EUROWD08

16TH EUROPEAN WHITE DWARF WORKSHOP

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Abstract Book

Oral Contributions

Luminosity function, mass function and populations

The White Dwarf Luminosity Function from SuperCOSMOS Sky Survey data

Submitted by Nicholas Rowell
by Nicholas Rowell, Nigel Hambly, Pierre Bergeron

We present the early results of a large all-sky proper motion survey for Galactic white dwarfs. Using SuperCOSMOS Sky Survey data, a large, kinematically selected sample of white dwarfs can be drawn with well constrained completeness. We fit the three-band photographic colours to synthetic atmosphere models, and use the derived distances to measure the luminosity function for white dwarfs. The application of this to studies of Galactic structure and star formation history will be discussed, with particular emphasis on any potential spheroid white dwarfs present in our survey.

SDSS DR4: Progress on the Hot White Dwarf Luminosity Function

Submitted by Jerzy Krzesinski
by J. Krzesinski, A. Nitta, S.J. Kleinman, S. Hugelmeyer, S. Dreizler, J. Liebert, H. Harris

A large collection of white dwarf (WD) spectra from Sloan Digital Sky Survey (SDSS) data release 4 (DR4) WD catalog data allowed us to obtain a luminosity function (LF) for the hottest WDs. The LF was calculated basing on spectra of the WDs from a special class of SDSS objects called hot standards (HS), for which the WD sample completeness can be estimated. WD distances were determined from the observed and absolute SDSS g filter magnitudes derived from WD stellar atmosphere model fits to the SDSS spectra. The result LF covers -0.5 up to 7 absolute bolometric magnitude range and its cold part overlaps with the hot end of previously determined WD LF from SDSS data release 3 (DR3). Our LF shows a slight disagreement at the cold end comparing to the literature one but it can be due to some problems with WD completeness estimations. However, it is clearly visible that the LF has unexpected plateau from 1.5 up to 4 absolute bolometric magnitudes. The plateau might be connected to the problems SDSS has with spectra calibration of the blue objects and lack of good stellar atmosphere models for the hottest DA white dwarfs. From the other hand, a closer investigation of separate LFs built for DA and non-DA WDs that helium lines are visible suggests that the plateau can be real.

White dwarfs, red dwarfs and halo dark matter

Submitted by Enrique Garcia-Berro
by E. Garcia-Berro, S. Torres, J. Camacho & J. Isern

The nature of the microlensing events observed towards the LMC still remains controversial. Substellar objects and stars with masses larger than ~1 $M_\odot$ have been ruled out as major components of a MACHO Galactic halo, while stars of ~0.5 $M_\odot$ are the most probable candidates. In this work we assess the contributions of both red dwarfs and white dwarfs to the mass budget of the Galactic halo, using a a Monte Carlo simulator that incorporates up-to-date evolutionary sequences of both red dwarfs and white dwarfs as well as detailed descriptions of both our Galaxy and the LMC. We explore the complete mass range of interest of the possible microlensing candidates and we compare the synthetic populations obtained with our simulator with the results obtained by the MACHO and EROS experiments. We find that the contribution of the red-dwarf population is not enough to explain the number of events claimed by the MACHO team. We also find that when the contribution of the red-dwarf population is taken into account the total optical depth almost doubles that obtained when the white-dwarf population alone is considered. Finally, we also find that the contribution to the halo dark matter of the entire population under study, is smaller than 10%, at the 95% confidence level.

The galactic population of white dwarfs

Submitted by Ralf Napiwotzki

by Ralf Napiwotzki

I present a model of the population of white dwarfs (WDs) in our Milky Way based on observations of the local WD sample and a standard model of the Milky Way. This model will be used to estimate the space densities of thin disk, thick disk and halo WDs and their contribution to the baryonic mass budget of the Milky Way. Simulations will be compared with a number of observational results and used to address a number of questions: How complete are current white dwarf samples? Can standard assumptions explain observations of WDs in the Milky Way halo or are the WD numbers much higher as suggested by Oppenheimer et al. (2001). Is it possible to explain the population of supermassive white dwarfs by single star evolution or is a merger channel required?

Axions and the white dwarf luminosity function

Submitted by Jordi Isern

by J. Isern, E. García-Berro, S. Torres, S. Catalán

White dwarfs are the end-product of the lifes of intermediate- and low-mass stars and their evolution is described as a simple cooling process. Recently, it has been possible to determine with an unprecedented precision their luminosity function, that is, the number of stars per unit volume and luminosity interval. We show here that the shape of the bright branch of this function is only sensitive to the averaged cooling rate of white dwarfs and we propose to use this property to check the possible existence of axions, a proposed but not yet detected weakly interacting particle. Our results indicate that the inclusion of the emission of axions in the evolutionary models of white dwarfs noticeably improves the agreement between the theoretical calculations and the observational white dwarf luminosity function. The best fit is obtained for $m_a \cos^2 \beta \approx 5$ meV, where m_a is the mass of the axion and $\cos^2 \beta$ is a free parameter. We also show that values larger than 10 meV are clearly excluded. The existing theoretical and observational uncertainties do not allow yet to confirm the existence of axions, but our results clearly show that if their mass is of the order of few meV, the white dwarf luminosity function is sensitive enough to detect their existence.

On the high surface gravities of cool white dwarfs

Submitted by Detlev Koester

by Koester, D. Kepler, S.O. Kleinman, S. Nitta-Kleinman, A.

Several large scale studies have found an apparent increase of the surface gravities of cool DA and DB. We study various possible explanations for this result.

New results on the white dwarf IFMR

Submitted by Paul Dobbie

by Paul Dobbie et al.

I will present results from our recent observational work on the white dwarf IFMR, focusing on recently obtained VLT and FORS1 spectroscopy of the white dwarf members (and non-members!) of a number of open clusters. The (semi-) empirical data now available hint at structure in the relation.

Testing the initial-final mass relationship of white dwarfs

Submitted by Silvia Catalan

by S. Catalan, J. Isern, E. García-Berro, I. Ribas

The initial-final mass relationship connects the mass of a white dwarf with the mass of its progenitor in the main-sequence. Although this function is of fundamental importance to several fields in modern Astrophysics, it is not well constrained either from the theoretical or the observational points of view. We have carried out a revision of the present semi-empirical initial-final mass relationship by re-evaluating the available data in the literature. From a careful analysis we have been able to give some clues on the dependence of the final mass of white dwarfs on different parameters such as metallicity or rotation. Finally, we have performed a test of the initial-final mass relationship by evaluating its effect on the luminosity function and mass distribution of white dwarfs, which has shed up some light upon its behaviour at the high-mass domain.

Compact Companions in Hot Subdwarf Binaries- from White Dwarfs to Black Holes

Submitted by Stephan Geier
by S. Geier, U. Heber, H. Edelmann, R. Napiwotzki

The masses of compact objects like white dwarfs, neutron stars and black holes are fundamental to astrophysics, but very difficult to measure. We present new results of an analysis of subluminous B (sdB) stars in close binary systems with unseen compact companions to derive their masses and clarify their nature. Based on high resolution spectra we were able to measure orbital as well as atmospheric parameters. The projected rotational velocity of the stars was determined with high accuracy. The orbital synchronisation of the binaries makes it possible to constrain inclination angles and companion masses. Using this method we were able to determine the masses of white dwarf companions as well as identify candidate neutron star and black hole companions. Here we report the status of this ongoing project.

HYPERMUCHFUSS - A undiscovered high velocity population

Submitted by Alfred Tillich
by Stephan Geier, Alfred Tillich, Uli Heber, Heiko Hirsch, Pierre Maxted, Ralf Napiwotzki, Roy Ostensen, Boris Gaensicke et al.

We present an overview and a status report of HYPERMUCHFUSS (HYPER velocity or Massive Unseen Companions of Hot Faint Underluminious Stars Survey) aiming at the detection of a population of high velocity subluminous B stars and white dwarfs. We studied a sample of 50 RV variable sdB stars for atmospheric parameters and analysed projected rotational velocities. Assuming tidally bound rotation we determined the companion masses. Most of them turned out to be normal white dwarfs. Surprisingly 2 (possibly 4) have companions heavier than 1.4 solar masses. Hence there migt be a yet undiscovered population of hot subdwarfs with neutron star or even black hole companions. Such stars define the first class of targets for our survey. The second class is formed by the recently discovered Hyper-velocity stars (HVS), which are moving so fast that the dynamical ejection by a supermassive black hole seems to be the only explanation for their origin. Therefore these stars provide kinematical insight into the environment of the supermassive black hole in the Galactic centre. Until now only one old HVS has been found, but we expect a larger population especially within the group of bound orbit HVS. We selected hot subdwarfs and white dwarfs with high galactic restframe velocities from the SDSS spectral data base, which serve as first epoch observations for a follow up project with the ESO VLT in Chile, Calar Alto in Spain and the WHT on La Palma. Therefore our unique targets selection will lead to the discovery of either binaries with massive companions or hyper velocity stars.

White dwarf structure and evolution

C/O WDs of low mass (0.33-0.5 Msun): possible evolutionary scenarios

Submitted by Pier Giorgio Prada Moroni
by Prada Moroni P.G. and Straniero O.

The standard lower limit of the mass of white dwarfs (WDs) with a C/O core is roughly 0.5 $M_\odot$. In the present work we investigate possible evolutionary scenarios leading to the formation of C/O WDs with mass as low as 0.33 $M_\odot$. Both the pre-WD and the cooling evolution of such nonstandard models will be described.

A Progress Report on the Carbon Dominated Atmosphere White Dwarfs

Submitted by Patrick Dufour
by P. Dufour, J. Liebert

Recently, we reported the unexpected discovery that a few white dwarfs found in SDSS had an atmosphere dominated by carbon with little or no trace of hydrogen and helium. We will now present a progress report on these new objects based on high signal-to-noise follow-up spectroscopic observations obtained at the 6.5m MMT telescope on mount Hopkins, Arizona.

