris Discs with Multi-Fluid Smoothed Particle Hydrodynamics
Sang Chul KIM	Discovery of a new WZ Sge-type Dwarf Nova KSP-OT-202104a
Sumari Barocci-Faul	Ultra-compact mass transferring binary searches with eROSITA: initial results and future prospects
Sumit Kumar Maheshwari	Near-infrared cyclotron emission in period-bounce polars
Sumit Kumar Maheshwari	Progenitors of the Double-Detonation Supernova Candidate CD-30
Tafadzwa Zivave	The discovery of new eclipsing white dwarf binary systems from NGTS
Tin Long Sunny Wong	Accretor Luminosity as Probe of Orbital Evolution in AM CVn Binaries
Vishaak Kotagal Balasubramanya	On the search for new AM CVn binaries
Warren Brown	ELM Survey X
Zenia Zuraiq	Simulating magnetized white dwarfs by time evolution: Chandrasekhar limit and beyond



Poster Abstracts

Session A

Session 1.1 | WD Population

Studies of white dwarfs from Gaia and the Virtual Observatory

Fran Jiménez-Esteban

Centro de Astrobiología (CSIC-INTA)

Gaia mission has revolutionized the study of white dwarf evolution. Since the beginning, Gaia and the Virtual Observatory have demonstrated to be a pairing of great value, which has been extensively exploited by our group. Using Virtual Observatory methodologies, we have combined Gaia (astrometric, photometric, and spectroscopic) data with observational data and theoretical models available in the Virtual Observatory to study white dwarfs: we were the first in publishing a Gaia catalogue of white dwarfs; we used Gaia spectra to classify the white dwarfs and study their spectral evolution; we studied the white dwarf population of the Galactic thin disk, thick disc, or halo; we also studied the binary (resolved and unresolved) population with at least one white dwarf member; and we identified and analysed white dwarf with infrared emission in the solar neighbourhood. Currently, we are preparing the exploitation of the new forthcoming Gaia DR4, which is expected at the end of this year. In this talk, I review the studies we have so far conducted with the Gaia DR2 and DR3, and what we can expect from the Gaia DR4.

Estimating the Milky Way Thick Disk Formation History with White Dwarf Ages and Kinematics

Allyson Woodruff

Embry-Riddle Aeronautical University

The formation history of the Milky Way's thick disk remains an open question in galactic evolution. White dwarfs (WDs), some of the oldest stellar remnants, provide a means of estimating the ages of early stellar populations. Our sample of thick disk candidate WDs is created by combining Pan-STARRS photometry and Gaia astrometry data from the local neighborhood. We estimate each star's U, V, and W velocity components using proper motion, parallax, and an estimated radial velocity. Using kinematics, the probability of each star residing in the thick disk is calculated, which allows us to identify a list of WDs to run through the software suite Bayesian Analysis of Stellar Evolution (BASE-9) to obtain posterior age distributions. We subsequently perform a hierarchal analysis of the candidate thick disk WDs to improve the inferred star formation history of the thick disk. We also examine the age – velocity dispersion relation to test whether older WDs exhibit higher velocity dispersions, and examine the possible contribution of dynamical heating processes within the thick disk. By obtaining kinematics, individual stellar ages, and the population's formation history, we can create a template to compare to the properties of nearby galaxies.

Session 1.1 | WD Population

The hot white dwarf luminosity function in the era of Gaia data

Karolina Jarosik

Astronomical Observatory of the Jagiellonian University

The first (and to date the only) hot white dwarf (WD) luminosity function (HLF) was constructed by Krzesiński et al. (2009, hereafter K9), based on a sample of 709 WDs with Teff $\gtrsim$ 23 000 K from SDSS DR4, limited to 19.5 dereddened magnitude in SDSS g filter. For the same SDSS DR4 photometric footprint and magnitude limit, Gaia provides now a substantially larger sample of hot WDs with Teff and logg determined by Gentile Fusillo et al. (2018). This expanded dataset should enable a more robust and statistically smoother determination of the HLF.

As a validation step, we first demonstrate that our methodology successfully reproduces the K9 HLF using their original WD sample (and WD physical parameters determined by K9). We then construct a new HLF using the Gaia-based WD sample, incorporating parallaxes, photometric colours, and G-band magnitudes. Bolometric corrections in the Gaia G band are applied using our empirically calibrated prescription. Our approach does not differentiate between WD atmospheric types, which would require spectroscopic classification, but it allows for an approximate reconstruction of the global HLF. In the poster we present the resulting HLF and discuss possible factors that may influence its shape.

Constraining particle physics with synthetic white dwarfs populations

Martín Lucio Alberino

FCAGLP

The white dwarf luminosity function is a powerful tool to constrain the properties of theoretical particles, such as the axion, standard and non-standard neutrinos and other hypothetical baryophilic and leptophilic scalars.

Using a Monte Carlo code to generate a synthetic population of white dwarfs, we aim to confront state-of-the-art models with observations. These observables include the Gaia DR3 galactic disk sample, which has virtually identified all white dwarfs whitin 100pc from the Sun.
This approach allows us to compute theoretical, statistical and observational errors consistently. Here we present our latest results, that include very conservative constraints on the axion-electron coupling derived from the galactic disk, which are among the tightest bounds to date.

WHIST: White-dwarf HR-diagram interactive synthesis tool

Yoav Ziv

Tel Aviv University

We present WHIST, an interactive tool for modeling the number density of WDs in the color-luminosity plane. WHIST incorporates all relevant physical processes affecting WD evolution in parametrized form, including: Galactic star-formation history, stellar initial mass function, initial-final-mass relation, WD mergers, and WD cooling processes (including crystallization, distillation, carbon dredge-up). For a given choice of physical parameters, selected via a user interface, WHIST calculates the HRD number density of WDs within a fraction of a second. This permits visualizing and intuiting the effects and degeneracies among the different parameters controlling the WD HRD, and learning which parameters affect which regions of the HRD.
Furthermore, the tool performs a statistical comparison of each model to the observed Gaia two-dimensional number density distribution in the entire HR plane (or selected parts of it), avoiding the loss of information inherent to traditional approaches that model one-dimensional projections in the HRD plane (e.g. mass function, luminosity function, Q-Branch).

Eccentricity and Formation of White Dwarfs Orbiting Millisecond Pulsars

Hagai Bareli

HUJI - The Hebrew University of Jerusalem, Israel

Some of the most intriguing binary white dwarfs orbit millisecond radio pulsars. One channel to form such white dwarfs is through the stable Roche-lobe overflow of intermediate-mass ($3M_\odot \lesssim M \lesssim 5M_\odot$) stars at the end of the main sequence or the beginning of the hydrogen shell burning phase. Depending on the initial orbital period, this channel can produce either CO or unique hybrid He-CO core white dwarfs. We compute this binary evolution channel both analytically and numerically, relating the final orbital period $P(m_{wd}, M)$ to the white dwarf's mass and to its progenitor's initial mass. We also theoretically calculate - for the first time - the eccentricity $e \sim 10^{-5}$ in this process, which is set by the fluctuating gravitational quadrupole moment of the progenitor's convective envelope. Thanks to the superb timing of millisecond pulsars, these tiny but non-zero eccentricities have been measured for a growing number of white dwarfs over the last decades. We compare our results to the observed sample, to lower-mass He white dwarfs, and to massive CO and ONe white dwarfs that formed through a different channel of unstable mass transfer during helium shell burning, followed by common envelope inspiral.

Session 1.2 | Clusters, Wide Binaries + IFMR

Crystallization of white dwarfs in globular clusters

Juan Pablo Castro Idarraga, Santiago Torres, Maria Camisassa, Benjamin Oostra

University of Los Andes, Barcelona Tech

Gaia observations of white dwarfs reveal that a small fraction of ultra-massive white dwarfs ($M > 1.1\ M_\odot$) exhibit substantial cooling delays. Neon-22 sedimentation and crystallization (extra energy sources) explain this, but only at very high metallicity levels. We analyzed these *e* ects—especially in ultra-massive white dwarfs—via synthetic globular clusters with varied parameters by using the ζ parameter and the ultra-massive quotient (new parameter). We obtained that younger, metal-richer clusters show higher ultra-massive quotients and ζ histograms peaked at lower values. In addition, Hertzsprung-Russell diagrams confirm that carbon-oxygen cores abruptly boost delays due to sedimentation and ultra-massive WD numbers. Observed clusters (NGC 6397, NGC 6791, 47 Tucanae) match synthetic ζ distributions for ultra-massive WDs. Finally, the ultra-massive quotient proves a useful tool to predict the observed cluster with the highest percentage of ultra-massive white dwarfs.

Project link: https://repositorio.uniandes.edu.co/entities/publication/cab0f86d-83bd-48e3-8bb2-7408463fc253

White dwarfs in open clusters and tidal tails as tracers of contamination and stellar interactions

Vikrant Jadhav

Chales University, Prague

Recent Gaia studies have produced many catalogues of open clusters (OCs) and their tidal tails. We compile a list of white dwarfs (WDs) associated with these clusters from recent literature. The aims of this work are to validate the membership of WDs in tidal tails, use OC–WD pairs to study the initial–final mass relation, and identify WDs formed through non-standard evolution. We estimate WD properties using ultraviolet to infrared photometry. Colour–magnitude diagrams (CMDs) and spectral energy distributions (SEDs) are used to derive masses, cooling ages, temperatures, radii, luminosities, and surface gravities, and to compare them with cluster properties. We identify 206 OC–WD pairs detected by Gaia, of which 47 are located in tidal tails.
More than 25% of these WDs are likely non-members based on their cooling ages. This result shows that WDs can be used to trace contamination in tidal tail catalogues, as previously suggested for the Pleiades. A similar level of contamination (≈25%) is expected for lower mainsequence stars of comparable magnitude. We identify nine WDs (four in tidal tails and five in cluster cores) that are good candidates for improving constraints on the initial–final mass relation. We also identified 40 WDs which are likely formed by binary evolution. Spectroscopic follow-up is needed to confirm their cluster membership, identify WDs formed through non-standard evolution, and obtain precise mass measurements.

Session 1.2 | Clusters, Wide Binaries + IFMR

Deep Observations of the Metal-Rich Open Cluster NGC 6253

Elizabeth Jeffery

Cal Poly, San Luis Obispo

We present deep photometric observations of the metal-rich open cluster NGC 6253, with the goal of observing the cluster white dwarfs for the first time. These observations provide an important test of our understanding of white dwarf cooling in super metal-rich environments. We cross-match our observations with Gaia astrometry to identify bright cluster members and fit PARSEC isochrones using BASE-9, a sophisticated algorithm that utilizes Bayesian statistics. From this we measure a main sequence turn-off age of 3.947 ± 0.082 Gyr, as well as a binary fraction of 22%. We identify 75 blue stellar objects in the color-magnitude diagram near the expected location of the cluster white dwarf cooling sequence; although given the abundance of field stars in this region, we do not believe all of these to be cluster white dwarfs. Our current data is such that we cannot confidently identify the cluster white dwarfs; however, these images can be used with follow-up observations to measure proper motions of the faint objects to distinguish cluster members from field stars.

Evidence for an excess population of luminous white dwarfs in the atypical Galactic Globular Cluster NGC 2808.

Laksh Gupta

Argelander Institute of Astronomy, University of Bonn

We analyze the white dwarf (WD) cooling sequence of the Galactic globular cluster NGC 2808 using deep near-ultraviolet observations from the Hubble Space Telescope, combined with theoretical models, to determine whether the cluster exhibits an excess population of WDs. Such excesses are uncommon and have only been identified in a few globular clusters. Our approach involves comparing star counts across different evolutionary stages in the near-UV color–magnitude diagram with evolutionary timescales predicted by BaSTI models. The analysis is performed within a central region extending to 1.5 arcminutes from the cluster core, as well as in a similarly sized field located 5 arcminutes away. We detect a WD excess of approximately 60–70% when comparing the WD cooling sequence to the main-sequence turn-off, considering various levels and fractions of helium enhancement. This excess decreases to about 30–40% when the comparison is made with the horizontal branch. Although the excess appears slightly higher in the central field, the difference relative to the outer field remains consistent within the uncertainties. We suggest that this excess may be linked to the presence of sub-luminous carbon–oxygen white dwarfs, the so-called Slowly Cooling White Dwarfs and/or Helium-core WDs in NGC 2808, and could be directly connected to the cluster's extended blue horizontal branch.

Session 1.2 | Clusters, Wide Binaries + IFMR

What Can BASE-9 Do For White Dwarf Science?

Ted von Hippel

Embry Riddle Aeronautical University

Bayesian Analysis of Stellar Evolution with 9 Parameters (BASE-9) is an astrostatistics software suite that derives stellar properties by comparing stellar models to photometry, while using distance, metallicity, and line-of-sight absorption as priors. From these data, BASE-9 can derive White Dwarf (WD) cooling ages, total ages, stellar masses, and binarity, and for clusters BASE-9 can also derive the Initial-Final Mass Relation. Current datasets that underpin our field will be dramatically extended by the Vera Rubin Observatory, Nancy Grace Roman Telescope, Landolt mission, etc., yielding opportunities to push WD science to higher precision and distant locations in the Galaxy. We present examples of BASE-9 results for white dwarfs and ideas for future opportunities that take advantage of the next generation of data sets. We are happy to support others in using BASE-9 and welcome potential new collaborations.

First planetesimals from DESI DR1: 12 highly metal-rich white dwarfs

Paula Izquierdo

University of Warwick

Metal-enriched white dwarfs provide a unique insight into the composition of exoplanet interiors. These stars accrete the debris of disrupted planetary bodies, and hence, measuring the stellar parameters and photospheric abundances yields the bulk compositions of the parent bodies. At present, over 1750 debris-accreting white dwarfs are known, but just a few dozen are sufficiently enriched to allow a detailed abundance study. Here we report the analysis of 12 highly metal-enriched white dwarfs observed within the Data Release~1 of the Dark Energy Spectroscopic Instrument (DESI). We characterised their stellar parameters and photospheric metal abundances and we identified between three and nine different elements in their optical spectra, including most of the rock-forming species: O, Mg, Si, Ca and Fe. We conclude that the accreted bodies broadly resemble compositions found within the inner Solar System such as primitive meteorites and planetary cores. Six of the systems allowed a more thorough analysis: four of the parent bodies are composed of dry rock-forming elements; and two of them of something akin to a water-rich planetesimal. Thus, this study establishes DESI as a potent survey for identifying metal-rich targets, yielding reliable compositions of accreted exoplanetary material.

Session 1.3 | Large Spectroscopic Surveys

Fitting DAs in DESI DR1

<u>João Gabriel Leite Medeiros</u>

Universidade Federal do Rio Grande do Sul

The atmospheric parameters of white dwarfs provide insight into their properties and, consequently into stellar evolution. In my work, I wrote a code intended to fit normalized hydrogen line profiles to model atmospheres of DAs. Three model grids for DAs with cool temperatures, focused on the ZZ Ceti instability strip, were computed using the codes Tlusty and Synspec, but a precomputed grid was also used. Previous determinations using SDSS data were used to evaluate the quality of the code, before it was used for new determinations of effective temperature and surface gravity. For this work, I have fitted over 20000 spectra from candidate DAs present in DESI DR1 using my fitting code, including the ones outside the ZZ Ceti instability strip. Most fitted parameters were in range of what is expected for this type of star, further validating the code.

Retrieving white dwarf-main sequence binary systems in the main sequence using machine learning

<u>Enrique Miguel García Zamora</u>

Universitat Politécnica de Catalunya

TWhite dwarf-main sequence binaries (WDMS), both wide and close, are of capital importance to solving several astrophysical problems, such as determining the age-activity-rotation and age-metallicity relations, the initial to final mass relation, the efficiency of the common envelope phase, or the origin of low mass white dwarfs. Unfortunately, population synthesis studies show that most unresolved WDMS systems are expected to contain a relatively bright companion, causing them to occupy the main-sequence region of the Gaia Hertzsprung–Russell diagram. In order to retrieve them, we apply machine learning techniques to the Gaia 100 pc sample, focusing in a region within the main sequence. We show that our algorithm, trained with synthetic MS and WDMS spectra, achieves an accuracy above 99% and a precision of approximately 90% when classifying known MS stars and unresolved WDMS systems. We then apply the model to a sample of 18536 objects within 100 pc and find that approximately 2% of the targets are unresolved WDMS systems. Their proportion and location in the HR diagram agree with population synthesis simulations. These newly identified systems provide an important opportunity to improve our understanding of several outstanding problems in stellar and binary evolution.

Session 1.3 | Large Spectroscopic Surveys

The WEAVE White Dwarf Survey

Roberto Raddi

Universitat Politècnica de Catalunya

The William Herschel Telescope (WHT) Enanced Area Velocity Explorer (WEAVE) is a survey spectrograph. It operates a multi-object spectrograph (MOS) with ~1000 fibres over a 2-degree field of view, a 90x78 arcsec2 integral field unit (LIFU) and 20 mini-integral field unit (mIFU) bundles. All three instruments can observe at low- and high-resolution (R ~ 5000 and 10,000, respectively), broadly covering the 3700-9600 Å spectral range. Among eight projects, the WEAVE-WD survey (PI B. Gaensicke) will observe most of the northern-hemisphere white dwarfs, providing cutting edge science as well as flux calibration to the low-resolution WEAVE surveys with about 15 targets per field. The MOS instrument is completing its science verification, delivering 500+ white dwarf targets. In this presentation, we will describe our science objectives, preliminary results, and future perspectives. Synergies with ongoing and future multi-object spectroscopic surveys, also targeting white dwarfs, will enhance the scientific output from WEAVE.

The White Dwarf Binary Survey of 4MOST

Alberto Rebassa-Mansergas

Universitat Politècnica de Catalunya

The White Dwarf Binary Survey is a recently initiated observational program within 4MOST, aimed at characterizing binary systems containing white dwarfs across a wide range of orbital configurations and evolutionary stages. By benefiting from the high multiplexing capability and broad spectral coverage of 4MOST, the survey will deliver a statistically significant and homogeneous sample of white dwarf binaries. In this contribution, I will present an overview of the survey design, target selection strategy, and scientific goals. I will also show representative spectra from the initial observing runs, along with preliminary results. These early data highlight the survey's potential to significantly advance our understanding of white dwarf binary populations and their role in broader astrophysical contexts.

Session 1.3 | Large Spectroscopic Surveys

The 4MOST southern white dwarf survey

Nicola Gentile Fusillo

Università degli studi di Trieste

We present the 4MOST southern white dwarf survey, an ambitious spectroscopic campaign that will observe 80,000–100,000 white dwarfs down to magnitude 20.5 at R~5,000. 4MOST is a 2,400-fiber multi-object spectrograph mounted on the VISTA telescope at Paranal, and white dwarfs constitute a high-priority component of its Galactic survey.
This poster will outline the survey design, including target selection criteria, observing strategy, and expected completeness for white dwarfs. We will present key performance metrics of 4MOST and we will showcase the first white dwarf spectra obtained during the science verification phase, demonstrating the data quality achievable and signal-to-noise regimes. These early results highlight both the survey's capabilities and practical challenges to be encountered in automated spectral classification and parameter determination for such a large sample.
The southern hemisphere remains, spectroscopically, largely unexplored. With its multiplex capability 4MOST will more than double the number of spectroscopically confirmed white dwarfs, providing an extremely valuable dataset for all white dwarfs research fields from stellar evolution to the fate of planetary systems.

Searching for Magnetic White Dwarfs in LAMOST

Sicheng Yu

University of Oulu

Magnetic white dwarfs (MWDs) are perfect laboratories to study the origin and evolution of magnetic activities in degenerate stars. Recent years have seen a rapid increase of new discoveries of MWDs through spectroscopical surveys like SDSS. With a similar approach, we cross-matched LAMOST DR10 spectra with the most recent SDSS-based MWD catalog to study their behaviors, and to use them as exemplary samples to look for more MWDs in the huge LAMOST database. Zeeman splitting in Balmer and helium absorption lines were used as the primary diagnostic to identify magnetic fields and to estimate their strengths. We identified 63 isolated MWDs in LAMOST DR10, of which 32 are new discoveries. Surface magnetic field strengths were measured from Zeeman splitting, covering a range from a few MG up to several tens of MG. For previously known SDSS MWDs, our LAMOST-based field measurements show mostly agreement with published values. The newly discovered objects expand the known population and provide valuable targets for future high-resolution spectroscopic and polarimetric follow-up studies.

Session 1.3 | Large Spectroscopic Surveys

Tracing Galactic Disk Heating with White Dwarfs: A Combined SDSS–Gaia DR3 Study

Ozcan Caliskan[1], Selcuk Bilir[1], Mukremin Kilic[2]

[1]Istanbul University (Astronomy & Space Sciences),
[2]The University of Oklahoma (Physics & Astronomy)

This study investigates the kinematics and Galactic orbital properties of 5,837 white dwarf stars in the solar neighborhood using a catalog constructed from SDSS photometric and spectroscopic data combined with Gaia DR3 astrometry. After applying strict quality criteria, space velocities and orbital parameters were derived with high precision. Based on kinematic and dynamical analyses, the relative contributions of thin disk, thick disk, and halo populations were estimated, yielding thick disk and halo fractions of approximately 7% and 0.2%, respectively. By imposing constraints on vertical distance (Z), total space velocity (SLSR), and orbital parameter (Zmax), velocity dispersions were calculated and used to estimate kinematic ages. The subsamples show a systematic increase in velocity dispersion (40–220 km s^{-1}) and age (2.8–15 Gyr) with distance and total space velocity. This trend is consistent with dynamical heating processes in the Galactic disk. Overall, the results provide robust constraints on the kinematic structure and dynamical evolution of white dwarf populations in the Milky Way, based on high-precision modern survey data.

Hundreds of Newly Confirmed White Dwarfs from HETDEX

Barbara Castanheira

Baylor University

I present results from a large spectroscopic survey of white dwarfs based on data from the Hobby–Eberly Telescope Dark Energy Experiment (HETDEX). Using integral-field spectroscopy from the VIRUS instrument array, covering 3500–5600 Å at a spectral resolution of R ~ 750, we have identified and newly spectroscopically confirmed more than 800 white dwarfs as a by-product of the HETDEX data releases, extending down to g $\simeq$ 21. Many of these objects lacked any previous spectroscopic classification. By cross-matching with Gaia and Sloan Digital Sky Survey (SDSS) data, we obtain robust effective temperatures and surface gravities through spectral fitting. The untargeted, integral-field nature of HETDEX largely eliminates the color-selection biases inherent to earlier surveys, such as SDSS. I will discuss the properties of this growing sample and its implications for white dwarf demographics, and show how it enables the construction of a white dwarf luminosity function extending several magnitudes fainter than previous surveys.

Session 1.3 | Large Spectroscopic Surveys

The SALT Survey of He-rich Hot Subdwarfs: New Constraints on WD Mergers

Matti Dorsch

Universität Potsdam

Most helium-rich hot subdwarfs (He-sdOs) are understood to form through the merger of two helium-core white dwarfs and will themselves evolve onto the white dwarf cooling sequence. They thus provide a direct observational link between low-mass HeWD progenitors and the resulting CO white dwarfs of up to ~1.0M☉. Because He-sdOs are uniquely identifiable as merger products, they allow us to probe the mass distribution of merger remnants even where it overlaps with the main single-WD mass peak.
Our recently completed SALT survey was designed to discover He-sdOs and exploit this connection. Using medium-resolution RSS spectroscopy, nearly 700 hot subdwarfs were observed, including 393 helium-rich subdwarfs, 17 extreme helium stars, and 21 helium-rich stars of other types, forming the largest homogeneous sample of such objects to date. A subset of the He-sdOs are strongly magnetic, and explain a fraction of the population of highly magnetic white dwarfs. I will present an overview of the survey and a model-atmosphere analysis of the He-sdO population. The resulting mass distribution is double-peaked, and its correlation with surface abundances provides new constraints on the progenitor masses and mass ratios of HeWD merger channels.

Visual classification of DESI DR1 White Dwarfs

Weligton Nogueira Costa Junior

Universidade Federal do Rio Grande do Sul

We present a spectral classification of white dwarf stars from the DESI DR1 survey. We analyzed a sample of 46000 stellar spectra, selecting objects with a signal-to-noise ratio $S/N \geq 3$. Each spectrum was visually inspected and classified according to its spectral features, allowing the identification of different types of white dwarf. For objects classified as DA, we additionally performed atmospheric parameter determinations, deriving effective temperature, surface gravity (log g) and mass estimates. This study contributes to expanding the statistical characterization of white dwarf populations and provides a robust dataset for future investigations in stellar evolution and asteroseismology.

Session 1.4 | Asteroseismology + Hot WDs

On some mysteries of the `Red Edge' of the DA instability strip

Anwesha Biswas, Steven D. Kawaler

Iowa State University

Pulsating white dwarfs occupy narrow temperature ranges where non-radial g-modes drive observable variability. For pulsating DA white dwarfs, theoretical models accurately reproduce the blue edge of the instability strip, showing a strong dependence on the convective mixing-length parameter – which we demonstrate with standard linear pulsation models. The cause of the red edge remains uncertain. Near it, long-period pulsations show less coherent variability than at shorter periods. The stars also occasionally display flare-like outbursts lasting hours. These phenomena are symptomatic of nonlinear energy transport processes in the subsurface convection zone. Linear pulsation modes remain unstable at cooler temperatures and longer periods than observed. Nonlinearity can allow otherwise independent g-modes to exchange energy via parametric instability, triggered by steep thermal and pressure gradient in the outer convection zone. Here, we investigate nonlinear mode coupling in white dwarf models. We consider the simplest coupling, involving an $\ell = 1$ coupled to two damped modes of different ℓ . These nonlinear interactions redistribute pulsation energy among the modes and the convection zone, altering mode amplitudes on time scales of days to weeks. We conclude that nonlinearity can explain the disappearance of driven modes, and perhaps the observed outbursts, at the observed temperatures.

DAV White Dwarf Pulsations: Impact of the Hydrogen Envelope Thickness

Pietro Brandli Ignacio[1] , Alejandra Daniela Romero[1] , Kepler de Souza Oliveira[1]

Universidade Federal do Rio Grande do Sul

Pulsation periods of DAV white dwarf stars are highly sensitive to structural parameters, particularly the mass of the hydrogen envelope. The occurrence of avoided crossings in the pulsation period values as hydrogen mass varies highlights the value of high-resolution model grids for studying the internal structure and improving asteroseismic analyses. In this work, we investigate the specific effect of the hydrogen layer thickness on the pulsation periods of DAVs. Building upon the reference grid previously developed by Romero et al., we computed a set of cooling sequences with varying hydrogen mass using the stellar evolution code LPCODE, focusing on three representative stellar masses near $0.6M_\odot$. By systematically and gradually varying the hydrogen envelope thickness, we mapped the behavior of the pulsation modes, further refining this foundational grid in regions of interest. This enhanced resolution provides a more robust framework for interpreting the pulsation modes of DAVs, allowing more precise determinations of their physical properties.