Measuring the Surface Inhomogeneity of Metals on Accreting White Dwarf Stars

Submitted by Michael H. Montgomery
by M. H. Montgomery, Susan E. Thompson, Ted von Hippel

The presence of metals in white dwarf atmospheres together with their rapid expected settling times imply that these objects should be actively accreting metals. This accretion, if from a debris disk, is likely to be aspherical, leading to an inhomogeneous distribution of metals across the star's surface. The pulsations of variable white dwarfs are non-radial g-modes, with different modes sampling the surface in different ways. We show how time-series spectroscopy of these objects can be used to sample the angular distribution of metals on their surfaces, and what this implies for the accretion process. Finally, we show what conclusions can be drawn from existing data sets.

White dwarf ages

Calibrating Cosmological Chronometers: White Dwarf Masses via Astrometry

Submitted by John P. Subasavage

by John P. Subasavage(1) Todd J. Henry(1) Wei-Chun Jao(1) Edmund Nelan(2) Hugh C. Harris(3) (1) Georgia State University, USA (2) Space Telescope Science Institute, USA (3) United States Naval Observatory, USA

In an effort to increase the number of accurate dynamical masses for white dwarfs (WDs), we have begun an initiative using Hubble Space Telescope's Fine Guidance Sensors (FGS) to resolve suspected binary WDs. With the increasing number of WD trigonometric parallaxes becoming available via CTIOPI's and the USNO's ongoing parallax programs, we have targeted objects that are overluminous at V magnitude and are presumably unresolved multiple systems. A few targets were selected because of possible perturbations evident in the residuals of the trigonometric parallax solutions. A total of 16 HST orbits were designated to this program and 12 have been completed. Of the eleven WDs observed thus far (one object was observed twice), all but one were unresolved. Analysis of the most recent orbit's data indicate a pair was resolved with a separation of 70 mas and a delta V magnitude of ~1.4. Coupled with astrometric data from the USNO parallax program, we are able to reliably constrain component masses.

The White Dwarf Age of the Open Cluster NGC 2477

Submitted by Elizabeth Jeffery

by Elizabeth J. Jeffery, The University of Texas at Austin, T. von Hippel, The University of Texas at Austin, S. DeGennaro, The University of Texas at Austin, W.H. Jefferys, The University of Texas at Austin & The University of Vermont, D. van Dyk, The University of California at Irvine, N. Stein, The University of Texas at Austin

Currently there are two main techniques for independently determining the ages of stellar populations: main sequence evolution theory (via cluster isochrones) and white dwarf cooling theory. Open clusters provide the ideal environment for the calibration of these two clocks. We present a new analysis of the white dwarf age of NGC 2477, employing a new Bayesian statistical technique that has been developed by our group.

White dwarf catalogs and surveys

The DR6 SDSS WD Catalog

Submitted by Scot Kleinman
by S.J. Kleinman

I report on the in-progress results of the next SDSS catalog of spectroscopically confirmed white dwarf stars, based on DR6 data. In addition to approximately 4000 new objects, I present new fits of the previous DR4 and DR1 white dwarf stars based on the latest SDSS reductions and an updated model grid which features finer spacings between grid points in addition to updated physics. I"ll report on the resulting mass distribution and highlight continued areas of work..

Spectroscopic analysis of DA white dwarfs from the McCook & Sion Catalog

Submitted by Alexandros Gianninas
by A. Gianninas & P. Bergeron Université de Montréal

For some years now, we have been gathering optical spectra of DA white dwarfs in an effort to study and define the empirical ZZ Ceti instability strip. However, we have recently expanded this survey to include all DA white dwarfs from the McCook & Sion catalog down to a limiting visual magnitude of V=17.5. We present here a spectroscopic analysis of over 1000 DA stars from this ongoing survey. We have several specific areas of interest most notably the hot DAO white dwarfs, the ZZ Ceti instability strip, and DA+dM binary systems. Furthermore, we present a comparison of the ensemble properties of our sample with those of other large surveys of DA white dwarfs paying particular attention to the mass distribution and its variation as a function of effective temperature.

What Fraction of White Dwarfs are Members of Binary Systems?

Submitted by Jay B. Holberg
by J. B. Holberg

White dwarfs were originally discovered as the faint subordinate companions of bright nearby stars (i.e. Sirius B and 40 Eri B). Several general categories of binary systems involving white dwarfs are recognized: Sirius-like systems, where the white dwarf may be difficult to detect; binary systems containing white dwarfs and low mass stars, where the white dwarf is often readily discerned; and double degenerate systems. Different modes of white dwarf discovery often bias our perception of both the overall binary fraction and the nature of these systems; proper motion surveys emphasize resolved systems, while photometric surveys emphasize unresolved systems containing relatively hot white dwarfs. Recent studies of the local white dwarf population offer some hope of achieving realistic estimates of the relative number of binary systems containing degenerate stars.

Spectral Analysis of 636 White Dwarf-M Star Binaries from the Sloan Digital Sky Survey

Submitted by René Heller
by R. Heller [Hamburger Sternwarte, Germany], D. Homeier [Inst f. Astrophysik, Goettingen, Germany], S. Dreizler [Inst f. Astrophysik, Goettingen, Germany], Roy Østensen [Inst. f. Astronomy, Leuven, Belgium]

While white dwarfs (WDs) are the common final stage of stellar evolution, M stars are the most frequent stars. We present a study on spectra of 636 WD-M Star Binary Systems, which we identified in the Sloan Digital Sky Survey (SDSS). To all of these combined spectra, we applied a decomposing procedure in order to derive the fundamental parameters of the components. Those fits were used to estimate the constituents' distances from Earth, independently from each other. For a subsample we could also find an optical separation on the SDSS photometric data, which allowed us assessments on their orbital separation and periods. Additionally, our sample comprises post-common-envelope binaries, and candidates, and a number of cool DOs. At the EUROWD08 we will showcase the statistical output of our study: amongst others the SDSS biased temperature function of Das.

Post common envelope binaries from the SDSS

Submitted by Matthias R. Schreiber

by Matthias Schreiber (Universidad Valparaiso), Boris Gaensicke, John Southworth, Alberto Rebassa-Mansergas (University of Warwick), Axel Schwope, Ada Nebot Gomez-Moran (Astrophysikalisches Inst. Potsdam)

Since 2006 we run a project especially designed to provide a well-defined and large sample of post common envelope binaries (PCEBs) in order to constrain current theories of compact binary evolution. This project has become feasible as the SDSS turned out to efficiently identify new white dwarf/main sequence (WDMS) binaries (see proposed talk by Rebassa-Mansergas). To characterize the PCEBs among these WDMS we follow a two step strategy with the identification of the PCEBs from at least two follow-up spectra in stage one and the orbital period measurements in stage two. So far we identified 55 new PCEBs and measured 28 orbital periods. In general, the fraction of post common envelope systems among SDSS white dwarf/main sequence binaries is found to be about ~35% but significantly depends on the mass of the secondary star. The measured orbital period distribution peaks at Porb~0.7-0.8 days with a steep decline at Porb~1day. Comparing these results with theoretical predictions of binary population models provides new constraints on the common envelope phase and angular momentum loss through magnetic braking

The physical parameters of white dwarf plus main sequence binaries from SDSS

Submitted by Alberto Rebassa-Mansergas

by Alberto Rebassa Mansergas Boris Gaensicke John Southworth Matthias Schreiber Ada Nebot Gomez-Moran Axel Schwope

We have developed a procedure based on chi^2 template fitting and signal-to-noise ratio constraints to identify white dwarf-main sequence (WDMS) binary candidates in the Sloan Digital Sky Survey (SDSS) Data Release 6 spectroscopic database. In this talk, I will present our catalogue of over 1500 WDMS binaries identified in this way. Using a spectral decomposition/model atmosphere analysis, we have derived white dwarf temperatures, masses, cooling ages, companion star spectral types, and distances, and I will discuss the distributions of these parameters. I will also show how multiple SDSS spectroscopy can be used to identify close WDMS binary candidates. Finally, I will show some examples of our ongoing follow-up studies, and highlight the additional physical information that can be drawn from such data. The content of this talk complements with the presentation proposed by M.R. Schreiber, and we would like to suggest that, if the topic seems appropriate for the WD workshop,to schedule both talks next to each other.

Central stars of planetary nebulae

SBS1150++599A: the Double degenerate core of Planetary Nebula

Submitted by Gagik Tovmasian
by Tovmassian, G., Tomsick, J., Napiwotzki, R., Suleymanov, V.,

We present results of multi-wavelength observations of the close binary nucleus of the Planetary Nebula (PN G135.9+55.9). The components of the binary are two white dwarfs in a peculiar state: the central star of the PN is on its way of contraction, its more massive component is a super soft X-ray source heated by the nuclear burning of accreted matter on its surface. We discuss atmospheric models to both components.

Do all planetary nebulae derive from binaries? Constraining the answer using WD binaries.

Submitted by Orsola De Marco
by Orsola De Marco

Mounting theoretical "evidence" points to a very large binary role in the formation and shaping of planetary nebulae (PN). An observational confirmation in the form of a high binary fraction for central stars of PN has been slow in coming due to large biases and constraints. A new collaboration, dubbed PlaN-B (PLAnetary Nebula Binaries) is actively seeking direct observational tests to the binary hypothesis. All the while answers are being sought by turning to the progenitors of the central stars, the AGB and post-AGB stars as well as their progeny: the WDs. In this contribution we will weave binary post-AGB stars, binary central stars of PN and binary WDs into a single evolutionary scenario, emphasizing where the evolutionary thread is in conflict with the observations.

UV Spectroscopy of the Central Star of the Planetary Nebula NGC 7094

Submitted by Marc Ziegler
by M. Ziegler, T. Rauch, K. Werner, L. Koesterke, J. W. Kruk

The hydrogen-deficient PG 1159 stars are the result of a late helium-shell flash (late thermal pulse, LTP). The time when such a flash (the re-ignition of helium-shell burning in a post-AGB star or white dwarf) occurs determines the amount of remaining photospheric hydrogen. Still on the AGB (AGB final thermal pulse, AFTP), flash-induced mixing of the hydrogen-rich envelope (10^{-2} M).

Supernovae progenitors

A typical thermonuclear supernovae from tidally crushed white dwarfs

Submitted by Stephan Rosswog
by S. Rosswog E. Ramirez-Ruiz R. Hix

Suggestive evidence has accumulated that intermediate mass black holes (IMBHs) exist in some globular clusters. As stars diffuse in the cluster, some will inevitable wander sufficiently close to the hole that they suffer tidal disruption. An attractive feature of the IMBH hypothesis is its potential to disrupt not only solar-type stars but also compact white dwarf stars. Attention is given to the fate of white dwarfs that approach the hole close enough to be disrupted and compressed to such extent that explosive nuclear burning may be triggered. We present a large set of calculations in which the dynamics of the encounter coupled with a nuclear reaction network. This allows for a realistic determination of the explosive energy release, and it is argued that ignition is a natural outcome for white dwarfs of all varieties passing well within the tidal radius. Although event rates are estimated to be significantly less than the rate of normal Type Ia supernovae, such encounters may be frequent enough in globular clusters harboring an IMBH to warrant a search for this new class of supernova.

White dwarfs in novae and CVs

Rapid Optical Oscillations in V842 Cen (Nova Cen 1986)
Submitted by Brian Warner
by Brian Warner & Patrick A. Woudt

We observed V842 Cen in February and March 2008 and found that it has developed a number of optical modulations since we last observed it in 2002. There is a strong coherent 56.79 s periodicity, with a side band at 57.13 s and another possibly at 56.45 s. In addition there is a possible oscillation at ~44.9 s. At longer periods there are large amplitude modulations at 1.186, 1.26, 2.89, 3.16 and 5.71 hours. There are also possible periods around 30 mins. We do not yet have a clear assignment of causes, but some of the longer periods are probably related to an orbital and/or superhump modulation with harmonics, with the possibility also of a GW Lib type longer period photometric variation of unknown origin. The shorter periods may be caused by non-radial oscillations. This is the youngest old nova to show such short period oscillations**.**

The Evolution of the White Dwarf during the 2006 Outburst of RS Oph
Submitted by Sumner Starrfield
by Sumner Starrfield, Jan-Uwe Ness, Michael Bode, Julian Osborne, Kim Page, Joachim Krautter, Jeremy Drake, Neil Gehrels, A. Evans, G. Schwarz, A. P. Beardmore, M.R. Goad, Tim O'Brien, et al.

RS Oph was observed in outburst on February 12, 2006 and, for at least the fifth time in recorded history, reached naked eye visibility. We jumped at the opportunity to observe this system both with the large number of satellites now in orbit and ground based facilities that had far superior detectors to those available for its last outburst in January 1985. This system has a white dwarf (probably massive) in a 455 day orbit around a cool giant. The giant is transferring hydrogen rich matter onto the white dwarf at a rate that is sufficient for an explosion every 20 years or so. I will report on what we learned about the white dwarf from the data that we obtained with X-ray satellites such as Chandra, XMM and Swift. I will also discuss the possible relationship between RS Oph and Supernovae of Type Ia.

Faint Thermonuclear Supernovae from AM CVn Binaries
Submitted by Ken Shen
by Lars Bildsten, Ken J. Shen, Nevin N. Weinberg, Gijs Nelemans

Helium that accretes onto a C/O white dwarf in the double white dwarf AM Canum Venaticorum (AM CVn) binaries undergoes unstable thermonuclear flashes when the orbital period is in the 3.5-25 minute range. At the shortest orbital periods (and highest accretion rates, Mdot > 10^{-7} M$_\odot$/yr), the flashes are weak and likely lead to the helium equivalent of classical nova outbursts. However, as the orbit widens and Mdot drops, the mass required for the unstable ignition increases, leading to progressively more violent flashes up to a final flash with helium shell mass ~ 0.02-0.1 M$_\odot$. The high pressures of these last flashes allow the burning to produce the radioactive elements 48Cr, 52Fe, and 56Ni that power a faint (M_V = -15 to -18) and rapidly rising (few days) thermonuclear supernova. Current galactic AM CVn space densities imply one such explosion every 5,000-15,000 years in 10^{11} M$_\odot$ of old stars (~ 2-6% of the Type Ia rate in E/SO galaxies). These ``.Ia" supernovae (one-tenth as bright for one-tenth the time as a Type Ia supernovae) are excellent targets for deep (e.g. V=24) searches with nightly cadences, potentially yielding an all-sky rate of 1,000 per year.

HST Time-Resolved Spectroscopy of V471 Tauri
Submitted by Howard E. Bond
by Howard E. Bond Edward M. Sion Don Lindler

(longer version to follow) We report UV spectroscopy of the eclipsing binary V471 Tau. Results include a refined double-lined orbital solution, refined dynamical masses, time-resolved spectroscopy taken during the 9.25-minute rotation period of the white dwarf, and direct measurement of Zeeman splitting of photospheric lines.

The Accreting White Dwarfs in VY Scl Nova Like Variables

Submitted by Edward M. Sion
by Edward M. Sion

The VY Sculptoris subtype of nova-like variables undergo unpredictable deep low optical brightness states during which their accretion disks are very faint or absent and their underlying white dwarfs are exposed. FUSE, Hubble STIS and IUE archival spectra have revealed the temperatures, and in some cases the chemical abundances and rotational velocities of the accreting white dwarf in several of these systems. These properties are compared with the observed properties of white dwarfs in dwarf novae at the same orbital periods. Implications are discussed.

Where are the Progenitors of Magnetic Cataclysmic Variables (Polars) ?

Submitted by James Liebert
by James Liebert

Silvestri et al. (2007, AJ, 134, 741) document the now over 1,250 white dwarf plus M dwarf pairs from the Sloan Digital Sky Survey with mostly DA primaries. All of these have spectra of sufficient quality to reveal Zeeman splitting from a > 2-3 megagauss field. Not one such magnetic white dwarf is paired with a nondegenerate companion, not counting low accretion rate polars (LARPs) or polars in a low state. At the same time, SDSS has built up the number of known magnetic white dwarfs with fields of 3MG or larger to 149 (as of Kawka et al. 2007, ApJ, 654, 499). Even with the likely strong selection effect that magnetic white dwarfs are higher/lower than average mass/radius and therefore harder to discover in a magnitude-limited sample, the statistics are now overwhelming that magnetic white dwarfs do not have nondegenerate companions. Strong magnetic fields in white dwarfs have traditionally been assumed to be fossil fields, evolving from Ap/Bp stars. Tout, Wickramasinghe, Liebert, Ferrario, and Pringle (2008, MNRAS, in press) propose instead that the field is generated on the primary of a common envelope binary by a dynamo mechanism. This results in a merged, high mass magnetic white dwarf if the secondary star is degenerate, or in a polar if the secondary is nondegenerate.

Physical processes in white dwarfs and magnetic white dwarfs

Parameter-Free Stark Broadening of Hydrogen Lines in DA White Dwarfs

Submitted by Pier-Emmanuel Tremblay
by Pier-Emmanuel Tremblay, Pierre Bergeron & Jean Dupuis

We present new calculations for the Stark broadening of hydrogen line profiles in the dense atmospheres of white dwarf stars. Our improved model is based on the unified theory of Stark broadening from Vidal, Cooper & Smith but also includes non-ideal gas effects from the Hummer & Mihalas formalism directly inside the line profile calculations. This approach replaces previous calculations that have used an ad-hoc free parameter to describe the dissolution of the line wing opacity in the presence of high electric microfields in the plasma. We thus present the first grid of model spectra for hot (T_{eff} > 12,000 K) DA white dwarfs that has no free parameters. The atmospheric parameters obtained from optical and UV spectroscopic observations using these improved models are shown to differ substantially from those published in previous studies. We also show a significant improvement between the observed and expected mass distributions of DA stars in the temperature range considered.

Analysis of the Hydrogen-rich Magnetic White Dwarfs in the SDSS

Submitted by Baybars Kulebi
by Baybars Kulebi, Stefan Jordan, Fabian Euchner, Heiko Hirsch, Osvaldo Aquines, Wolfgang Loeffer

We have calculated the optical spectra of hydrogen-rich magnetic white dwarfs with strengths between 1 MG and 1000 MG for temperatures between 7000 K and 50000 K. Through a least squares minimization scheme with an exolutionary algorithm, we have analyzed the spectra of 101 magnetic DAs from the SDSS (92 previously published plus 9 newly discovered). Since we were limited to single spectrum for each object we used simple centered dipoles or dipoles which were shifted along the dipole axis. We also investigated the statistical properties of magnetic-field geometries of this sample.