Session 1.4 | Asteroseismology + Hot WDs

Asteroseismology of the ultra-massive ZZ Ceti star GD 518

Alejandro Hugo Córsico

University of La plata

Asteroseismology of pulsating ultra-massive white dwarfs (WDs) provides a unique window into constraining core compositions and the physics of crystallization. In recent years, targeted surveys and high-cadence photometry have significantly expanded the sample of known massive and ultra-massive pulsating DA WDs (ultra-massive ZZ Ceti stars). While the benchmark star BPM 37093 (Kanaan et al. 1992) remains the most extensively studied, GD 518 (Hermes et al. 2013) was the second object of this class to be discovered. Using the 2.1 m Otto Struve Telescope at McDonald Observatory, Hermes et al. identified three pulsation periods at 440 s, 513 s, and 584 s. These were later utilized by Córsico et al. (2019) to derive an asteroseismic model assuming an oxygen-neon (ONe) core. However, with only three periods available, those results remain tentative; furthermore, the possibility of a carbon-oxygen (CO) core was not explored in that study. In this poster, we present the first results of a reanalysis of the pulsation spectrum of GD 518. Our work incorporates new photometric observations acquired with the Astrophysical Research Consortium Telescope Imaging Camera (ARCTIC) on the 3.5 m Apache Point Observatory (APO) telescope, alongside high-cadence data from the HiPERCAM multiband imager on the 10.4 m Gran Telescopio Canarias (GTC). We perform a comprehensive asteroseismic analysis leveraging state-of-the-art ultra-massive WD models, considering both ONe- and CO-core configurations.

Strategic Improvements to White Dwarf Asteroseismic Fitting in the Gaia Era

Andrew H. Dublin[1], Keaton J. Bell[2], Agnes Bischoff-Kim[3]

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Pulsating white dwarf stars have complex interior structures that, in principle, can be probed by the resonant frequencies of their standing wave oscillations; these resonant frequencies manifest as measurable, periodic brightness variations at the surface of the star. The traditional approach used to match observed pulsation frequencies to those computed by stellar evolution models (to within uncertainties) is known as period-byperiod asteroseismic fitting. However, there remain significant hurdles in achieving reliable results using the period-by-period fitting approach, and improved methodologies are required to address these issues. In this poster, we present novel strategies to characterize precise asteroseismic solutions in the Gaia era. Firstly, we demonstrate that the computational burden of computing large grids of models can be reduced by interpolating model periods over coarse grids. Second, we show how by incorporating absolute magnitude from Gaia astrometry into the statistical quality function used in the period-byperiod fitting, solution degeneracy is significantly reduced. Lastly, we present a new method of isolating seismic solutions based on fixed mode identification. By fitting Gaussian distributions to the resulting solutions, we can more accurately characterize the precision and degeneracy of the asteroseismic constraints.

The Seismic Technique for Accurate White Dwarf Parameters

Keaton Bell[1], Agnes Bischoff-Kim[2]

[1]CUNY Queens College, [2]Penn State Scranton

Pulsations of white dwarf stars reveal resonant frequencies of these stars that are sensitively tuned by their interior structures. Asteroseismology of white dwarf stars typically compares measured pulsation periods to those computed for stellar models in attempts to map the stellar interior. Despite many advances in both observation and theory of white dwarf pulsations, reliable structural constraints from pulsations are limited. We develop a new "seismic technique" for accurately determining the properties of pulsating white dwarfs that combines Gaia astrometry with measurements of the mean period spacing between consecutive radial pulsation modes. These measurements, when available, permit unique and accurate solutions for the global parameters of mass and effective temperature, and our statistical framework propagates errors from uncertainties on the interior stellar profile. Measuring these global properties is a powerful step toward reliably constraining the detailed interior structures of pulsating white dwarfs in the Gaia era, and can serve as valuable benchmarks for other parameter estimation methods such as the spectroscopic technique.

Census of known ZZ Cetis

Alejandra D. Romero, A. J. Soares Henicka, S. O. Kepler, L. C. Sultan, J. G. Leite Medeiros, and W. N. Costa Junior

Universidade Federal do rio Grande do Sul

Pulsating DA white dwarf stars, known as ZZ Ceti stars, are the most populated group of pulsating white dwarf stars. Since the discovery of the first object HLTau 76 by Arlo Landolt the list has been growing, reaching around 180 objects in 2016. With the large photometric surveys, as the ones from Kepler and TESS satellites, the number og known ZZ Cetis has double. In this work, we compile a list of all known ZZ Ceti stars to date, being almos 400 stars. For each object we compile the obseved periods and amplitudes, and the different determinations of effective temperature and surface gravity. Finally, we analyze the observed properties of this sample, as the period distribution with temperature and stellar mass, pulsation amplitude as a function of temperature, among other parameters of interest.

Spectroscopic Survey of Faint Planetary-Nebula Nuclei: Thirty New Hydrogen-Deficient Central Stars

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Our ongoing spectroscopic survey of faint planetary-nebula nuclei (PNNi) has revealed thirty new hydrogen-deficient central stars. The majority of them (21) belong to the PG1159 spectral class (having He-C-O-dominated atmospheres). They increase the number of known PN central stars of this type from 25 to 46. Our spectral analysis finds that their eƯective temperatures are high (T_{eff} = 110,000-180,000 K), locating them in the GW Vir pulsational instability strip. Future photometric observations should therefore substantially increase the number of the currently nine known PNN pulsators. We found six new members of the O(He) spectral type (He-dominated atmospheres; T_{eff} = 120,000- 150,000 K), tripling the number of known PNNi of this class. Finally, we identified three hot helium-rich white dwarfs with traces of carbon and/or nitrogen (spectral type DOZ; T_{eff} = 70,000-100,000 K). They are the first objects of this spectral class found to be associated with a PN.

Theoretical ultraviolet spectra from atmosphere and global wind models of central stars of planetary nebulae

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Reliable modelling of ultraviolet radiative fluxes emerging from central stars of planetary nebulae is essential for understanding the ionization state of planetary nebulae and for interpreting ultraviolet color-magnitude diagrams. We compared HI, HeI, and HeII ionising fluxes calculated using plane-parallel TLUSTY and global METUJE models; we found significant differences in HI and HeI ionising fluxes from plane-parallel and global models for cooler stars, while the fluxes remain similar for hot stars. We studied similarities and differences in theoretical ultraviolet spectra from atmosphere and global wind models of central stars of planetary nebulae. Differences between planeparallel TLUSTY and global METUJE models in the ultraviolet region are caused by absorption of the photospheric flux in the wind. In a plot of the far-UV/near-UV flux ratio versus far-UV flux, we demonstrated evolutionary tracks for different initial masses from post-asymptotic giant branch stars through central stars of planetary nebulae to white dwarfs on the cooling track. We obtained an evolutionary path analogous to the track in the Hertzsprung-Russell diagram, indicating good usability of ultraviolet fluxes obtained from theoretical models for evolutionary studies.

New mass-loss rate predictions for central stars of planetary nebulae approaching the Eddington limit

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Central stars of planetary nebulae, being hot and relatively luminous, are able to launch line-driven winds. The luminosity dependence of these winds has not yet been studied using global wind models that consistently describe both the photosphere and the wind. We present global line-driven wind models for central stars of planetary nebulae, focusing on more luminous central stars approaching the Eddington limit. The predicted mass-loss rate scales with stellar luminosity, whereas the terminal velocity depends only weakly on luminosity and instead increases with the effective temperature. The predicted values are broadly consistent with observations. However, the observational mass-loss rates exhibit significant scatter, and the predicted terminal velocities are slightly lower than the observed values. Despite the proximity to the Eddington limit, the winds remain optically thin. This low optical thickness suggests that [WR]-type central stars are associated with objects that possess an enhanced mass fraction of heavy elements.

Session 1.4 | Asteroseismology + Hot WDs

The mass distribution of hot subdwarf stars

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Hot subdwarf stars (sdO/B) form a diverse class of progenitors of white dwarfs. The multitude of observed phenomena imply that several pathways may form hot subdwarfs, most involving close binary channels. We present the results of quantitative spectral analyses of about 500 hot subdwarfs in three homogenous samples of stars: a volume-complete survey of hot subdwarfs (Dawson+2026,A&A,707,A6), a sample drawn from the Arizona-Montreal survey (Latour+2026,A&A, 705, A248), and a third one drawn from the Hamburg Quasar Survey (Heber+2026,A&A,708,A115). New homogenous grids of model atmospheres and synthetic spectra calculated with a hybrid LTE/NLTE approach, the socalled "Second generation Bamberg model grids", were used to derive effective temperatures, surface gravities and helium abundances. Spectral energy distributions were used to derive angular diameters and interstellar extinction. Gaia parallaxes allowed us to derive radii, luminosities, and masses from the atmospheric parameters allowing us to places them in the Hertzsprung-Russell diagram. We derive their distributions for all major subclasses (sdB, sdO, He-poor, Herich, pulsating …) and discuss the implications with respect to evolutionary concepts.

Hot subdwarf stars from the Hamburg Quasar Survey

Lennard Kufleitner, Ulrich Heber

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Hot subdwarf stars (sdO/B) are evolved low-mass stars formed from red giants that have lost nearly all of their envelopes, likely through multiple channels involving close binary evolution. Using improved hybrid LTE/non-LTE model atmospheres and Gaia astrometry, we present a spectroscopic analysis of 122 non-composite subdwarfs discovered in the Hamburg Quasar Survey. We confirm that sdB stars reside on the extreme horizontal branch with a canonical mean mass of 0.45 $M_\odot$ and that their mass distribution shows no significant differences between pulsating and nonpulsating populations. In contrast, helium-rich sdOB and sdO stars are located near the helium main sequence and exhibit a higher and broader mass distributions. These findings support a formation scenario in which helium-rich subdwarfs originate from the merger of two helium white dwarfs, linking their evolution directly to compact binary white dwarf systems.

Hot subdwarf stars in the PLATO era: a key window for intermediate stages of stellar evolution

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Hot subluminous stars (sdB, sdO, BHB, and ELM white dwarfs) are compact, hot objects, which have lost most of their hydrogen envelopes, likely through binary interaction. Their properties challenge standard stellar evolution scenarios, providing a testbed for binary evolution.

In the context of the PLATO mission, which will deliver high-precision light curves, we present a well-characterized sample of hot subluminous stars located in the mission's southern field. Using data from Gaia DR3 alongside various photometric and spectroscopic surveys, we constructed and analyzed spectral energy distributions spanning the UV to infrared. This enables a robust determination of stellar radius and luminosity, as well as the identification of main-sequence companions.

The PLATO mission will overcome observational limitations of the ongoing TESS mission and enable long, uninterrupted, high-precision time series. Our final target list comprises more than 300 bright (G < 17 mag), well-constrained objects selected through strict uncertainty cuts on the effective temperature, radius, and luminosity. For a subset, spectroscopy from the ESO archive, the ongoing SDSS-V and 4MOST surveys, provides surface gravity, helium abundance, and stellar mass when combined with the Gaia DR3 parallax. This dataset offers one of the most comprehensive samples of hot subluminous stars in a single field.

Session 2.1 | Advances in WD Modeling

Equation-of-state and transport properties of Warm Dense mixtures for White Dwarf Envelopes using Machine-Learned Quantum Molecular Dynamics

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Accurate physical models of the white dwarf (WD) interior and surface layers are essential for interpreting observable phenomena such as surface convection and planetary accretion. However, the partially ionized surface layers of WDs reside in the warm dense matter (WDM) regime, where traditional kinetic theory and tabulated equations of state (EOS) often lose accuracy. This study aims to provide high-fidelity EOS and ionic transport data for deuterated water serving as a benchmark for WDenvelope mixtures where diffusivity uncertainties directly impact stellar-pollution models. We utilize a novel computational framework combining spectral-partitioned density functional theory (SPDFT) with machine-learned interatomic potentials (MLIAP). This approach achieves orders-of-magnitude speedup over conventional DFT-MD while maintaining Kohn-Sham accuracy. Simulations were performed across a range of densities and temperatures spanning the transition from condensed matter to plasma conditions. Our results quantify interdiffusion and shear viscosity in the intermediate WDM regime, identifying the specific thermodynamic conditions under which various transport models converge. These benchmarks provide a robust foundation for improving WD evolution predictions in stellar models like MESA.

Phase Diagrams and White Dwarf Cooling

Michael Montgomery

University of Texas

The phase separation of carbon and oxygen during crystallization has long been a proposed energy source for delaying white dwarf (WD) cooling. Recently, theoretical calculations have shown that minor chemical species such as Ne-22 and, to a ltesser extent, Fe could provide additional age delays. In this poster we use self-consistent evolutionary models to study the crystallization properties of WD interiors when several minor chemical species are simultaneously present, varying both initial stellar mass and metallicity. We use these calculations to investigate the claim by Caplan et al. (2021) that under some conditions Fe-rich crystals can form and sediment out before the C/O crystallizes, producing an Fe-enriched core.

Bound–Free Opacity of Hydrogen in Strong Magnetic Fields: Implementation in Magnetic White Dwarf Atmosphere Models

Jonathan Roussy

Université de Montréal

In the presence of strong magnetic fields, the structure of the hydrogen atom is profoundly modified. While the splitting and shifting of bound energy levels are well known, the continuum states are also strongly affected, becoming structured and shifted due to magnetic quantization. These changes can significantly alter the bound–free opacity in stellar atmospheres. Recent quantum-mechanical calculations provide accurate descriptions of hydrogen bound–free spectra in strong magnetic fields, but their implementation in astrophysical models remains limited. Building on the recent work of G ´omez et al. (2024) and Zhao et al. (2021), which presents detailed calculations of the bound–free spectrum using advanced numerical techniques for different regimes, we incorporate these results into a magnetic stellar atmosphere code. This development enables improved modeling of the continuum opacity in strongly magnetic white dwarf atmospheres and provides a more realistic framework for interpreting their observed spectra.

Frequency and composition of planetary debris around young white dwarfs: Insights from HST/COS snapshot survey

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White dwarf atmospheric pollution provides a powerful probe of the bulk composition and occurrence of exoplanetary debris, offering unique insights into the ultimate fate of planetary systems. In this talk, we will present new results from the HST/COS snapshot survey of 427 hydrogen-atmosphere (DA) white dwarfs. We will first examine the frequency of detected planetary debris as a function of white dwarf parameters, including effective temperature, cooling age, and mass, considering both single stars and wide binary systems. We will also discuss trends with accretion rates derived consistently across the sample by accounting for both diffusion and radiative levitation effects. We will then present a comprehensive compositional analysis based on C/Si abundance ratios across the full sample, with particular focus on systems that also exhibit oxygen and other heavy elements. For these metal-enriched white dwarfs, we derive initial compositional constraints using abundance ratios such as C/O and C/Si to infer the nature of the accreted material, including rare cases that deviate from rocky compositions. These results provide new insights into the frequency and chemical composition of exoplanetary material around young white dwarfs.

Laboratory Measurements of Carbon at White Dwarf Photospheric Conditions

Jayden A. Blanchard, Bart Dunlap, Mike Montgomery

The University of Texas at Austin, Sandia National Laboratories

Hot DQs are a unique white dwarf subclass with carbon and oxygen dominated atmospheres. These objects are likely the result of double-degenerate mergers, and accurate modeling of them can lead to a better understanding of the merger process and, therefore, of the type Ia SNe process. Our current theoretical models of carbon line broadening disagree, which affects hot DQ surface gravity determinations, so laboratory measurements are critical to resolving these discrepancies. Using the Z platform at Sandia National Laboratories, we are able to generate plasmas at white dwarf photospheric conditions, including DQ conditions, allowing for benchmark measurements of carbon line profiles. We present new laboratory measurements of singly ionized carbon spectra at hot DQ conditions, provide an analysis of these spectra, and discuss our experimental platform. We also discuss our plans to improve limited and uncertain carbon atomic data by making measurements of neutral carbon lines, since the current carbon atomic data leads to ambiguities in the interpretation of warm DQ spectra. In the end, these improvements will lead to more accurate Teff, logg, and surface composition determinations and help develop state-of-the-art DQ atmospheric models.

Session 2.1 | Advances in WD Modeling

Progress on oxygen opacity experiments for stellar and white dwarf interiors

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Models of stellar structure and evolution require accurate opacity calculations for energy flow within stars. This can affect predictions of where convection zones form and the rate at which white dwarfs (WDs) cool. Experiments at the Z Facility and National Ignition Facility (NIF) aim to test opacity model predictions at stellar interior conditions relevant to the Sun and WDs. Previously, experiments at Z revealed severe model-data discrepancies in iron opacity as conditions approach the solar convection zone base, suggesting revisions to opacity theory may be needed as temperature and density increase. Oxygen opacity is important for the Sun and some WDs, and it is more strongly affected by treatments for density effects in opacity calculations. Furthermore, any findings for oxygen would also inform carbon calculations. This poster will discuss the progress of oxygen opacity experiments at each facility. Recent measurements of oxygen opacity from Z at lower temperature and density conditions show overall agreement with models, establishing confidence in the experiment and analysis methods, but they also reveal discrepancies in model lineshapes and findings for continuum lowering models. We will also discuss progress toward measurements at higher temperature and density and other preliminary results from each platform.

This work was supported by the Wootton Center for Astrophysical Plasma Properties (WCAPP) under National Nuclear Security Administration (NNSA), Stewardship Science Academic Alliances award number DE-NA0004149. Experimental time was awarded through the Z Fundamental Science Program of Sandia National Laboratories (SNL) and the National Ignition Facility's Discovery Science Program of Lawrence Livermore National Laboratory (LLNL). SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525. LLNL operates under DOE NNSA contract No. DEAC52-07NA27344 and Los Alamos National Laboratory under contract No. 89233218CNA000001.

Session 2.1 | Advances in WD Modeling

Mixing processes on low-mass stars: Chemical and pulsational consequences for white dwarfs and pre-white dwarfs

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During the evolution of low-mass stars on the asymptotic giant branch (AGB), thermal pulses lead to the formation of strongly stratified layers in the outer regions of the CO core, which might lead to inversions in the chemical gradient. Such inversions would produce instabilities beyond the ones accounted by the Schwarzschild criterion and the standard use of mixing length theory (MLT). We used a set of MLT equations that considers the impact of the background chemical gradients and applied through the evolution in the AGB phase and compared the chemical profiles resulting from standard and extended MLT. Then, we continued the evolution through a post-AGB thermal pulse and performed a pulsational analysis of the resultant pre-WD GW Vir models to assess g-mode pulsation periods. The extra mixing induced by the chemical instabilities led to significantly different chemical profiles using standard and extended MLT. Stellar evolution simulations show that Rayleigh-Taylor and thermohaline instabilities can play an important role during the TP-AGB, which would lead to clear modetrapping signatures in the pulsation spectrum of the pre-WD models. To conclude, we discuss the possible implication of this mixing processes for WD chemical profiles and discuss future lines of work.

The Impact of Improved Electron Broadening in White Dwarf Atmospheres

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The spectra of white dwarfs are dominated by pressure-broadened spectral lines. Spectral line shape models are often used to determine surface gravity, but changes in linebroadening models can produce changes in the atmosphere structure. Broader lines, especially near the black body peak, create a line blanketing effect that redistributes flux toward longer wavelengths. In this talk, we demonstrate how quantum treatment of electron broadening impact the spectra of DA and DB white dwarfs. For DAs, H-minus resonances increase the broadening of Ly-alpha. This increased broadening is enough to change the continuum in the visible and alter the H Balmer line shapes. And for DBs, we present how singlet to triplet collisions impact helium lines in DB atmospheres. Here, we will focus on the broadening of the He-alpha line and the impact of interference between singlet and triplet transitions. **We acknowledge support from the U.S. Department of Energy NNSA Center of Excellence under cooperative agreement number DE-NA0004146*

Session 2.2 | WD Magnetism

Constraining Surface Magnetic Fields of White Dwarfs using Phase-Resolved Zeeman Spectroscopy

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Magnetic white dwarfs constitute ~10-20% of the white dwarf population, yet the origin of their fields remains widely debated. The spectra of magnetic white dwarfs commonly exhibit Zeeman signatures indicative of the strength and structure of their surface magnetic fields. These signatures vary with rotational phase as different regions of the field rotate into view. We present a framework for constraining global surface field geometries of magnetic white dwarfs using the variation of Zeeman-split line components in phase-resolved spectroscopic data. Rather than computing atmospheric models, we model the positions and Zeeman profiles of absorption lines as a function of the field at each surface element. Subsequently, we create normalised line spectra by integrating over the visible hemisphere at each orientation. Spectra from each rotational phase are simultaneously fit using these synthetic models. Our method successfully incorporates a general multipole expansion or linear superposition of selected analytic field components as its prescription for field geometry. We recover convergent solutions for hydrogendominated (DA) magnetic white dwarfs in the intermediate field (1-100 MG) regime. These constraints on magnetic field geometries will enable correlations between field geometry and other physical properties of magnetic white dwarf populations, offering insights into theories of white dwarf magnetism.

Constraining the Long-Term Stability of Rapid Photometric Variability in Ultra-Massive Magnetic White Dwarfs

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East Texas A&M University

Approximately half of ultra-massive, strongly magnetic white dwarfs studied exhibit photometric variability on time scales ranging from ~60 s to a few hours. This variability is assumed by most (including us) to be due to rapid rotation of a spot on the WD's surface, though in most cases this rotation is deduced more by exclusion of other options than positive evidence. Under the assumption of rotation, we might expect to see long-term changes in period due to the pulsar mechanism or any internal differential rotation. On both long and short timescales, we might expect to be able to detect longitudinal wandering of the spot, changes in the spot geometry, or even evidence that the variability is due to ellipsoidal variations and not rotation. We present early results of a monitoring campaign of a handful of ultramassive magnetic white dwarfs with ~30 min photometric variability. Our initial goal is to determine the accuracy and precision to which pulse timing can be determined using meter-class, ground-based telescopes. Early results show promise that at least a subset of these rapidly varying stars can provide interesting constraints over several years' monitoring on P-dots due to the pulsar mechanism and gravitational wave radiation.

Session 2.2 | WD Magnetism

Searching for rotation periods in magnetic white dwarfs

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The origin of the intense magnetic fields in white dwarfs remains a problem in stellar astrophysics. To constrain theoretical models of field generation, it is necessary to establish a clear relationship between magnetism and rotation across a statistically significant population. In this study, we intend to measure the rotation periods of a large sample of magnetic white dwarfs using TESS data. We employ a customized light-curve extraction method to mitigate background contamination, ensuring high-precision period determinations. By correlating these measurements with stellar properties such as mass and cooling age, we provide empirical evidence to test proposed mechanisms for magnetic field evolution. These observations offer a more robust basis for identifying the physical pathways responsible for magnetism in the white dwarf population.

Rotation Periods of Isolated Magnetic White Dwarfs from ZTF Time-Domain Photometry

Sofia Vasieva, Ilaria Caiazzo, Aayush Desai

University of Cambridge, Institute of Science and Technology Austria (ISTA)

Significant magnetic fields from 1 to 10^3 MG are observed in 20% of white dwarfs (WDs), yet the relative contributions of different formation channels to this population remain unclear. I will present a catalogue of all known isolated magnetic white dwarfs (MWDs), for which we obtain rotational periods using time-domain photometry from the Zwicky Transient Facility. While most WDs rotate slowly, MWDs are observed with up to minute-scale periods. This rotation provides a key observational constraint on MWD formation channels since mergers are expected to produce the fastest rotators. However, measured periods for MWDs remain sparse and affected by selection effects such as source brightness and field crowding. Furthermore, time-series data, especially from ground-based observations, can produce false positives arising from systematic effects, including aliases associated with the sidereal day. Thus, a significant proportion of rotational periods may remain undetected. I will describe how we estimated the completeness of our detections across the parameter space using injection-recovery tests on a large number of synthetic light curves. Finally, I will outline how correlations between magnetic field strength and rotational period can be used to constrain the fraction of magnetic white dwarfs formed through double white dwarf mergers.

Session 2.2 | WD Magnetism

Constraining the Origins of White Dwarf Magnetism

Ciarra Coston, JJ Hermes

Boston University

The origin of magnetic fields in white dwarfs remains uncertain, with proposed mechanisms including fossil fields inherited from main-sequence progenitors and active dynamo generation, potentially initiated during crystallization. The stability of photometric spots provides a direct probe of magnetic field evolution. If magnetic fields are fossil remnants from earlier evolutionary stages, spot-induced variability should remain stable over long timescales. However, the development of deep convective zones in cool white dwarfs could enable an active dynamo, leading to detectable variability or instability in spot behavior. We test the hypothesis that crystallization does not significantly impact spot stability using 2-minute cadence data from the first 9 years of data from the Transiting Exoplanet Survey Satellite (TESS). We analyze rotational phase coherence, amplitude evolution, and period derivatives for a large sample of isolated white dwarfs spanning a broad range of temperatures, masses, and ages. We find that white dwarf photometric spots are all stable to within our limits, with no strong dependence on cooling age. This stability suggests that magnetic structures in white dwarfs are long-lived and that crystallization does not appear to drive an active dynamo on a scale large enough to affect spots.

Median Rotation/Orbital Period for White Dwarfs is Less than 6 hours

S. O. Kepler

Universidade Federal do Rio Grande do Sul, Brazil

I analyzed the 120 s/exposure TESS light curves of more than 15,000 white dwarfs from the first 5 years of observations, including single, binary, pulsating, magnetic, and cataclysmic variables, and found photometric periods for 3494 stars. The median period for all systems is less than 6 hours, contrary to the claimed one-day timescale.

Session 2.2 | WD Magnetism

3D Magnetohydrodynamic Simulations of Double White Dwarf Mergers

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The merger of a He white dwarf (WD) and a CO WD is the favored formation channel for R Coronae Borealis (RCB) stars. These stars exhibit $^{16}O/^{18}O$ ratios that are orders of magnitude lower than the solar value. However, it is not fully understood whether such low $^{16}O/^{18}O$ ratios can be achieved in WD merger remnants for the predicted lifetime of RCB stars of around 10^4 years. We perform detailed nucleosynthesis calculations based on a 3D magnetohydrodynamic Arepo simulation of the merger between a 0.3 $M_\odot$ He WD and a 0.6 $M_\odot$ CO WD, covering 4000s. At this stage, a steady state in temperature and density is reached. From this point, we follow several radial zones to study the long-term production of ^{18}O and its variability throughout the burning region. We find that the asymmetric merger process leaves an imprint on the distribution of the abundances at the end of our hydrodynamic simulation. During the long-term evolution up to 100 years, we observe $^{16}O/^{18}O$ ratios of order unity, although the timescale on which ^{18}O is destroyed again is highly location dependent.

Session 2.4 | Q branch + Massive WDs

Effects of Nuclear Reaction Rates on the Formation and Chemical Structure of Ultra-Massive CO White Dwarfs

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Ultra-massive carbon/oxygen white dwarfs (UMCO WDs) have attracted considerable interest because of their possible connection with the Gaia Q-branch. Standard stellar evolution predicts that super-AGB stars experience carbon ignition and eventually form O/Ne-core white dwarfs. However, recent work by our group has suggested that uncertainties in processes such as mass loss and stellar rotation may alter the conditions for carbon ignition, with the consequence that some of these stars evolve instead into UMCO WDs.

In this work, we investigate whether uncertainties in the nuclear reaction rates governing carbon burning and the production and destruction of 22Ne can affect the final fate of massive Asymptotic Giant Branch stars. We compute evolutionary sequences covering a range of initial masses and metallicities using updated reaction rates. Our results show that the adopted nuclear rates can significantly modify the onset and extent of carbon burning. Carbon ignition is may be weakened or avoided, shifting the boundary between CO-core and ONe-core remnants and favouring the formation of UMCO WDs from isolated progenitors. We analyse the resulting chemical structures, with particular emphasis on the abundances of carbon, oxygen, and 22Ne.

These models provide a new set of initial structures for future studies of cooling and pulsational properties in UMCO WDsd and may help clarify their possible contribution to the Gaia Q-branch population.