Disks, dust and planets around white dwarfs

Gaseous debris disks around warm white dwarfs

Submitted by Boris Gaensicke
by B. Gaensicke, T.R. Marsh, D. Koester, A. Rebassa-Mansergas, J. Southworth, C. Brinkworth, D.W. Hoard, C. Tappert

Since the last WD workshop in Leicester, we have identified three moderately hot (~20000K) white dwarfs in the Sloan Digital Sky Survey that exhibit double-peaked emission lines of the CaII 8600 triplet, SDSS0845+2257, SDSS1043+0855, and SDSS1228+1040. These lines are the unambiguous signature of rings of gas in Keplerian motion around these stars. All white dwarfs also exhibit significant photospheric Mg abundances, classifying them as DAZ / DBZ white dwarfs. The absence of H or He emission from the disks, and the very small upper limit on the H abundance in the photosphere of the DBZ white dwarf SDSS0845+2257 demonstrate that the circumstellar material is depleted in volatile elements, and the most likely origin of the gaseous rings is the tidal disruption of rocky asteroids. SDSS0845+2257, SDSS1043+0855, and SDSS1228+1040 represent hence the "warm" extension of the cold DAZ/DBZ white dwarfs G29-38, GD362, GD40, WD1150-153, and WD2115-560 exhibiting IR excess from warm dust. I will give a summary of our research on these warm white dwarfs hosting gaseous debris disks, including recent results from VLT spectroscopy, and the detection of a strong IR excess in our Spitzer observations of SDSS1228+1040. Spitzer will also have observed SDSS0845+2257 by the time of the conference, and I will report on those new data.

Spectral modeling of gaseous metal disks around DAZ white dwarfs

Submitted by Klaus Werner
by K. Werner, T. Nagel, T. Rauch

Gaensicke et al. (2006, 2007) have detected double peaked emission lines of CaII (8498, 8542, 8662 Angstroem) in two moderately hot DAZ white dwarfs and suggest that they stem from a gaseous disk of metal-rich material and that the origin of the disk is a tidally disrupted asteroid. We present first results of our attempt to model the disk and the CaII emission lines.

24 Micron Excesses of Hot White Dwarfs - Evidence of Dust Disks?

Submitted by Jana Bilikova
by Jana Bilikova, You-Hua Chu, Kate Su, Robert Gruendl, Thomas Rauch, Kevin Volk

Spitzer Space Telescope observations of the Helix Nebula's hot (T~110,000 K) central star revealed mid-IR excess emission consistent with a dust continuum emitted by a dust disk located at 35-150 AU from the central WD, and the dust is most likely produced by collisions among Kuiper Belt-like Objects (Su et al. 2007). Such a dust disk is a new and exciting phenomenon. To determine how common this phenomenon is, we have carried out a Spitzer 24 um survey of 72 hot WDs. To date, we have detected at least 8 WDs that exhibit clear mid-IR excess, all of them still surrounded by planetary nebulae (PNe). Inspired by the prevalence of PN environment for hot WDs showing IR excesses, we have surveyed the Spitzer archive for more central stars of PNe (CSPNs) with IR excesses; the search yields four cases in which CSPNs show excesses in 3.6-8.0 um. We present the results of these two searches for additional dust disk candidates, and discuss scenarios other than KBO collisions that need to be considered in explaining the observed near and/or mid-IR excess emission. These scenarios include unresolved companions, binary post-AGB evolution, unresolved compact nebulosity, etc. We describe planned follow-up observations aiming to help us distinguish between different origins of observed IR excesses.

Nearly a Planet: A Progress Report on GD66

Submitted by Fergal Mullally
by F. Mullally Steven DeGennaro E. Jeffery D. E. Winget

We report on our continuing efforts to confirm the existence of a planet around the pulsating white dwarf GD66. At the 15th WD conference, we suggested the presence of a companion to this white dwarf based on variations in pulsation arrival times. Two years of additional data confirm this variation, but do not provide coverage of a full orbit. The IRAC photometer on Spitzer is capable of detecting companions to this white dwarf in the infrared. However, our observations only detect a companion with 2 sigma significance, placing an upper limit on the companion mass. We review our observations to date, and consider other options to confirm this potentially exciting system.

The DODO project: directly imaging planetary-mass companions to white dwarfs

Submitted by Matt Burleigh
by Matt Burleigh (University of Leicester, UK) Emma Hogan (University of Leicester, UK) Fraser Clarke (University of Oxford, UK)

We will present full results from the "DODO" survey, a direct-imaging search for substellar and planetary-mass companions to ~40 nearby white dwarfs. We place limits on the fraction of white dwarfs with companions as cool as 400-500K, and masses as low as ~3 Jupiter masses, at wide separations. We will also discuss several "candidate" very low mass common proper motion companions revealed by the observations. Our results are complimentary to mid-IR photometric surveys for unresolved substellar companions with Spitzer, and for planets in orbits at a few AU through pulsation timing, helping to build the first picture of the frequency of solar systems around white dwarfs and their progenitors.

Transit detection limits for sub-stellar and terrestrial companions to white white dwarfs

Submitted by Francesca Faedi
by F. Faedi (1) R. West (1) M. R. Goad (1) M. Burleigh (1) L. Hebb (2) (1) University of Leicester (2) University of St. Andrews

The SuperWASP project is an ultra wide angle search for extra solar planetary transits that successfully produced 15 new planet detections so far. We aim to use SuperWASP photometric data to investigate the transit characteristics of and detection limits for brown dwarfs, gas giants and terrestrial companions in orbit around white dwarfs. The relatively small size of a white dwarf host star (approximately 1 Earth radius), implies that any sub-stellar or gas giant companion will completely eclipse it, while terrestrial bodies smaller then the Moon will produce relatively large (>1%) transits, if such objects exists. We performed extensive simulations to investigate our detection sensitivity using SuperWASP photometric data. We found that for Gaussian random noise we are sensitive to companions as small as the Moon. Our sensitivity drops considerably in the presence of co-variant noise structure, nevertheless we show that Earth size bodies, orbiting a V ~12 magnitude white dwarf, remain readily detectable in relatively low signal-to-noise data such as SuperWASP. We will present results from a sample of 171 white dwarfs, result of the cross-correlation of the McCook & Sion catalogue with the WASP data archive. This list of SuperWASP objects will be searched for transits using an implementation of the Box-Least-Square algorithm (Kovacs et al. 2002, A&A, 391, 369). Such observations will help place constraints on common envelope and close binary evolution, possibly reveal the ultimate fate of hot Jupiter systems, and help us to understand the evolution of solar systems in the post-main sequence phase. In addition the results from this study will be of importance for future surveys such as Pan_Starrs and LSST, as well as for space mission such as PLATO, capable of observing thousands of white dwarfs and therefore to detect a significant population of eclipsing sub-stellar companions, as well as increasing the chances of detecting any small, transiting rocky bodies in relatively close orbits.

On the Presence of Warm and Cool Dust at Metal-Contaminated White Dwarfs

Submitted by Jay Farihi
by J. Farihi M. Jura B. Zuckerman

Spitzer mid-infrared observations of metal-rich white dwarfs have confirmed the presence of orbiting dust around at least 10 stars. The characteristics of these circumstellar disks are highly uniform and consistent with the ongoing accretion of tidally disrupted minor planets. It has been found by expanded searches at longer wavelengths and over various atmospheric compositions that, in addition to high metal abundance, both hydrogen content and stellar effective temperature are correlated with the likelihood of extant dust. New Spitzer IRAC, MIPS, and IRS observations of several externally polluted and dusty white dwarfs will be presented. One of the most important discoveries made by Spitzer is that the majority of metal-contaminated degenerates are dust free, yet are likely experiencing ongoing accretion from circumstellar gas resulting from vaporized or collisionally destroyed dust.

White Dwarfs with unresolved substellar companions and debris disks in UKIDSS

Submitted by Paul Steele
by P.R. Steele, M.R. Burleigh, M.A. Barstow, R.F. Jameson, P.D. Dobbie

We present a near-infrared (NIR) photometric search for substellar companions and debris disks around white dwarfs in the UKIRT Infrared Deep Sky Survey (UKIDSS). We cross-correlate the SDSS DR4 and McCook & Sion catalogues of white dwarfs with the UKIDSS DR3 database producing 408 and 133 matches respectively. Blackbody models are then fitted to Sloan photometry to identify those with NIR photometric excesss consistent with an unresolved sub-stellar companion or a debris disk. We present follow up photometry from targets previously identified in UKIDSS DR2 and the first results from DR3.

Photospheric Calcium Line-Strength Variations in G29-38

Submitted by Ted von Hippel
by Ted von Hippel(1), Susan Thompson(2), Bill Reach(3), Fergal Mullally(4), Mukremin Kilic(5), & Atsuko Nitta(6) 1. University of Texas, Austin, TX, USA 2. University of Delaware, Newark, DE, USA 3. IPAC/CalTech, Pasadena, CA, USA 4. Princeton University, Princeton, NJ, USA 5. Ohio State University, Columbus, OH, USA 6. Gemini Observatory, Hilo, HI, USA

We report on archival Keck and VLT spectroscopy of the DAZd white dwarf G29-38, in which we have measured temporal variations in the line strengths of Ca II K. At the two best-observed epochs, we find that the Ca line equivalent width is 165 $\pm$ 4 mA (in 1996.885) and 280 $\pm$ 8 mA (in 1999.653), an increase of 70%. We find that pulsation adds an error of < 1 mA to these measurements. We also report on Ca and Mg EW variations in G29-38 from new HET and Gemini observations and on a small survey of DAZ stars at Palomar. We interpret these line-strength variations in terms of episodic accretion and discuss the implications for the debris disks.

Testing the Cool White Dwarf Model Atmospheres with Near- and Mid-Infrared Data

Submitted by Mukremin Kilic
by Mukremin Kilic (Ohio State University)

We present near- and mid-infrared photometry and spectroscopy for several dozen cool white dwarfs, including ultra-cool white dwarfs. We fit the spectral energy distributions (SEDs) of these stars with up-to-date model atmospheres. Our results indicate that most cool white dwarfs possess hydrogen-rich atmospheres. We also announce the discovery of several stars with strong near-infrared flux deficits, and show that the optical and near-IR SEDs of these stars are best explained with mixed H/He atmosphere models.