Poster Abstracts

Session B

Session 3.1 | Q branch + Massive WDs

The discovery of new eclipsing white dwarf binary systems from NGTS

Tafadzwa Zivave

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A majority of stars (95%) are born with masses below 8–10 M⊙ and will eventually evolve into a white dwarf (WD). Because of this, WDs play an integral role in deepening our understanding of the structure and evolutionary history of stellar bodies. They, however, present observational limitations because of their Earth-like radius and low luminosity. Since about a third of all white dwarfs are in binary systems, many of them in very close (hours) orbits, transit events have been highlighted as a key method to help discover these systems. In this talk, I will discuss my search for eclipsing binary systems containing a WD, which was conducted using the Next Generation Transit Survey (NGTS) private data archive. I will showcase the capabilities of NGTS in capturing such events and present preliminary analysis through the use of methods such as BLS and Lomb-Scargle algorithms, as well as SED fitting. With my analysis, I am able to obtain preliminary model-dependent orbital and physical parameters for the candidates, from which inferences can be made about the potential evolutionary history. These results highlight the potential of NGTS to study faint binary systems, enabling a blind survey of areas of the sky to discover new and important systems.

Characterising the volume-limited sample of eclipsing post-commmon-envelope binaries

Alex J. Brown

Hamburger Sternwarte, University of Hamburg, Germany

The most typical result of common-envelope (CE) evolution are close binaries made up of a white dwarf and a main-sequence companion. Many of these post-common-envelope binaries (PCEBs) go on to evolve into cataclysmic variables (CVs) and some will potentially contribute to the population of double white dwarf binaries and type Ia supernova progenitors. However, for both CV and CE evolution there remain a number of important open questions that limit our ability to accurately model or constrain later phases of binary evolution and the populations that result. A key step towards answering these questions is to formulate truly representative samples of PCEBs with well-understood selection effects, against which population synthesis and evolutionary models can be calibrated. Taking advantage of the relatively high eclipse probability of PCEBs, we have undertaken a follow-up campaign using high-speed eclipse photometry to precisely characterise a 150 pc volume-limited sub-sample of PCEBs that have been detected in ZTF, measuring the masses and temperatures of both binary components as well as the presence of any additional sources of variability such as pulsations or magnetic fields on the white dwarf. In this talk I will discuss the results from this follow-up campaign

Effects of Tidal Forces in WD+AFGK Binary Systems from Gaia and TESS Observations

Evelyn Puebla[1], Mercedez Hernandez[2], Lientur Celedon[1], Matias Valadares-Cruells[1], Fernanda Auger-Solís[1], and Steven Parsons[3]

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Binary systems composed of a white dwarf and an A/F/G/K main-sequence star (WD+AFGK systems) exhibit tidal interactions that, when the components are very close, induce two key effects: orbital circularization and synchronization between the stellar and orbital rotation of the binary. In this work, we analyze a sample of >100 WD+AFGK systems to determine their orbital periods, eccentricities, and rotation rates to understand these processes. The first two parameters (orbital periods and eccentricities) have been provided by the Gaia based on its high-precision astrometry and photometry modelling. Meanwhile, the rotation periods of the AFGK stars were measured via the detection of stellar spots associated with magnetic activity identified in TESS lightcurves. Our results show that most systems with orbital periods Porb $\lesssim$ 7 days achieve synchronization. The predicted synchronization times for stars with convective envelopes (types G and K) are shorter than for those with radiative envelopes (types A and F), in agreement with the theory of dynamical tides. Furthermore, convective stars circularize more rapidly, whereas systems with radiative envelopes retain appreciable eccentricities out to longer orbital periods. These findings confirm that short-period WD+AFGK systems tend to be both synchronized and circularized simultaneously, as predicted by modern tidal-evolution models.

ZTFJ040627: An unusual spotted eclipsing WD-dM binary

E. J. Snowdon

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ZTFJ040627+0958 is an eclipsing WD-dM binary which shows significant outof-eclipse flux modulation in the g′ and r′ bands. These modulations are not in phase with one another, and peak at the wrong phases to be explained by ellipsoidal deformation or reflection effects. We present the results of spectroscopic, photometric, and polarimetric analyses using XSHOOTER, ULTRACAM, and NOT ALFOSC aimed at determining the origin and nature of the variability in ZTFJ040627. We find no observational evidence for a strong magnetic field or ongoing accretion which could result in surface bright spots on the white dwarf component. This suggests the modulation may be caused by dark spots, which have been previously identified in isolated white dwarfs.

Session 3.3 | Rare Accreting WDs

What's the deal with radio-emitting white dwarfs?

Ingrid Pelisoli

University of Warwick

Radio emission from stars is indicative of particle acceleration in the presence of a magnetic field. With a large fraction of up to 30% of white dwarfs showing magnetic fields, one could imagine that radio emission is also common. However, the other necessary condition for radio emission – a source of free charge particles – is not easily met for white dwarfs. The exception are binary systems, where the companion can act as a source. Radio emission is commonly observed from cataclysmic variables, as well as from some detached binaries known as white dwarf pulsars. More recently, white dwarf binaries have been found to be the underlying source in some long-period radio transients, a puzzling class of sources showing periodic pulsed radio emission in timescales from minutes to hours. The exact mechanism for radio emission from these different types of systems is not always clear. Similarly, the possibility of an evolutionary connection between them has been postulated but not confirmed. This poster will summarise some of the recent work that collaborators and I have carried out to constrain radio emission from white dwarfs and to explore the connection between different classes of radio emitters.

High-cadence spectroscopy and Doppler tomography of AR Scorpii (AR Sco)

Nidhi Mehandiratta, Stephen Potter and Yusuke Tampo

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White dwarfs in interacting binaries provide important laboratories for studying magnetic interactions, accretion, and angular momentum evolution. A particularly intriguing subclass is that of white dwarf pulsars, recently established as a small but growing population, with AR Scorpii (AR Sco) as the prototype system. Despite extensive multiwavelength studies, key questions remain regarding the nature of the interaction between the white dwarf and its companion. We present a detailed Doppler tomography analysis of AR Sco using high-cadence, phase-resolved spectroscopy obtained with SALT/RSS. Our orbital tomograms reveal emission structures with significantly improved clarity compared to previous studies. In addition, we present, for the first time, spin-resolved Doppler tomograms of Hα emission, revealing signatures consistent with emission linked to magnetic poles. We also study how the system's emission varies with the relative orientation of the white dwarf and its companion. These results provide new constraints on the nature of magnetic interactions and energy transfer mechanisms in white dwarf pulsars.

Session 3.3 | Rare Accreting WDs

Electron Cyclotron Maser Emission in Magnetic White Dwarfs and Long-Period Radio Transients

Lilia Ferrario

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Electron cyclotron maser emission (ECME) is a highly efficient coherent radio emission mechanism capable of producing the extreme brightness temperatures, narrow duty cycles, and strong polarisation observed in a wide variety of magnetized astrophysical systems. In magnetic white dwarfs (MWDs), ECME is already implicated in several classes of interacting binaries, including magnetic cataclysmic variables and white-dwarf pulsars, demonstrating that compact stellar magnetospheres can generate powerful auroral radio emission. More recently, ECME has emerged as a compelling explanation for the enigmatic class of Long-Period Radio Transients (LPRTs), whose radio bursts exhibit periods of minutes to hours, brightness temperatures exceeding (10^{16}~K), and polarisation properties that are difficult to reconcile with conventional pulsar emission mechanisms.

I review the ECME framework recently developed for apparently isolated LPRTs, in which coherent radio emission originates in the outer magnetosphere and is beamed into a thin hollow cone. The model naturally reproduces the observed burst morphology and polarisation diversity, including sources that appear predominantly linearly polarized. In this picture, intrinsically circularly polarised maser emission is transformed by propagation through an overlying magnetized plasma layer, where Faraday conversion can efficiently convert circular polarization into linear polarization. The resulting emission properties closely resemble those observed in several known LPRTs.

Although the current evidence suggests that slowly rotating neutron stars with relatively low magnetic fields (10^8-10^{10} G) are the most promising candidates for the isolated LPRT population, MWDs remain attractive ECME laboratories. Their large magnetospheres, strong magnetic fields, and demonstrated ability to produce coherent radio emission make them natural environments in which to search for ECME. I discuss the physical conditions required for maser growth in MWD magnetospheres, possible sources of energetic electrons, and the implications for radio searches of isolated and interacting MWDs. Particular attention is given to recently identified merger remnants and highly magnetised WDs, which may provide favourable conditions for magnetospheric trapping, particle acceleration, and coherent radio emission.

Session 3.3 | Rare Accreting WDs

Evidence of binarity in long-period radio transients

Csanád Horváth

International Centre for Radio Astronomy Research, Curtin University

The Galactic long period transients (LPTs) discovered in recent years are a mysterious new class of object. They have periods of tens of minutes to hours, and produce strongly polarised pulses lasting seconds to minutes. Their characteristics are phenomenologically analogous to neutron star pulsars albeit at much longer timescales, but the underlying emission mechanism is unclear.

A handful of LPTs are now recognised as binary systems, with some of them optically confirmed to be white dwarfs with low-mass main-sequence companions. Furthermore, their radio intensity appears modulated on both orbital and spin periods. Last year, we found that the peculiar pulse morphology of the longest-lived LPT, GPMJ1839-10, can be modelled geometrically as a WD's magnetic axis coming in-and-out of alignment with its companion. In this talk I will review recent progress with this model, and show that it has explanatory power in other systems which might host WDs with spins synchronised, or nearly synchronized, with the orbit. Our work advances the ultimate goal of placing the LPTs in the wider context of stellar evolution.

Accretor Luminosity as Probe of Orbital Evolution in AM CVn Binaries

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AM CVn binaries are ultracompact systems with orbital periods Porb $\lesssim$ 70 min, where a white dwarf accretor accretes from a He-rich semidegenerate donor. At short orbital periods (Porb $\lesssim$ 20 min), rapid accretion reheats the accretor. As the system widens and the mass transfer rate decreases, the accretor follows standard white dwarf cooling at longer orbital periods (Porb $\gtrsim$ 30 min). The accretor cooling luminosity then acts as a powerful probe into the orbital evolution of the binary. Recent observations show that the accretor appears brighter (younger) at long orbital periods, compared to models where orbital angular momentum loss is solely set by gravitational wave emission. We show that additional angular momentum loss, which we ascribe to magnetic braking of the donor, can better reproduce observations of accretor luminosity. We test and constrain various proposed magnetic braking formalisms. None of the magnetic braking formalisms in their original form can reproduce the observations, but the widely popular magnetic braking proposed by Rappaport et al. 1983 boosted by a factor ≈ 5, or the saturated magnetic braking proposed by Matt et al. 2015 boosted by a factor of ≈ 150, yields satisfactory results.

Session 3.3 | Rare Accreting WDs

Exploring the accretion disk activity in the white dwarf binary AM CVn stars through superhump and color variations

Taichi Kato, Naoto Kojiguchi, Yasuyuki Wakamatsu, Daisaku Nogami, Nobuyuki Kawai, Yoichi Yatsu, Ryosuke Itoh, Katsuhiro Murata, Tomohito Ohshima, and VSOLJ & VSNET collaborations

Kyoto University, Science Tokyo, University of Hyogo

Rebrightenings - short outbursts occurring shortly after a main superoutburst - are observed in various accretion disks, including hydrogen-rich WZ Sge-type dwarf novae, white dwarf binary AM CVn stars, and X-ray novae. The basic disk instability model cannot explain this phenomenon, as the post-superoutburst disk mass is insufficient to trigger another outburst so quickly. Two competing models exist: enhanced mass transfer from the secondary star due to irradiation, and an enhanced viscosity model with an outer mass reservoir. Neither has gained definitive observational support, leaving the underlying mechanisms uncertain. We present ground-based and archival (ZTF and Swift) observations of the AM CVn star SDSS J1411+4812. We detected variations in color, brightness, and disk radius throughout its "double superoutburst" and subsequent rebrightenings. The object exhibited a brighter, redder component before and after the rebrightenings. These color variations, combined with other observational features, suggest the presence of an extended, high-viscosity mass reservoir in this white dwarf binary system, rather than a high-temperature hot spot expected from enhanced mass transfer.

On the search for new AM CVn binaries

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AM CVn systems are ultra-compact accreting binaries with a white dwarf primary and a He-rich secondary. With orbital periods between 5 and 65 minutes, these systems are strong gravitational wave sources in the upcoming Laser Interferometer Space Antenna (LISA) frequency regime. Many of these systems are expected to be LISA verification binaries. With multiple formation channels proposed, we present a search and follow-up approach involving the cataclysmic variable (CV) evolution channel to find new AM CVn systems. We query the ZTF alerts to select candidate CVs in outburst and trigger spectroscopic follow-up with the newly established SDSS-V ToO mode for a classification spectrum. Systems with strong helium and no hydrogen lines are considered strong AM CVn candidates. This search and follow-up method allows us to test the time-domain capabilities of large-scale multi-object spectroscopic surveys. Rubin-LSST is expected to find fainter transients, and we discuss the integration of these alerts into our pipeline. Although we have no confirmed AM CVns, we demonstrate a novel search method for these systems. This work allows us to build on the current sample of AM CVn binaries for LISA.

Session 3.3 | Rare Accreting WDs

An eclipse study of 20 AM CVn binary systems

Matthew Green

University of Oklahoma

AM CVn binaries are ultracompact binary systems consisting of two white dwarfs undergoing stable mass transfer. They are of interest as LISA sources and potential progenitors of SNe Ia, and their study can place constraints on binary star evolution. To date, our understanding of the population has been limited by small sample numbers. In particular, eclipsing systems (for which the most reliable system parameters can be measured) numbered only a handful of systems until the last half-decade. In this talk, I will present preliminary results from a study of 20 eclipsing AM CVn binary systems, almost all of which have been discovered by ZTF in the last 5–10 years. I will show the constraints on period evolution arising from the entire sample. I will argue that this sample-wide study can be used to place strong constraints on AM CVn formation models – in particular on processes of angular momentum loss. I will also raise some warnings about the interpretation of instantaneous measurements of orbital period change, which will be especially relevant to the interpretation of LISA data. Finally, I will show preliminary measurements of AM CVn component masses across the sample, and discuss the implications for AM CVn formation.