Pulsating white dwarfs

A New Look at GD358

Submitted by Judith Provencal

by J. L. Provencal, M. H. Montgomery, A. Kanaan, H. L. Shipman, A. Baran, S. O. Kepler, M. Reed, A. Zhou, J. Eggen, T. K. Watson, D. E. Winget, S. E. Thompson, B. Riaz, A. Nitta, S. J. Kleinman, R. Crowe, J. Slivkoff, S. L. Kim, Wen-Ping Chen, H. C. Lin, C. C. Lin, C. W. Chen, A. V. Sergeev, D. Mkrtichian, M. Andreev, R. Janulis, M. Siwak, S. Zola, D. Koziel, G. Stachowski, M. Paparo, Z. Bognar, G. Handler, D. Lorenz, B. Steininger, P. Beck, T. Nagel, D. Kusterer, A. Hoffman, E. Reiff, R. Kowalski, G. Vauclair, S. Charpinet, J. E. SOlheim, E. Pakstiene, L. Fraga

GD358 is the prototype helium atmosphere (DB) white dwarf pulsator. Its rich pulsation spectrum displays a wide range of excited modes with complex multiplet structure, in addition to numerous combination frequencies. GD358 is also the most observed object in its class, and has been a target in 4 WET runs. The most recent observations, in May 2006, consist of 436.1 hrs of nearly continuous high speed photometry, obtained with the goal of using the nonlinear pulse shapes to empirically determine the parameters of the convection zone. We present results of our asteroseismological analysis of GD358, using observations spanning its discovery in 1982 to 2006. These observations provide insight into interpretation of multiplet structure, reveal the importance of the convection zone1-302-737-0990, and display evidence supporting the presence of a local magnetic field in GD358.

A Photometric Analysis of ZZ Ceti Stars: A Parameter-Free Temperature Indicator?

Submitted by Pierre Bergeron

by P. Bergeron Université de Montréal, Canada, S.K. Leggett Gemini Observatory, Hawaii, USA, H.C. Harris US Naval Observatory, Flagstaff, Arizona, USA

We present a model atmosphere analysis of optical VRI and infrared JHK photometric data of about two dozen ZZ Ceti stars. We first show from a theoretical point of view that the resulting energy distributions are not particularly sensitive to surface gravity or to the assumed convective efficiency, a result which suggests a parameter-free effective temperature indicator for ZZ Ceti stars. We then fit the observed energy distributions with our grid of model atmospheres and compare the photometric effective temperatures with the spectroscopic values obtained from fits to the hydrogen line profiles. Our results are finally discussed in the context of the determination of the empirical boundaries of the ZZ Ceti instability strip.

Frequency and amplitude variations in the PG 1159 pulsator PG 0122+200

Submitted by Gerard Vauclair

by Vauclair, G., Fu, J.-N., Chevreton, M., Dolez, N., Kim, S.-L., Solheim, J.-E., Wood, M. A., Silver, I.M.

The pre-white dwarf pulsators of PG 1159 type, or GW Virginis variable stars, are in a phase of rapid evolution towards the white dwarf cooling sequence. The rate of change of their nonradial g-mode frequencies can be measured on a reasonably short time scale. From a theoretical point of view, it was expected that one could derive the rate of cooling of the stellar core from such measurements. At the cool end of the GW Virginis instability strip, it is predicted that the cooling is dominated by neutrinos. PG 0122+200 defines the red edge of the instability strip and has been followed-up though multisite photometric campaigns for about fifteen years. With as many as 23 frequencies, its global structure is well constrained. We report here the first measurements of the rate of change of its 7 largest amplitude frequencies. We find that both the frequencies and the amplitudes vary on time scales much shorter than the ones expected from a neutrino dominated core cooling. These results point to the existence of other mechanisms responsible for the frequency and amplitude variability. We will discuss the role of nonlinearities as one possible mechanism.

New Pulsating ZZ Cetis

Submitted by S.O. Kepler
by S. O. Kepler, Bárbara Garcia Castanheira, Scot Kleinman, Atsuko Nitta, Detlev Koester

Over the last four years we went from 32 to a total of 143 known pulsating DA white dwarf stars, 83 from stars discovered by the Sloan Digital Sky Survey and selected from fits of synthetic spectra from model atmospheres to the SNR<30 optical spectra. With time series photometric observations with the SOAR 4.1m telescope, we found 38 of these pulsators, extending the instability strip in terms of Teff and log g, but mainly in terms of low amplitude pulsators. The discovery of 1.5 mma pulsators raises the necessity to reobserve all stars classified as non-pulsators close to the instability strip, as their limits in general were above 3 mma. Therefore the real extent of the instability strip and contamination with non-pulsators, specially at the borders, is still an open question.

Dynamic masses for the close PG1159 binary SDSSJ212531.92-010745.9 as derived from radial velocities

Submitted by Sonja Schuh
by S. Schuh, B. Beeck, T. Nagel

Methods to measure masses of PG 1159 stars in order to test evolutionary scenarios are currently based on spectroscopic masses or asteroseismological mass determinations. SDSS J212531.92-010745.9, a recently discovered PG 1159 star in a close binary system, has finally allowed the first dynamical mass determination, after previous analysis on the basis of one SDSS spectrum and photometric monitoring. In order to be able to phase radial velocity measurements of the system SDSS J212531.92-010745.9, we have derived an improved ephemeris for the orbital motion of the system from three seasons of white light time series of the brightness variation of SDSS J212531.92-010745.9 with the Tübingen 80 cm and Göttingen 50 cm telescopes. In 2007, we have obtained a series of phase-resolved medium-resolution spectra with the TWIN spectrograph at the 3.5 m telescope at Calar Alto, which have allowed us to derive the radial velocity curves for both components of the system, and will allow to perform spectral analyses of the irradiating and irradiated components at different phases. From a combination of light curve modelling and radial velocities, we have carried out a mass determination.

Pulsations in carbon-atmosphere white dwarfs: A new chapter in white dwarf asteroseismology

Submitted by Gilles Fontaine
by G.Fontaine, Université de Montréal, P. Brassard, Université de Montréal, P. Dufour, University of Arizona, E.M. Green, University of Arizona

We present some of the results of a survey aimed at exploring the asteroseismological potential of the newly-found carbon-atmosphere white dwarfs. We show that, in certain regions of parameter space, carbon-atmosphere white dwarfs may drive low-order gravity modes. We demonstrate that our theoretical results are consistent with the recent exciting discovery of luminosity variations in SDSS J1426+5752 and some null results obtained by a team of scientists at McDonald Observatory. We also present follow-up photometric observations carried out by ourselves at the Mount Bigelow 1.6 m telescope using the new Mont4K camera. The discovery of g-mode pulsations in SDSS J1426+5752 is quite significant in itself as it opens a fourth "asteroseismological window", after the GW Vir, V777 Her, and ZZ Ceti families,through which one may study white dwarfs.

Recent DAV Observations by the WET

Submitted by Susan E. Thompson
by Susan E. Thompson, J. L. Provencal, M. H. Montgomery, H. L. Shipman, and the entire WET team

We report on recent activities of the Whole Earth Telescope under direction of the Delaware Asteroseismic Research Center. Observational efforts have been focused on measuring the convection zone on the surface of pulsating white dwarf stars through the technique introduced by Montgomery et al. (2005). We obtained multi-site campaigns on three new DAVs with this goal in mind. EC14012-1446, our southern hemisphere target for XCOV26, was observed by 14 telescopes including the 4-meter SOAR and the 10-meter SALT. The obvious non-linear shape of the light curves was quite evident and will enable successful convective light curve fitting. We also observed two large amplitude DAVs that show large non-linear pulse shapes. In both cases, the large amplitudes appear to arise from an abundance of moderate amplitude modes. Their multitude of pulsations makes G38-29 and R808 ideal asteroseismic targets, though the lack of only a few large modes may pose a significant challenge to measuring their convection zones.

Seismological studies of ZZ Ceti stars

Submitted by Barbara G. Castanheira
by Barbara G. Castanheira, S. O. Kepler

White dwarfs are the evolutionary end point of almost 98% of all stars. Their evolution is dominated by cooling; as they cool, they cross three distinct instability strips. We compared the observed modes to a fine grid of adiabatic models to determine the internal structure of 72 pulsating white dwarfs with H dominated atmosphere (DAVs or ZZ Cetis). Prior to this work there were only 12 ZZ Cetis that had been studied seismologically. Our main contribution was the inclusion of relative weights proportional to the observed amplitudes in the fits. We performed a broader search in the parameter space, using the spectrocopic determinations as a guide. By searching the whole grid, we avoid local minima. We determined that the average hydrogen mass is $10^{-6.3\pm1.6}$ M_* and that the helium mass is $10^{-2.5\pm1.6}$ M_*. We did not find evidence for accretion nor for mass loss while the stars evolve through the instability strip.