Evolution of Extremely Long-Period CVs as double-degenerate binaries and AM CVn Precursors.

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Cataclysmic variables (CVs) are traditionally expected to evolve toward shorter orbital periods due to angular momentum loss driven by magnetic braking and gravitational radiation. Systems with very long orbital periods (Porb $\gtrsim$ 12 h) are therefore rare and represent an important opportunity to explore alternative evolutionary channels. Recent observational work has revealed a small but growing sample of such systems, including objects with evolved donor stars and unusual accretion properties, which are difficult to reconcile with standard CV evolution. Detailed studies of several systems with Porb > 12 h show evidence for donors that have undergone significant nuclear evolution prior to the onset of mass transfer, leading to mass-transfer histories that differ substantially from those of classical CVs with unevolved late-type secondaries.

In this talk, I present observational results for approximately half-a-dozen extremely long-period CVs, combining optical spectroscopy, photometry, and multiwavelength constraints to characterize their donor stars, accretion properties, and system parameters. These systems exhibit properties consistent with thermal time-scale mass transfer (TTMT) phases and donors that have already evolved away from the main sequence before entering Roche-lobe contact.

To interpret these systems, we employ MESA binary evolution calculations that incorporate expanded prescriptions for angular momentum loss (AML) and the effects of TTMT. The models show that binaries with initially more massive donor stars can evolve through phases of rapid mass transfer, gradually stripping the donor envelope and transforming the system into a hydrogen-deficient compact binary. In this framework, long-period CVs with evolved donors represent a transitional evolutionary stage that may ultimately lead to the formation of double-degenerate binaries and AM CVn systems.

These results suggest that extremely long-period CVs constitute an observational bridge between classical CVs and compact helium-transferring binaries. Understanding their evolutionary pathways is therefore essential for constraining the formation channels of AM CVn stars and for clarifying the role of evolved donor binaries in the broader landscape of compact binary evolution.

Session 4.1 | CVs and Accreting WDs

Identifying Helium Emission-Line Stars with the Condor Array Telescope

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Helium emission-line stars, including cataclysmic variables, AM Canum Venaticorum binaries, and symbiotic stars, are tracers of compact object binary populations in the Milky Way, but their space densities are not well constrained. I present a narrow-band photometric search for helium emission-line stars using deep imaging data from the Condor Array Telescope in the field of M81 and M82. Condor simultaneously imaged a 3.5 square degree field in HeI, HeII, and [OIII] narrowband filters to a limiting magnitude of ~19–20. Using the [OIII] filter as a continuum reference, I created a catalog of ~3,000 Condor sources with photometry calibrated against Gaia Data Release 3. I identified helium-bright outliers by sorting sources based on their standard deviations from the mean helium-to-continuum magnitude ratio and plotted the outlier stars on Hertzsprung-Russell diagrams to infer their stellar types. Fourteen candidate helium emission-line stars were selected via this method, which are in the process of being sent to the OSMOS spectrograph at MDM Observatory for spectroscopic follow-up. This project’s code pipeline is designed to be applied to all 58 fields in Condor's full dataset of the Local Group, enabling future population-level estimates of helium emission-line star space densities in the Milky Way.

Ultra-compact mass transferring binary searches with eROSITA: initial results and future prospects

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Ultra-compact binaries (UCBs) are among the most extreme stellar systems in the Universe, with orbital periods shorter than one hour. The most compact systems can reach periods as short as five minutes with separations smaller than the Earth-Moon distance. Such systems are expected to be of the strongest Galactic sources of gravitational waves detectable by the upcoming Laser Interferometer Space Antenna (LISA). The most compact binary currently known, HM Cancri, has an orbital period of just 5.4 minutes and was first identified as a highly modulated X-ray source. It is interpreted as a semi-detached double white dwarf system in which the donor fills its Roche lobe and transfers material directly onto the accreting white dwarf. Due to the system’s extreme compactness, no accretion disk forms; instead the stream impacts the stellar surface, producing X-ray emission that is modulated as the impact region rotates in and out of view. Large X-ray surveys such as eROSITA provide an unprecedented opportunity to discover more of these rare direct-impact accretors. Using the German eROSITA data set, we have begun identifying candidate systems and characterising their X-ray variability. This presentation outlines our methodology, initial results, and ongoing efforts to refine targets for multi-wavelength followup.

Session 4.1 | CVs and Accreting WDs

Search for Compact Accreting Binaries with TESS

Jan Kára

University of Texas Rio Grande Valley

Compact accreting binaries are an exotic class of short-period interacting binary systems in which the primary component is either a white dwarf, a neutron star, or a black hole. As such, they represent the final stages of stellar evolution. Typically, matter from a secondary star is being accreted onto the primary star via an accretion disc, which can undergo sudden brightness changes known as outbursts. Detections of outbursts can be used in identifying new members of this class, and their light curves can be used in characterising the systems' properties. Some outbursts are only a few days long, which makes their detection and analysis challenging when only ground-based observations are available, as they typically provide sparse coverage. Therefore, space missions such as TESS present a unique opportunity to study these short-lived outbursts, as they can provide uninterrupted observations over long time spans. I will present preliminary results of a survey, which uses the data obtained during the first two years of the TESS mission, to identify new transients. I will particularly focus on the detection of ultra-compact accreting white dwarfs and how the combination of TESS observations and multi-wavelength data can be used for a more accurate classification.

The Surface Chemical Abundances of 36 Accreting White Dwarfs in Cataclysmic - Variables Above and Below the Period Gap

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The chemical abundances of WDs in CVs have been derived largely from high quality HST and FUSE spectra. The observed metal lines are fitted with NLTE model atmospheres with rotationally broadened theoretical line profiles. The S/N is high enough to determine reliable individual chemical abundances. In Table 1, the chemical abundances determined to date for 36 CV WDs are summarized. They present an overall picture of the abundance patterns characterizing the accreting WDs in CVs. Implications of the Abundances including the N/C abundance ratios are discussed.

Session 4.1 | CVs and Accreting WDs

Discovery of spiral structure in the accretion disc of a new nova-like

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Novalikes host white dwarfs accreting at high rates, yet the accretion flow is not steady: quasi-periodic "stunted outbursts" modulate the luminosity on timescales of days to weeks, implying that the rate at which material reaches the white dwarf fluctuates. The physical mechanism linking disc instabilities to these accretion-rate changes remains poorly understood. J194827−131733 is a newly identified eclipsing novalike with an orbital period of 5.1989 h, derived from TESS photometry. Long-term ATLAS and ZTF light curves reveal recurrent stunted outbursts, confirming its novalike nature. We obtained time-resolved spectroscopy during both the high and low states of the stunted outburst cycle. During the high state, Doppler tomography reveals spiral-arm structures in the Balmer and He II lines, making J194827−131733 only the fourth novalike where these features have been detected, together with a hot spot consistent with an extended disc and irradiated donor. These spirals can steepen into shocks acting as efficient angular-momentum transport, potentially enhancing accretion onto the white dwarf and driving the stunted-outburst modulation. In the low state, the spiral structures vanish and a dominant hot spot emerges, suggesting the disc reorganises when accretion subsides. These results implicate tidally driven spiral structure as a key element in the stunted-outburst phenomenon.

Discovery of a new WZ Sge-type Dwarf Nova KSP-OT-202104a

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We report the discovery, photometric and spectroscopic analysis of a new WZ Sge-type Dwarf Nova (DN) KSP-OT-202104a. The photometric data are obtained from the Korea Microlensing Telescope Network (KMTNet) Supernova Program, while the spectroscopic data are from the Gemini-South/Gemini Multi-Object Spectrograph (GMOS). The light curve shows a ~28 days-long superoutburst with no rebrightnining (type D). From the phase dispersion minimization (PDM) analysis of the superoutburst superhump data, we obtain the superhump period of 71.7 minutes (=0.04978 days), to which the orbital period must be similar with only ~1% difference. As in the usual WZ Sge-type DNe, we infer the primary of KSP-OT-202104a is a white dwarf and the secondary be a small-mass, high-density helium-rich star. Since the period is believed to be shorter than the period minimum, we consider KSP-OT-202104a is a transitional ultracompact accreting binary that might be evolving toward the AM CVn stars with very short ortibal periods.

Multi-band Photometry and Polarimetry of five Asynchronous Magnetic Cataclysmic Variables: V1025 Cen, FO Aqr, V2400 Oph, TX Col and EX Hya

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The correlation between the detection of polarized light and the presence (or absence) of accretion disks in the magnetic cataclysmic variables categorized as intermediate polars (IPs) has not yet been well established and has the potential to expand our knowledge about the geometry, physical phenomena, and evolution of IPs. We present simultaneous multiband (g, r, i, z) photometric and polarimetric observations of five IPs: V1025 Cen, FO Aqr, V2400 Oph, TX Col and EX Hya. These systems are of particular interest due to the evidence of alternating accretion with and without the presence of an accretion disk.

Using the SPARC4 instrument at the Pico dos Dias Observatory (Brazil), we characterize the spin and beat periods using different wavelengths. Significant circular polarization of 8% in the z band was detected in the system V2400 Oph, while for the remaining targets, we established upper limits on both linear and circular polarization. This study is part of a doctoral thesis that aims to investigate the properties of accretion in IPs and their relationship with the detection of polarized light.

Progenitors of the Double-Detonation Supernova Candidate CD-30

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White dwarf (WD)–hot subdwarf (sdB) binaries represent a critical evolutionary stage for understanding Type Ia supernova progenitors, particularly within the double-detonation scenario. However, the formation pathways leading to these systems remain uncertain. We investigate an evolutionary channel in which the sdB star forms first through stable mass transfer, followed by the formation of a WD companion during a subsequent common-envelope (CE) phase. To explore this scenario, we constructed an extensive grid of approximately 103,000 main-sequence binary models using MESA, systematically varying initial stellar masses, orbital periods, and mass-transfer efficiencies, β.

To assess the grid's predictive power, we selected a subset of 65 simulations that reproduce the observed stellar masses of the prototypical system CD–30°11223. By evolving these systems from the main sequence and comparing them to observed parameters, we determined the best-fitting common-envelope efficiency, α_{CE}, for each case. Our analysis reveals clear correlations between the initial orbital period, β, and α_{CE}. In particular, the shorter initial periods ($\approx$ 1.5–3 days) favor higher β and correspond to larger α_{CE} values, whereas longer periods ($\gtrsim$ 4.5 days) tend toward lower α_{CE} and moderate β.

These trends suggest a coupled dependence between pre-CE mass transfer and envelope ejection efficiency. Overall, our results support a constrained evolutionary pathway for WD–sdB binaries and provide insight into the physical conditions required to produce Type Ia supernova progenitors.

Photometric observations of new cataclysmic variable TCP J06330104+0303350

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Here we present photometric observations of the eclipsing binary TPC J06330104+0303350 (Gaia DR3 3130088774241620608), which believed to be a dwarf nova of the WZ Sge type. The first outburst of this variable was detected by Japanese scientists in late November 2024, when the system's brightness reached $V=13^{m}.4$. They also reported the detection of superhumps in the light curves of this system and determined their period. Our observations were conducted using a more powerful, the 2m, telescope, in March 2025 (3 nights) in the V band. At that time, the system was in an inactive state, with a brightness of approximately 18 mag. We continued our observations in March 2026 using the 2.5m telescope, also in the V band. Based on these observations, we have constructed light curves for TPC J06330104+0303350 for the inactive state. These light curves cover three eclipses over a period of 4 hours, with an eclipse depth of up to 21 mag. The orbital period determined from our observations is $P_{orb}=0^{d}.0578885$. We have also constructed an average light curve from TESS data that we could find for this system in the Archive, and we have determined a period that is in good agreement with the period determined from our observations.

Session 4.1 | CVs and Accreting WDs

SRGA J115215.0–510656: an unusual long-period eclipsing dwarf nova with disc wind signatures

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Christian Knigge[3]
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Dwarf novae (DNe) are the most commonly observed subclass of non-magnetic cataclysmic variables (CVs) due to their recurrent outbursts, while long-period DNe represent a small and atypical subset of the overall population. We present our findings from the first detailed optical study of the CV SRGA J115215.0–510656, based on new time-resolved photometric and spectroscopic observations complemented by long-baseline Transiting Exoplanet Survey Satellite (TESS) data. The TESS light curve reveals deep, recurring eclipses consistent with a high-inclination geometry and an orbital period of 0.43567659(9) d. The eclipse morphology during outburst is consistent with a possible 'inside-out' type outburst and supports classification of the system as a U Gem–type DN. The persistence of single-peaked Balmer lines during outburst, together with strong He II 4686 Å emission and a flattened Balmer decrement, points towards emission arising in a disc wind or vertically extended regions above the disc. The combination of relatively deep eclipses, frequent DN outbursts, and possible indications of a disc wind contribution makes J1152 an especially compelling target for future long-term monitoring and multi-wavelength follow-up studies, offering new insight into accretion and outflow processes in long-period DNe.

Using nova shells as a diagnostic of nova eruptions

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Nova eruptions occur on the surface of accreting white dwarfs (AWDs). Hydrogen-rich matter builds up until reaching the critical pressure to trigger a thermonuclear runaway, releasing large amounts of energy. This process is commonly observed in cataclysmic variables (CVs), where a low-mass mainsequence star transfers mass to the AWD via Roche-lobe overflow.