Singing and Dancing White Dwarfs

Submitted by Anjum S. Mukadam
by Anjum S. Mukadam, Paula Szkody, Boris T. Gaensicke

Accreting white dwarfs in cataclysmic variables (CVs) have also recently been shown to exhibit non-radial pulsations similar to their non-interacting counterparts; GW Librae was the first accreting pulsator discovered in 1998 (Warner & van Zyl 1998; van Zyl et al. 2000, 2004). When the orbital period of a CV is close to the evolutionary period minimum, the accretion rate is mostly small (Gaensicke et al. 2006). The system is in quiescence and the white dwarf flux dominates the light from the CV (Sion 1999). A search for non-radial pulsations among suitable candidates close to the period minimum has led to the discovery of 12 such systems known to date. These unique systems provide us with an opportunity to learn about the physical parameters of the accreting and pulsating white dwarf using the technique of asteroseismology. Accreting pulsators are of interest as they have likely undergone a few billion years of accretion and thousands of thermonuclear runaways. Studying these systems will allow us to address the following questions: what extent accretion affects the white dwarf mass, temperature, and composition and how efficiently angular momentum is transferred into the core of the white dwarf. Accreting pulsators in non-eclipsing CVs may prove to be our only opportunity to obtain meaningful mass constraints for the primary white dwarfs. Constraining the population, mass distribution, and evolution of accreting white dwarfs is also important for studying supernovae Type Ia systematics. With the goal of establishing an instability strip or strips for these pulsating accretors, we have acquired HST ultra-violet time-series spectroscopy of a handful of these systems. This enables us to measure the effective temperature of the white dwarf along with an attempt to use the pulsation information in the light curve to additionally constrain the system. This project has had a few surprises in store for us as to the distinct nature of these pulsating accretors compared to their non-interacting counterparts.

The Long Term Period Stability of the DBV White Dwarf EC20058-5234

Submitted by Denis Sullivan
by Denis J Sullivan

Since its discovery over a decade ago, the helium atmosphere pulsator EC20058-5234 (QU Tel) has been studied both spectroscopically, and also extensively using the techniques of time-series photometry. Model atmosphere fits to quality spectra obtained with one of the Magellan telescopes have confirmed its status as the hottest know DBV, so it currently defines the blue edge of the DBV instability strip. Extensive time-series photometry (primarily from Mt John in NZ but also including a Whole Earth Telescope run) clearly demonstrates that this white dwarf is a very stable low amplitude pulsator. This is consistent with its position at or near the blue edge of the DBV instability strip. However, of perhaps greater significance is the possibility of employing this period stability to look for a period change that can be sourced to the predicted neutrino-dominated cooling of the hot white dwarfs. We will provide an update on this work.

The white dwarf in dwarf nova SDSS J0804: Entering the instability strip

Submitted by Elena Pavlenko
by E.P. Pavlenko

SDSS J0804 is the WZ Sge type binary, that displayed rare outburst in 2006. There were no white dwarf pulsations neither prior the outburst nor in one year after the outburst in this system. However the strong non-radial pulsations with period 12.6 min. and mean amplitude of 0.05 mag were first detected in V with 2.6-m Shajn mirrow telescope of the Crimean astrophysical observatory in almost two year after the maximum of outburst. The evolution of pulsations over several months are considered. It is supposed that these pulsations appeared when the cooling white dwarf (after the outburst) entered the instability strip.

Poster Contributions

Luminosity function, mass function and populations

1 - A Determination of the Luminosity Function of DA White Dwarfs from the KISO Survey

Submitted by Marie-Michèle Limoges
by M.-M. Limoges, P. Bergeron

We rederive the luminosity function for the sample of DA white dwarfs from the KISO Schmidt ultraviolet excess survey (KUV stars) using the spectroscopic method where the atmospheric parameters (T_{eff} and log g) and absolute visual magnitudes for each star are obtained from detailed model atmosphere fits to optical spectroscopic data. We compare the result of our determination with that obtained by Darling (1994) based on empirical photometric calibrations. Our luminosity function is also compared with that derived spectroscopically from the PG survey. Misclassified objects are also discussed.

White dwarf structure and evolution

2 - Modeling He-rich subdwarfs through the hot-flasher scenario

Submitted by Marcelo Miguel Miller Bertolami
by Marcelo Miguel Miller Bertolami, Leandro Gabriel Althaus, Achim Weiss

We present 1D numerical simulations aimed at studying the Hot-Flasher scenario for the formation of He-rich subdwarf stars. Sequences have been calculated for a wide range of metallicities and physical assumptions, like the stellar mass at the moment of the helium core flash. This allows us to study the two previously proposed flavors of the Hot-Flasher scenario (“deep'' and “shallow'' mixing cases) and to identify a third transition type. Our sequences are calculated by simultaneously solving the mixing and burning equations within a diffusive convection picture, in the context of the standard mixing length theory. This allows us to follow the chemical evolution during deep mixing events where hydrogen is violently burnt and to present a homogeneous set of abundances for different metallicities and all kinds of Hot Flashers. We extend the scope of our work by analyzing the effects of non-standard assumptions such as the effect of chemical gradients, extra-mixing at convective boundaries or a possible reduction in convective velocities. Particular emphasis is done on the predicted surface properties of the models. We find that, if He-rich subdwarfs harbor weak winds which prevent gravitational settling, only a minor fraction of the Hot-flasher episodes lead to abundances consistent with the surface properties of He-SdO stars. This result is altered if no mass loss is present in these stars as suggested by recent studies or if mixing velocities are strongly altered during the ingestion of H into the hot interior of the star. Also our simulations show that the inclusion of the effect of chemical gradients may be important, as they may prevent the penetration of convection into the H-rich envelope if extramixing events are not efficient.

3 - Spectral analysis of sdO stars

Submitted by Heiko Hirsch
by Heiko Hirsch, Uli Heber

We present some results of our specral analysis of sdO stars from SPY and SDSS. As the helium-enriched sdOs are also enriched in carbon and/or nitrogen, we have started to measure their abundances. So far, slightly above solar values for carbon have been found. Surprisingly, the analysis of the metal lines showed some stars to have a significant rotational velocity.

4 - A New Generation of sdB Stars Models Geared for Asteroseismology

Submitted by Pierre Brassard
by P. Brassard, G. Fontaine

We present our third generation of sdB stars models. Along with our previous generation of envelope models which provide iron profiles that takes into account the effects of radiative levitation, we can now complete the structure with a nucleus that include descriptions of nuclear burning and neutrinos effects. Comparisons with observations will be provided.

5 - A Study of the Convective Efficiency in DB White Dwarfs

Submitted by Pierre Dufour
by Pierre Dufour & P. Bergeron, Université de Montréal, Canada

We present a homogeneous model atmosphere analysis of optical and UV spectroscopic observations of DB and DBA stars. The atmospheric parameters - $T_{\rm eff}$, log g, and N(H)/N(He) - are derived for each object using new model atmospheres and synthetic spectra calculated within the mixing-length theory. Various parametrizations of the convective efficiency are explored. In particular, we examine the effect of changing the value of the mixing length on the mass distribution and on the internal consistency between effective temperatures obtained from optical and ultraviolet spectroscopic data. Finally, an attempt is made to calibrate the convective efficiency in these objects.

White dwarf ages

6 - The Age of White Dwarf Companions

Submitted by Simon Weston
by S.Weston, R.Napiwotzki

We compare the cooling ages of primary and secondary white dwarfs in double degenerates comparing the time scales with that estimated by three evolutionary models. The primary (brighter) white dwarf in each system has well established intrinsic properties determined in the ESO supernova type Ia progenitor search (SPY) survey from which a cooling age is deduced. With the known properties of the primary, synthetic Hα spectra are generated and fitted to the observed. A secondary component is added and its properties changed until the fit decreases below a significance limit. Temperature limits are defined for hypothetical masses and a minimum cooling age deduced. Most of the ten system sample have a minimum age difference of 0.5 Gyrs and their small orbital distance is highly suggestive of at least one unstable mass transfer phase. This implies that unstable mass transfer is the most likely contact binary scenario to have occurred in double degenerate systems.

White dwarf catalogs and surveys

7 - Discovering Cold and Old WDs in the UKIDSS and SDSS

Submitted by Atsuko Nitta
by Sandy Leggett (Gemini Observatory), Pierre Bergeron (University of Montreal), Nicolas Lodieu (Instituto de Astrofísica de Canarias), Atsuko Nitta (Gemini Observatory)

We present the initial results of a search for very cool white dwarfs in the UK Infrared Deep Sky Survey, UKIDSS. Candidates are identified using the UKIDSS, SDSS and USNO databases, by color and proper motion. We have followed up seven candidates using GMOS-N on Gemini telescope to obtain spectra in the red, and confirm that all seven are previously unknown hydrogen-rich cool white dwarfs, with T_{eff}=5500-6700K, and 2-5 Gyr old. Further observational follow-up is planned, and we hope to discover 3500K to 5800K objects with ages 5-11 Gyr. Optical spectra, together with both optical and near-infrared photometry, are vital for determination of the chemical composition of the white dwarf atmosphere. The opacity of the atmosphere controls the cooling of the remnant, and hence composition must be known for an accurate age measurement.

8 - Searching for white dwarfs candidates in Sloan Digital Sky Survey Data

Submitted by Mirosław Należyty
by Mirosław Należyty, Agnieszka Majczyna, Jerzy Madej, Anna Ciechanowska

Large amount of observational spectroscopic data are recently available from different observational projects, like Sloan Digital Sky Survey. We aim to identify white dwarfs stars based on SDSS data itself i.e. without reference to white dwarf model atmospheres and spectra. We note, that the existing methods of white dwarfs identification presented in Kleinman et al. (2004) and in Eisenstein et al. (2006) did not allow to find all the white dwarfs in examined data. We test various criteria of searching for white dwarf candidates in SDSS archives which are based on photometry and spectral features.

9 - Discovery of the Partially Eclipsing White Dwarf Binary SDSS J143547.87+373338.5

Submitted by Justin Steinfadt
by Justin D. R. Steinfadt, UCSB, Lars Bildsten, UCSB and KITP, Steve B. Howell, WIYN Observatory and NOAO

We have discovered a partially eclipsing white dwarf, low-mass M dwarf binary (3.015114 hour orbital period), SDSS J143547.87+373338.5, from May 2007 observations at the WIYN telescope. Here we present blue band photometry of three eclipses. Eclipse fitting gives main sequence solutions to the M dwarf companion of M_S= 0.15-0.35 $M_\odot$ and R_S =0.17-0.32 $R_\odot$. Analysis of the SDSS spectrum constrains the M dwarf further to be of type M4-M6 with M_S=0.11-0.20 $M_\odot$. Once full radial velocity curves are measured, high precision determinations of the masses and radii of both components will be easily obtained without any knowledge of stellar structure or evolution. ZZ Ceti pulsations from the white dwarf were not found at our 4 mmag detection limit.

10 - SDSS1212-0123: A New Eclipsing Post Common Envelope Binary

Submitted by Ada Nebot Gómez-Morán
by Ada Nebot Gomez-Moran, Axel Schwope, Matthias Schreiber, Boris Gaensicke

We report the discovery of a new eclipsing post common envelope binary - SDSS1212-0123. Optical photometry reveals an orbital period of 8.06 hours and an eclipse of the primary star of 23 minutes. By fitting the SDSS composite spectrum we determine the effective temperature of the white dwarf, the spectral type of the secondary star, masses of both components, and the distance to the system.

11 - Three new eclipsing white dwarf plus main sequence binaries from SDSS

Submitted by Stylianos Pyrzas
by S. Pyrzas, B.T. Gaensicke, A. Aungwerojwit, A. Rebassa-Mansergas, M. Schreiber, P. Rodriguez-Gil, T.R. Marsh

We report the discovery and follow-up observations of three eclipsing white dwarf plus main sequence binaries from the Sloan Digital Sky Survey. Two of the systems contain a DA white dwarf, and the third one a DC white dwarf. We establish accurate orbital periods and orbital ephemerides from multi-season photometry. A spectral decomposition/ fitting technique is used to isolate the contribution of each of the components in the total spectrum, and to determine the white dwarf effective temperatures and surface gravities, the spectral types of the companion stars, and the distances to the systems. Fitting the eclipse profiles and the ellipsoidal modulation/reflection effect in the light curves and using the constrains from the mass function of the white dwarf determined from time-resolved spectroscopy, we constrain the stellar parameters. Two of the white dwarfs are of low mass (~0.4-0.5 M⊙), in line with the expectations from close binary evolution. The third white dwarf is unusually massive (M~0.8-0.9 M⊙) for a post-common envelope system.

Central stars of planetary nebulae

12 - Central Stars of Planetary Nebulae in SDSS and IPHAS

Submitted by Simon Weston
by S. Weston, R. Napiwotzki, S. Sale

A large range in PNe formation rates has been produced by different studies. The uncertainty in the literature has lead to different theories for the final phases of low/intermediate star evolution. We started a project to deduce a birthrate using a sample of PNe within 2kpc. The central stars will be determined by their photometric colours and then used to establish improved distance estimates. Our study has concentrated on PNe in SDSS and the INT Photometric Hα survey (IPHAS) so far. IPHAS is a nearly complete northern galactic plane survey in Hα, r and i bands. Many PNe have been discovered with IPHAS which have previously been unknown. We investigate implications of a more complete local sample on PN birthrate estimates.

White dwarfs in binary systems – Coalescence and gravitational radiation

13 - White dwarfs in binary systems

Submitted by Judit Camacho
by J. Camacho, S. Torres, E. García-Berro

We present a detailed Monte Carlo simulator of the population of binary stars within the solar neighborhood. We have used the most updated models for stellar evolution from Hurley et al. (2000), a complete treatment of the Roche lobe overflow episodes, as well as a full implementation of the orbital evolution. Special emphasis has been placed on processes leading to the formation of binary systems in which one of the members is a white dwarf.

14 - White dwarf coalescences

Submitted by Marius Dan
by Marius Dan, Stephan Rosswog, Marcus Brueggen

The observation of the apparently supra-Chandrasekhar mass supernova SNLS-03D3bb has re-strengthened the interest in the double degenerate scenario for type Ia supernovae. We present a series of three-dimensional hydrodynamics-plus-nuclear-reaction-network simulations that of coalescences of white dwarfs. We explore a wide range of masses and initial compositions, special attention has been paid to a careful construction of accurate initial conditions. First results and their astrophysical implications will be discussed.

15 - Gravitational wave radiation from close-encounters of white dwarfs in globular clusters

Submitted by Pablo Loren
by P. Loren, J. Isern, A. Lobo, E. García-Berro

In the dense central regions of globular clusters close encounters of two white dwarfs are relatively frequent (one or more strong encounters per star in the lifetime of the cluster). Such encounters should be potential sources of gravitational wave emission. Thus, it is foreseeable that these collisions could be either detected by LISA or they could contribute significantly to the background noise of the detectors. We compute the gravitational wave pattern resulting from these encounters for a broad range of system parameters, which include the masses and the relative distances of the white dwarfs involved in the encounter.

White dwarfs in novae and CVs

16 – The not-so-extreme white dwarf of the CV GD 552

Submitted by Eduardo Unda-Sanzana
by Eduardo Unda-Sanzana, Instituto de Astronomía, Universidad Católica del Norte, Antofagasta, Chile

GD 552 is a cataclysmic binary which was previously believed to be composed of an M-star and a white dwarf, the latter having an extreme mass of 1.4 solar masses. I show that this is not compatible with new observational evidence and present an alternative model in which the white dwarf has a typical mass and the companion is a brown dwarf, making the system a likely member of the elusive group of CVs which have already evolved through minimum orbital period. I use spectroscopy (optical at the WHT and ultraviolet at STIS) taken with the aim of detecting emission from the mass donor in this system and modelling the white dwarf properties. I do not detect emission from the previously proposed M star, at a level which allows us to rule out the presence of a near-main-sequence star donor. I find that it is possible to successfully model the system as composed of an ordinary white dwarf and a brown dwarf, at a moderate inclination angle. This poster is based in a article accepted by MNRAS, authored by Unda-Sanzana, E.; Marsh, T. R.; Gänsicke, B. T.; Maxted, P. F. L.; Morales-Rueda, L.; Dhillon, V. S.; Thoroughgood, T. D.; Tremou, E.; Watson, C. A.; Hinojosa-Goñi, R.

17 - Cataclysmic variables from the SDSS: a new population of CVs

Submitted by John Taylor (Southworth)
by John Southworth & Boris Gaensicke (University of Warwick, UK)

Cataclysmic variable stars (CVs) are important tools for investigating the physics of white dwarfs, low-mass stars and accretion. For many years the observed properties of the known population of CVs have been remarkably different from theoertical predictions, in particular regarding the orbital period distribution of these close binary systems. The SDSS has spectroscopically identified over 200 CVs, and it is becoming clear that the characteristics of this population are much closer to theoretical expectations than any previous sample of CVs. We present our project to characterise the population of CVs identified by the SDSS. A substantial fraction of the SDSS CVs exhibit in their optical spectra the accreting white dwarf, with very little flux contributions from the accretion flow, and practically no sign of the extremely low-mass mass donors. We pay particular attention to the properties of pulsating white dwarfs in CVs and discuss the strange case of SDSS J2205, a CV containing a white dwarf which has stopped pulsating.

18 - Correlations of Emission Line Intensity for White Dwarf in Close Binaries

Submitted by Irina Voloshina
by Nataly Katysheva & Irina Voloshina, Sternberg Astronomical Institute, Moscow, Russia vib@sai.msu.ru

Some statistical parameters are estimated for selected cataclysmic variables and properties of the white dwarfs in such systems are considered. Correlations of emission line intensities of H, He I and He II by spectroscopic data collected from the literature are given for the active and quiescent states. Variations of the physical parameters characterizing the regions of emission are studied. The work was done using the updated version of the Catalogue of Close Binary Systems (Sternberg Astronomical Institute).

19 - Search for Short-Term Variability in Dwarf Nova SS Cyg Outbursts

Submitted by Irina Voloshina
by Irina Voloshina(1), Vladimir Metlov(1), Helen Rovithis-Livaniou(2) - (1) Sternberg Astronomical Institute, Moscow State University, Russia; (2) Dept. of Astropysics, Astronomy & Mechanics, Athens University, Greece

Here we report the results of CCD and broad-band photometric observations of SS Cyg carried out with the two 60-cm telescopes (V band) in Crimea during the last years. These observations cover a few outbursts in 2006, 2007 and 2008. Power spectrum analysis of our data clearly show the existance of rapid periodic oscillations in the light curve of SS Cyg at a stage of decline after maximum. CCD observations in autumn 2006 outburst revealed oscillations with the two periods 10 s and 76 s, in November 2007 - with period of about 41 s and in January 2008 - 98 s. We interpret the detected variations as a quisi-periodic variability typical for dwarf nova during outburst.

20 - Multicolor BVR photometry of asynchronous polar BY Cam

Submitted by Julia Radyga
by Ju. Babina(1), E.P. Pavlenko(1), M. Andreev(2) - (1)Crimean Astrophysical Observatory (2)Terskol Branch of the RAS Institute of Astronomy

We present in the work the result of the multicolor (B,V,R) CCD - observations of the asynchronous polar BY Cam in 2006 -2008 years in the Crimean astrophysical observatory with 2.6-m and in the Terskol astronomical observatory with 60 – sm telescopes. This system relates to a subclass magnetic cataclysmic variables - polars. BY Cam is one of the four asynchronous polars , with knows orbital and spin periods, and with beat (synodical) period (Pavlenko 2006). This system observations in the low accretion state and high. Nature of accretion in the low state depends from phase beat period. There are introduced diagrams magnitude-color and color-color for different phase period beat and for different configuration magnetic field. Diagrams have strongly differences from each other on the different phase period beat. The system is blue when in minimum of brightness. Diagrams V-(V-R) displays more complex behavior from phase to phase. That could be caused by the variable contribution of the cyclotron radiation from the accretion columns at surface white dwarf and radiation white dwarf.