During an eruption, the accreted material is expelled into the interstellar medium, forming a nebular structure known as a nova shell. The ejecta's geometry, mass, velocity, and chemical composition are expected to depend on the properties of the white dwarf, particularly its mass. Integral field spectroscopy provides a powerful tool to study nova shells, especially using the Multi Unit Spectroscopic Explorer (MUSE) at the Very Large Telescope (VLT). Compared to narrow-band imaging and long-slit spectroscopy, it enables a comprehensive geometric and kinematic characterisation.

We analyze 17 nova shells observed with MUSE/VLT, spanning ages from ~25 to 160 years. The sample shows diverse morphologies, including ring-like, fragmented, compact, and asymmetric structures, often with [N II] and [O III] emission tracing substructures. We find no clear correlations between shell properties and CV parameters, suggesting either observational limitations or missing physics in nova ejection models.

Different types of variability and accretion processes of the NL system V592 Cas

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We present results of photometric variabilities of the nova-like (NL), cataclysmic variable (CV) binary V592 Cassiopeia (Cas). V592 Cas also belongs to the UX UMa subclass of novalikes, in which the high state brightness is known to remain active. We use our own photometric observational data, obtained with the 2.0 m telescope at the National Astronomical Observatory (NAO) Rozhen, Bulgaria. The data from both the Transiting Exoplanet Survey Satellite (TESS) and the American Association of Variable Star Observers (AAVSO) International database are also applied in this survey. In the periodograms of data from the 2 m telescope Rozhen, we identify variations in brightness with a low-amplitude and a period slightly longer than the orbital period, known as superhumps. Furthermore, flickering within the superhump interval is observed.

In this work, we also emphasize on the accretion processes around the white dwarf primary component, as the existence of a disc accretion is known by the spectral study of V592 Cas. The accretion efficiency is estimated, based on the maximum values of luminosity measured during observational times from all three facilities. The results show that the disc efficiency is a dominant type in this case, which is indicative of an active mass-transfer mechanism in the system. Temperature variations in the inner and outer parts of the accretion disc in relation to the flickering activity are calculated.

Toward Explaining Infrared Variability in White Dwarf Debris Discs: Modelling Collisions and Phase Changes

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Debris discs around metal-polluted white dwarfs provide insights into the physics of planetary debris accretion. Recent observations have revealed infrared variability in ~85% of these systems (Noor et al. 2025), in stark contrast to the predictions of canonical disc models. This variability has been attributed to collisions among solid material supplied to the disc. However, additional processes such as gas–dust phase changes and radial transport are expected to play a key role in disc evolution, and the dominant mechanisms controlling the variability remain unclear.

We extend the disc evolution model of Okuya et al. (2023) by incorporating collisions between solid bodies and refining the existing model physics to create one of the first frameworks that consistently treats collisions, transport, and phase changes. This framework successfully reproduces the variability found in Kenyon & Bromley (2017) under collision-dominated conditions. However, when phase changes are included, dust produced outside the sublimation radius accumulates, forming an optically thick disc. In this regime, mass transport is limited by PR drag, leading to the suppression of variability across a wide range of model parameters. These results suggest that efficient dust removal processes, such as collisional vaporisation, may therefore be essential to explain the observed variability.

Evidence for IR Excess around van Maanen's Star With JWST Imaging and MRS Spectra

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We present JWST/MIRI imaging and medium-resolution spectroscopy of the two nearest solitary white dwarfs, Van Maanen's star and GJ 440. These observations probe the potential of JWST to detect and characterize material and companions around white dwarfs at unprecedented sensitivity. Using the MRS data, we search for deviations from white dwarf models. We detect evidence for a modest infrared excess around Van Maanen's star at ~1–2% in the 5–10 μm range. This excess is best explained by a small, ~400–1200 K debris disk near the Roche limit. While we favor the debris disk interpretation, we cannot rule out a scenario in which the excess arises from a ~2 R⊕, 400 K exoplanet near the Roche limit; however, the expected dynamical instability, with the improved fit provided by hotter debris disk models slightly inside the Roche limit, makes this explanation less likely. If the former, this system may represent one of the first detections of a population of "missing" disks around metal-polluted white dwarfs with no prior infrared detections. Although the excess is unlikely to arise from a planet, the successful detection of a small infrared excess demonstrates that detecting terrestrial-sized worlds is within reach of JWST.

Reprocessed Pulsation Geometry in the Dusty White Dwarf G29-38

JJ Hermes

Boston University

G29-38 is a benchmark system for both white dwarf pulsations as well as dusty debris disks. We develop a geometric framework that predicts the amplitude and phase of each non-radial pulsation mode as seen directly from the star and after reprocessing by the disk. We compute the disk-star amplitude ratios and phase offsets for all possible mode spherical harmonics across a range of star-disk configurations (accounting for system inclination, disk misalignment, and disk optical depth). These calculations show how the disk can reprocess certain modes while not reprocessing others in the infrared, as observed in recent JWST NIRSpec time-resolved spectroscopy.

Gas-Dust-Planet Interplay in White Dwarf Debris Discs with Multi-Fluid Smoothed Particle Hydrodynamics

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Mounting observations of disintegrating planetesimals and debris discs orbiting within a few Roche radii of white dwarfs motivate detailed simulations of the interplay of these planetary signatures. Nearly all observed white dwarf debris discs are dust-dominated; however, the dust-to-gas ratio is highly uncertain and can range from 0 to infinity. This project carries out the first comprehensive campaign of smoothed-particle hydrodynamics (SPH) simulations of dust-gas interactions in these compact discs, establishing a foundation upon which models of individual known and future systems can be usefully constructed. Incorporating the combined evolution of gas and dust in these extreme environments is critical to understanding disc shapes and properties. We self-consistently calculate observables that can be compared with realistic observational data, such as Doppler tomography and Spectral Energy Distributions. We perform simulations of planetesimals embedded within these discs to investigate how they influence the disc structure over time. We explore a range of dust-to-gas ratios and planet masses to search for "propellers" and gaps under various scenarios.

The First Double Gaseous Debris Disc: WD J1328-1450 and Emerging Complexities in White Dwarf Discs

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We present our analysis of WD J132800.85−145019.95, a white dwarf hosting an unprecedented double gaseous debris disc. Unlike all previously known gaseous discs exhibiting double-peaked emission from a single rotating disc, this system displays quadruple-peaked Ca II and O I profiles—never before observed in any circumstellar disc. The system's exceptional infrared excess (τ = 2.7%) requires a geometrically complex dust distribution and kinematic modeling reveals two concentric gaseous rings: an inner disc (0.14–0.34 $R_\odot$) and outer disc (0.54–1.93 $R_\odot$), inclined at 77°. We propose that two distinct embedded planetesimals generate gas through collisional interactions. Tidal disruption analysis constrains these bodies from tens to hundreds of kilometers in the inner disc, and potentially Pluto-sized (~2,300 km) in the outer disc. Compositional differences are evidenced by Mg emission detected exclusively from the inner disc, despite both discs showing O emission at comparable excitation energies. This discovery demonstrates that white dwarf debris discs can host multiple surviving planetary bodies sculpting separate gas reservoirs, expanding the models of post-main-sequence evolution explored so far. We conclude by presenting two additional systems with bizarre properties still lacking adequate interpretation, further highlighting the emerging complexity of gaseous debris discs.

Session 4.3 | WD Transits and Direct Imaging

Groundbased follow-up of the MEAD Survey Sample

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STScI, U. of Oaklahoma, UCSD, U. de Montréal, STScI, U. of Oaklahoma, U. de Montréal, U. de Montréal, Space Science Institute

The MIRI Excesses Around Degenerates (MEAD) was a Cycle 2 JWST survey that observed 56 WDs in an unbiased and volume limited sample, providing very sensitive limits at 10 and 15 micron to dust and planetary mass companions. We look at some targets that show evidence for significant IR excesses or resolved candidate companions and present both Keck HIRESb spectroscopy and Keck/NIRC2 Laser Guide Star follow-up imaging of these candidates. We use these preliminary results to look at the MEAD sample in the context of a statistical sample with which to probe the long term evolution of planetary systems.

Transiting Planetary Debris Traces Complex Dynamics in White Dwarf Planetary Systems

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Measured orbital periods of transiting planetary debris around white dwarfs span the range expected from simulations of tidally disrupted asteroids, from highly eccentric orbits with periods of hundreds of days to lower-eccentricity orbits near the Rohe limit with periods of 4.5 - 5.0 hr. Thus, transiting systems offer snapshots into the various stages of debris disk formation and accretion onto white dwarfs. We spotlight recently published time-series photometry of two transiting debris systems whose measured periods and changing transit morphologies may suggest the influence of multiple orbiting components. ZTF J1944+4557 is the second known system to show periodic transits near the Roche limit and the first to show a complete cessation of transits and their return, still repeating at 4.97 hr. We also highlight ZTF J0328-1219, whose transits switched from being dominated by debris following a 9.94-hr orbit to transits from an independent 11.2-hr orbit. These observations suggest that dynamical processes, such as interactions from shepherding bodies and collisions, are modulating the observed transit morphologies. Reproducing the behavior of ZTF J1944+4557 and ZTF J0328–1219 with simulations will provide a critical test of whether secondary bodies are present in these systems.

White Dwarf Gaia Spectra Increase the Sample of Massive Remnant Planetary System Hosts

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Remnant planetary systems around massive white dwarfs (masses greater than 0.8 solar masses) are intrinsically rare and remain poorly characterized. These systems o!er essential constraints on the formation and survival of planetary systems around intermediate-mass main sequence progenitors. In the absence of large, dedicated spectroscopic surveys, Gaia provides a powerful means of identifying candidate metalpolluted white dwarfs and expanding the currently known sample. We obtained spectroscopic follow-up of massive, metal polluted white dwarf candidates selected from Gaia XP extremely-low-resolution spectra to identify high-mass hosts of remnant planetary systems among objects with e!ective temperature below 15,000 K. We find e!ective recovery of metal polluted white dwarfs, confirming photospheric metals in 74 of 108 targets in our sample. However, Gaia photometry alone is not su"cient to identify the most massive systems, as reliable mass determinations require more detailed atmospheric modeling. We present the subset of our follow-up sample confirmed to be both massive and metal polluted, and demonstrate that Gaia substantially increases the number of known metal polluted white dwarfs.

The meaning of Li/Fe: Li enrichment in white dwarfs as evidence of ancient planetary crusts?

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White dwarfs offer a vital and unique probe into the nature of exoplanetary systems, due to the frequent accretion of external metals onto their atmospheres. The relative abundances of these metals reveal the geological processes which control the formation and evolution of rocky bodies beyond the Solar System. One such process is the formation of planetary crusts, as evidenced by white dwarfs with unusually high Li abundances relative to other rock-forming metals such as Fe. However, Li enrichment can also be attributed to formation in an early epoch of the galaxy when metallicity was low and Li was relatively abundant. I will show new work investigating the evidence for these scenarios. We incorporate galactic chemical evolution and crust formation models into the state-of-the-art geological inference code PyllutedWD. We use Bayesian statistics to quantify the evidence for either, or both, of these effects across a sample of cool white dwarfs. The white dwarf cooling ages and galactic population memberships inform our Bayesian priors. I will present preliminary results, discussing those white dwarfs whose metal abundances can be accounted for, as well as highlighting others which we are currently unable to explain. I will discuss the implications for our understanding of 'exogeology'.

ELM Survey X

Warren Brown, Mukremin Kilic

Smithsonian, Oklahoma University

I present the latest results of our spectroscopic survey for Extremely Low Mass (ELM) white dwarfs. Combining Gaia parallax and synthetic u-band photometry yields an efficient target selection. Over the last few years we've completed radial velocity orbits for another 50+ double white dwarf binaries. The full sample of 200 white dwarf binaries reveals interesting patterns in the distribution of measured and derived parameters. The median object is about 10% over-luminous compared to a single low mass white dwarf model, which suggests the unseen companions are normal white dwarfs of similar temperature.

Extreme mass loss during common envelope evolution: The origin of the double low-mass white dwarf system J2102–4145

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We present a detailed evolutionary analysis of the eclipsing double white dwarf system J2102–4145, combining new binary constraints with state-of-the-art evolutionary sequences tailored to low-mass white dwarfs formed through different mass-transfer channels. Using models computed with LPCODE, we explore the formation of both components under common-envelope (CE) and stable Roche-lobe overflow (RLOF) scenarios, placing particular emphasis on the role of residual hydrogen envelope mass in shaping their cooling evolution.
We show that the observed properties of the system cannot be consistently reproduced assuming a single formation channel for both components. The less massive secondary is well matched by a CE evolutionary track with an extremely thin hydrogen envelope, leading to rapid cooling and negligible residual nuclear burning. In contrast, the more massive primary requires a significantly thicker hydrogen envelope, compatible with an RLOF origin, and exhibits a non-negligible contribution from residual hydrogen burning to its luminosity.
By comparing evolutionary timescales, we demonstrate that the inferred cooling ages support a formation sequence in which the primary formed first but evolved more slowly than the secondary. This apparent inversion is naturally explained by the different envelope masses and associated cooling delays. Our results provide strong constraints on the interplay between binary interaction channels and white dwarf cooling, and highlight the need for consistent evolutionary modelling when interpreting compact binary systems.

Session 5.1 | Hypervelocity Supernova Survivors + ELMs

Hot, Bloated, and Hard to Find: A Survey for Massive Pre-Helium White Dwarfs

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Between the main sequence and the white dwarf cooling track lies a zoo of hot and subluminous stars. While many are core helium burning objects, a significant fraction fall below the mass threshold for helium ignition. Since the lifetimes of their low-mass main sequence progenitors exceed a Hubble time, these pre-helium white dwarfs (pre-HeWDs) must form through binary interactions. After stripping, they remain thermally bloated before contracting onto the white dwarf cooling track. Dedicated surveys have revealed over 120 such objects in close binaries, but have been mainly limited to cool, compact high surface gravity systems below 18,000K and masses of 0.15 to 0.20Msol. The hotter, more massive pre-HeWDs remain almost entirely unexplored, as their evolutionary tracks cross regions heavily populated by main sequence and horizontal branch stars. Only a single such object has ever been identified, HZ22, discovered in 1972. Yet a peak in the white dwarf mass distribution between 0.2 and 0.4Msol hints that this population might exist. Combining Gaia parallaxes with archival spectroscopy and SED fitting, we have uncovered dozens of new pre-HeWD candidates, and present the status of this ongoing survey and initial results.

Cerberus: a new three-armed high-speed CMOS imager for the 200-inch Hale Telescope

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Many white dwarf systems, particularly those that are highly magnetized, in binaries, or host disks, exhibit photometric variability on minutes-long timescales. While this activity can sometimes be discovered through wide-field surveys, detailed characterization requires high-speed imagers on large telescopes. Cerberus is a new high-speed prime focus imager in development for the 200-inch Hale telescope at Palomar Observatory. It will offer simultaneous three-band imaging in u, g, and r/i/z filters, as well as narrow-band capabilities. Taking advantage of recent development driven by consumer technology, Cerberus uses CMOS detectors which have extremely low read noise (0.3 e-) and very high frame rates. We have successfully conducted on-sky testing of the detectors, with system first light slated for late 2026.

Exploring the Formation of Double White Dwarf Mergers in COMPAS via Type Ia Supernovae

Melanie Santiago

University of California San Diego

Type Ia supernovae are powerful cosmological probes, however their progenitors are uncertain, with single and double degenerate channels contributing to the observed population. Similarly, there still remain uncertainties in the formation and occurrence rates of binary neutron star mergers. In this study, we evolve isolated stellar binaries to compact object formation using COMPAS, a rapid binary population synthesis code, which allows us to systematically explore how similar uncertainties in binary evolution shape predicted Type Ia supernovae and binary neutron star merger rates in our universe. We simulate 18 variations of five million binaries, varying assumptions such as those governing common envelope evolution. From these populations, we identify and calculate the merger rates of double white dwarf systems capable of producing Type Ia supernovae, and binary neutron stars. In particular, for our merging double white dwarf systems, we explore three subpopulations: systems with (i) at least one carbon oxygen white dwarf, (ii) a total mass exceeding the Chandreskhar limit, and (iii) a Two Star Supernova. By comparing our predicted merger rates across models to observed Type Ia supernova and LIGO-Virgo-KAGRA rates, we quantify the impact of binary evolution uncertainties, simultaneously constraining formation and explosion types for white dwarfs and neutron stars.

Progenitors of the Double-Detonation Supernova Candidate CD-30°1122

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Stephania Hernandez
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White dwarf (WD)–hot subdwarf (sdB) binaries represent a critical evolutionary stage for understanding Type Ia supernova progenitors, particularly within the double-detonation scenario. However, the formation pathways leading to these systems remain uncertain. We investigate an evolutionary channel in which the sdB star forms first through stable mass transfer, followed by the formation of a WD companion during a subsequent common-envelope (CE) phase. To explore this scenario, we constructed an extensive grid of approximately 103,000 main-sequence binary models using MESA, systematically varying initial stellar masses, orbital periods, and mass-transfer efficiencies, β. To assess the grid's predictive power, we selected a subset of 65 simulations that reproduce the observed stellar masses of the prototypical system CD−30°11223. By evolving these systems from the main sequence and comparing them to observed parameters, we determined the best-fitting common-envelope efficiency, αCE, for each case. Our analysis reveals clear correlations between the initial orbital period, β, and αCE. In particular, the shorter initial periods (≈ 1.5–3 days) favor higher β and correspond to larger αCE values, whereas longer periods (≳ 4.5 days) tend toward lower αCE and moderate β. These trends suggest a coupled dependence between pre-CE mass transfer and envelope ejection efficiency. Overall, our results support a constrained evolutionary pathway for WD–sdB binaries and provide insight into the physical conditions required to produce Type Ia supernova progenitors.

On the isotopic yields of thermonuclear explosions in non-accreting White Dwarf progenitors

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Type Ia supernovae are traditionally associated with thermonuclear explosions of White Dwarfs in binary star systems. Recent theoretical work (Antoniadis et al. 2020) challenges this paradigm by suggesting that thermonuclear supernovae may also arise from non-accreting or single White Dwarf progenitors. If substantiated, this alternative channel could significantly impact our understanding of white dwarf evolution and the supernova progenitor pathways. To further explore this hypothesis, in this study we build on the 1D stellar evolution models from Antoniadis et al. (2020), and we extend the investigation to 3D simulations of the explosion phase, to rigorously examine the dynamics and nucleosynthetic yields in dense oxygen–neon cores.

The precise isotopic composition of these events remains largely unconstrained. To address this, we use our simulations to track nuclear reactions throughout the explosion and then post-process the results with a detailed nuclear network using the NuGrid tools to obtain detailed isotopic abundances. This study presents the estimates of their isotopic yields and the first early-time synthetic spectra for this explosion channel, providing direct, testable observational diagnostics. This analysis is imperative for constraining the frequency of such thermonuclear events in white dwarf populations and facilitates the generation of state-of-the-art synthetic observables.

Session 5.2 | WD Supernova Connections

A Future Between Supernova and Accretion-Induced Collapse: Massive White Dwarfs in Close Orbits with Hot Subdwarfs

Fabian Mattig

Universität Potsdam

Type Ia supernovae are key cosmological distance indicators and the main producers of iron in the universe, yet the nature of their progenitors remains an open question. These progenitors are rare and highly sought-after systems involving ultra-massive white dwarfs in a tight binary orbit. Many galactic type Ia candidates involve hot subdwarf stars, which evolve into white dwarfs before merging with their companion to trigger a thermonuclear explosion. The exact fate of these systems is often obscured by the unknown nature of the companion: a CO white dwarf is required for the SN Ia scenario, while an ONe white dwarf would more likely lead to accretion-induced collapse. I will present the massive binary system J065816.72+094343.1, a very promising supernova type Ia / accretion-induced collapse progenitor we recently discovered. In this system a 0.82(+-0.17) $M_\odot$ hot subdwarf star orbits a 1.30(+0.31/−0.26) $M_\odot$ unseen companion, sitting at the intersection between the most massive CO and ONe white dwarf stars as well as lower mass neutron stars. I will discuss our efforts to determine the companion's nature and how collaboration between the hot subdwarf and white dwarf communities could help identify this and other systems as SN Ia progenitors in the future.

Modeling Radiative Transfer in Double White Dwarf Mergers in the Era of Time-Domain Surveys

Megha Das, Prof. Mattia Bulla

University of Ferrara

Double white dwarf (DWD) mergers are a natural outcome of binary stellar evolution and represent a key channel linking compact object binaries, gravitational-wave sources, and astrophysical transients. While some mergers may lead to Type Ia supernovae, a large fraction are expected to form long-lived remnants accompanied by the ejection of a small amount of high-velocity material. These systems are promising progenitors of faint, rapidly evolving optical transients, yet their observational signatures remain poorly constrained. A major uncertainty lies in the efficiency with which radioactive decay energy in the ejecta is thermalized and converted into observable radiation, directly shaping peak luminosities, color evolution, and inferred ejecta properties. In this talk, I will present time-dependent radiative transfer simulations of DWD merger ejecta using POSSIS (POlarization Spectral Synthesis In Supernovae), a three-dimensional Monte Carlo code. These models capture transport-driven effects that are not accounted for in commonly used semi-analytic approaches, enabling more realistic predictions of light curves and spectral evolution. This framework provides physically grounded diagnostics to distinguish DWD merger transients from other fast, low-luminosity events. In the era of wide-field surveys such as the Legacy Survey of Space and Time (LSST) at the Vera C. Rubin Observatory, such modeling will be essential for identifying and interpreting these elusive transients.

Towards systematic searches for LISA white dwarf binaries with multiband photometry

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Short-period double white dwarfs (DWDs) are pivotal systems in astrophysics, providing key insights into a wide range of questions, from stellar-binary evolution and Type Ia Supernova progenitors to gravitational waves (GWs). They represent the most numerous sources for the Laser Interferometer Space Antenna (LISA), an ESA-adopted mission scheduled for launch in 2035, which will revolutionise GW astronomy. Electromagnetic (EM) counterparts of these systems will be pivotal in enhancing both the scientific return and the overall performance of the mission: this makes the present an ideal opportunity to chart the population of short-period DWDs across the Galaxy. We developed a strategy to identify LISA source candidates in multiband photometric surveys, in order to select targets for further follow-up and characterisation. Starting from a theoretical population of Galactic WDs, combined with consistent cooling models for the evolution, we constructed a synthetic EM catalogue of WD detections. We find that the resulting magnitude and colour distributions can help us distinguish LISA source candidates from the broader WD population: the former populate a specific area in colour-colour diagram, with little contamination from single systems and wide binaries. This method is now guiding the design of a proposal for the Canada-France-Hawaii Telescope community survey (2027-2033).

Characterizing log g variations in Ellipsoidally Modulated Hot Subdwarf Binaries

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The accuracy and precision of type Ia supernovae (SN Ia) as cosmological distance indicators rely on our understanding of SN Ia progenitor channels. A promising class of progenitor candidates consists of close binaries of white dwarfs (WDs) and hot subdwarfs (sdBs), which are evolved, core helium-burning stars. Such sdB+WD binaries may show >10% light curve modulations due to tidal deformation of the sdB by the WD. As we observe the sdB from different angles, the star's deformation can cause resolvable variations in the spectroscopically-derived surface gravity (Kosakowski et al., in prep). Since log g is a key prior for determining the system's mass via light curve modeling, such log g variations could introduce additional uncertainty into the system's mass estimate, and thus its classification as a SN Ia progenitor. We quantify for the first time the effect of log g variations on the derived masses of multiple known sdB+WD systems, including SN Ia progenitor candidates. For each system, we use phase-resolved spectroscopy and multi-color light curves collected using the 4.1-m SOAR Telescope and 0.8-m TTT2 Telescope to derive phase-resolved log g and mass solutions. Here we present the results of our analysis.

Sampling white dwarf interiors via stellar collisions

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Neon-22 is, after C-12 and O-16, the most abundant isotope in white dwarf stars. As a consequence of the change of solubility during the gradual solidification of the star it can migrate towards the central regions through a process of distillation inducing an important release of gravitational energy. This process noticeably slows down the cooling process of white dwarfs and could allow to account for the existence of the Q-branch in the white dwarf Hertsprung-Russell diagram as well as the white dwarf luminosity function in the metal-rich open cluster NGC 6791. This distillation process, however, demands a high initial abundance of Ne-22 (mass fractions of the order or larger than3\%), a condition that is not satisfied by the majority of stars. In the case of lower Ne-22 abundances, phase diagrams do not predict a distillation but the formation of a thin shell made of C/Ne, and smaller delays in the cooling process that, for the moment, are not detected in the luminosity function. One possibility for detecting this peculiar C/Ne shell is via SNIa explosions since the abundance distribution of neutron-rich isotopes is modified, another one is the ablation of this shell via collision with a compact object (white dwarf, neutron star or black hole). In this work we examine the observaConal consequences of such a collision.

Simulating magnetized white dwarfs by time evolution: Chandrasekhar limit and beyond

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Magnetic white dwarfs (WDs) are a significant fraction of observed WDs, present in both isolated and binary cases. The surface fields of these magnetized WDs can range from 103 to 1010 G. These magnetic fields can lead to various interesting effects on the WD structure. They can also be linked to unusual observations, i.e., as the super-Chandrasekhar progenitors of over-luminous type Ia supernovae (e.g. SNLS-03D3bb), as slow-rotating pulsars (e.g. GPM J1839−10), etc. We explore in detail, for the first time, the time-dependent simulation for the evolution of magnetized main sequence (MS) stars to magnetized white dwarfs (WDs) using the Cambridge Stellar evolution code: STARS. In order to do so, we have appropriately modified the said code by introducing magnetic effect and cooling. We investigate further the possible existence of stable, massive, super-Chandrasekhar WDs, inferred from observations. Magnetic fields greatly contribute to the existence of massive WDs, both through classical and quantum effects, as shown by our group's previous theoretical calculations. In this work, we explore the classical effects of magnetic fields on the structure of the MS stars, the evolution of the star on the HR diagram and finally, WDs. We investigate the stability of magnetic WDs, both below and above the Chandrasekhar limit. We obtain the possibility of existence of super-Chandrasekhar WDs and new mass limit(s), depending on the magnetic field geometry, mass accretion from its companion and cooling rates. These magnetic WDs, both sub- and super-Chandrasekhar, can further explain unusual slow-rotating pulsar/long-period transient observations (e.g. GPM J1839−10, GLEAM-X J162759.5-523504.3) depending on the field geometry and obliquity angle.

Precise Parameters for Two LISA Sources

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We present precise parameters for two compact double white dwarf (DWD) binaries, SDSS J232230.20+050942.0 (J2322+0509) and SDSS J063449.92+380352.2 (J0634+3803), with orbital periods of 20 and 26.5 minutes, respectively. These systems will serve as verification sources for the Laser Interferometer Space Antenna (LISA). To significantly improve the electromagnetic (EM) constraints on these two systems and the LISA detectability predictions, we conducted spectroscopic follow-up observations using HST/STIS, Keck I/LRIS, and Keck II/ESI. Our analysis significantly improves the temperature, surface gravity, and mass constraints for both primary and secondary components in J2322+0509, as well as dynamical properties such as radial velocities and orbital periods in both systems. For J2322+0509, we derive an updated inclination of i=25+4.5-3.0 deg, while for J0634+3803, we obtain i= 43+5.6-7.0 deg. We assess the detectability of these sources using GLASS. Incorporating EM priors on inclination significantly enhances the gravitational-wave signal recovery, reducing uncertainties in amplitude by a factor of 2–4 and shortening the detection time by up to a few months. Our results underscore the importance of multimessenger observations in characterizing DWD binaries and maximizing LISA's early scientific capabilities.

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