21 - Multicolour Photometry of MR Ser

Submitted by Alex (Olexandr) Golovin

by Golovin, A. (1, 2); Pavlenko, E. (3); 1 - Main Astronomical Observatory of National Academy of Sciences of Ukraine, Kyiv, UKRAINE; 2 - Kyiv National Taras Shevchenko University, Kyiv, UKRAINE ; 3 - Crimean Astrophysical Observatory, Crimea, UKRAINE

The multicolour photometry of magnetic cataclysmic variable (polar) MR Ser is presented. Observations were done with the help of 2.6 meter and 0.38 meter telescopes at Crimean Astrophysical Observatory (Ukraine) in UBVR-bands. Time of observations is 2006-2007 years. Color-Color and Color-Magnitude various diagrams were plotted and analysed for our observations. During our observations MR Ser system was in 'bright' state. We made attempt to determine Tcol of the white dwarf in MR Ser system (Tcol - Color Temperature). Our result is in good agreement with the value, determined from far-ultraviolet spectroscopy carried on the Hubble Space Telescope (Araujo-Betancor S., 2005).

22 - V455 And – a life before the 2007 superoutburst

Submitted by Nataly Katysheva

by N. Katysheva, S. Shugarov

We present the CCD photometry of HS2331+3905 (V455 And) in 2004-2006 before its superoutburst. HS2331+3905 is a new dwarf nova that (according to Araujo-Betancor et al., 2005) "has it all", i.e. the orbital variability, white dwarf pulsations, permanent superhumps etc. A superoutburst of HS2331+3905 began in September, 2007. We investigated the plates of Moscow photo archive from 1907 to 1957.The limit of Moscow plates is about 12 mag and there were no star signs on the 45 plates (the 2007 outburst magnitude is 8.5). The obtained in 2004-2006 light curves are analyzed. And the values of some binary parameters are given.

23 - Spot Activity of AK Her binary stars

Submitted by Karim Mahmood Ababakr

by Karim Mahmood Ababakr

In this investigation B and V filters light curves of the AK Her are presented. Their light curves notice O'Connell effect phenomenon in which the level of the primary maxima peak being higher than that of the secondary ones or contrarily in both filters. Photometric solutions were carried out by using the latest version (2003) of the W-D program; the presented light curves are analyzed. The spot model has been applied to fit the asymmetric light curves in order to explain the O'Connell effect. The explanation of the O'Connell effect by spot model of AK Her binary carried out for the first time by cool spot on the primary component and the spot parameters of such system have been determined. It has been observed that by changing only the spot parameters, the model light curves can fit the observed light curves. This indicates that the variation of the spot location, size and its temperature is the main reason for changing the shape of light curves. The spot effect has been calculated to compare how much the light curve is distorted by the star spot; also the spot area has been calculated. It is found that the system is over-contact of A-subtype. From our data analysis, the fundamental orbital, physical and geometrical parameters were determined, and the absolute parameters have been determined.

24 - Diagnostics of very early stages of the classical nova explosion by the modeling of its X-ray emission.

Submitted by Ekaterina Filippova

by E.V. Filippova, M.G. Revnivtsev, A.A. Lutovinov

We present a spherically symmetric model of the interaction of classical nova ejecta with the matter of the companion star stellar wind. We compare the predictions of our model with the data of observations of the unusual bright X-ray transient CI Cam and demonstrate that its outburst in 1998 can be explained as the X-ray emission at early stages of the classical nova explosion in the binary system. Due to a very strong stellar wind of the companion star the X-ray outburst was so bright that it was observed by the X-ray instruments almost immediately after the start of the motion of the ejecta (within 0.3-0.7 days). This given us the unique possibility to constrain two important parameters of the classical nova explosions - the velosity and the mass of the primary ejecta. We showed that the ejecta velocity was v~3000 km/sec and remained at this value over ~1 day after the explosion, that indicates the presence of the radiation pressure from the surface of the WD. The time dependence of the X-ray emission intensity during the outburst allowed us to estimate the mass of the primary ejecta as $m_{ej} \leq 3x10^{-7}$ $M_\odot$. The obtained results are providing the important information about the input parameters for models of classical nova explosions.

Physical processes in white dwarfs and magnetic white dwarfs

25 - The outward flow of metals in hot DA white dwarfs as a function of the abundance

Submitted by Klaus Unglaub
by Klaus Unglaub

The interplay of diffusion and pure metallic winds may be a possible scenario to explain the abundance anomalies in hot hydrogen-rich white dwarfs.For the special case T_{eff} = 66000 K, log g = 7.7 it will be discussed how large the mass loss rates of the elements C, N and O can be, at maximum.If hydrogen and helium are in hydrostatic equilibrium, then the radiative force on the outflowing metals must compensate not only the inward gravitational force, but the frictional force due to collisions, preferably with protons, in addition. Therefore the metal abundances should be lower as would be expected from the equilibrium condition between gravitational settling and radiative levitation.With the assumption of small concentration gradients, the outward flow can be calcuated as a function of the abundance and a maximum value of the flow can be derived.

26 - Non-LTE spectral analyses of the lately discovered DB-gap white dwarfs from the SDSS

Submitted by Simon Hügelmeyer
by Simon D. Hügelmeyer (Institut für Astrophysik Göttingen, Germany), S. Dreizler (Institut für Astrophysik Göttingen, Germany)

For a long time, no hydrogen-deficient white dwarfs have been known that have effective temperature > 30 kK and < 45 kK, i.e. exceeding those of DBs and having lower ones than DOs. Therefore, this temperature range was long known as the DB-gap. Only recently, the SDSS provided spectra of several candidate DB-gap stars. First analyses (Eisenstein et al., 2006) confirmed that these stars had 30kK < T_{eff} < 45 kK using model spectra assuming local thermodynamic equilibrium (LTE). It has been shown for DO white dwarfs that the relaxation of LTE is necessary to account for non local effects in the atmosphere by the intense radiation field. Therefore, we calculated a non-LTE model grid and re-analysed the aforementioned set of SDSS spectra. Our results confirm the existence of DB-gap white dwarfs.

27 - Density and temperature dependence of the far red wing of the Lyman alpha line

Submitted by Nicole Allard
by N.F.Allard, Institut d'Astrophysique de Paris, 98 boulevard Arago, F-75014 Paris, France and J.F. Kielkopf, Department of Physics and Astronomy, University of Louisville, Ky 40292, USA

A reliable determination of the line profiles in physical conditions of cool white dwarfs requires a unified theory which takes into account both the singlet and triplet transitions contributing to Lyman alpha using accurate interaction potentials and radiative dipole transition moments. Multiple perturber effects have to be considered using the autocorrelation formalism. The comparison with experimental spectra shows that indeed multiple H-perturbers occurred in the far wing.

28 - FUSE observations of intermediate temperature DA: atmospheric parameters and metal abundances

Submitted by Jean Dupuis

by Jean Dupuis, Canadian Space Agency, Vincent Hénault-Brunet, Université de Montréal, Pierre Chayer, Space Telescope Science Institute, Stéphane Vennes, Florida Institute of Technology, Jeffrew W. Kruk, The Johns Hopkins University

We present results from our analysis of a sample of DA white dwarfs having effective temperature inferior to 25,000 K observed with the FUSE satellite with the goals of better understanding the origin of metals detected in the atmosphere of these stars. When possible, we combine the FUSE spectra with the IUE spectra and determine atmospheric parameters by fitting the Lyman line profiles. In general we find a good agreement with published values based on fits of Balmer series. We observe that the continuum in the blue wing of the Lyman Alpha line profile is generally lower in comparison with model spectra and that the discrepancy appears to become less important at higher effective temperature. The agreement between models and observations is excellent at wavelengths shorter than 1100 A, which gives us confidence in the determination of atmospheric parameters. Finally, using adopted atmospheric parameter; we have performed a detailed analysis of the composition of these stars. In several instances, we have observed the presence of Silicon and in one case that of Carbon. For each stars in the sample we have either measured or set an upper limit on the presence of key species such as CII, CIII, Si III, and Si IV. We compare the measured abundances with predicted equilibrium abundance by radiative levitation theory for each star. In this limited sample, we find that when detected, the abundance of Silicon is in good agreement with theory. However there are several cases where the upper limits are much inferior to the predictions and one case where it is considerably larger.

29 - Equilibrium and Stability of Magnetic Fields in Polytropes

Submitted by Taner Akgün

by Taner Akgün

We consider the equilibrium and stability of toroidal and poloidal magnetic fields in fluid stars with polytropic equations of state. We extend the stability criteria for toroidal fields established by Tayler (1973) to cases where the magnetic free energy can be expressed as a function of magnetic field and background density. This formalism applies both to normal conducting stars and type II superconducting neutron stars.

30 - Non-thermal electromagnetic radiation from pulsating and collapsing magnetized white dwarfs

Submitted by Volodymyr Kryvdyk

by Volodymyr Kryvdyk, Tetiana Nikolaiuk

The non-thermal electromagnetic radiation from pulsating and collapsing magnetized white dwarfs is considered. This radiation generates when the magnetospheres of magnetized white dwarfs change during pulsation or collapse and its magnetic field will change greatly. The induced electric fields will accelerate of charged particles, which generates radiation when moving in the magnetic field. Thus the pulsating and collapsing magnetized white dwarfs can be the powerful sources of the electromagnetic pulses that can be observed by means of radio, X- and gamma- telescopes.

31 - Strong linear polarization of bremsstrahlung emissivity in photospheres of magnetic white dwarfs

Submitted by Sergey Koryagin
by I. I. Bubukina, S. A. Koryagin

We discuss the strong linear polarization and appreciable decrease of the bremsstrahlung emissivity below the electron cyclotron frequency (infrared wave band) in the unique conditions realized in the photospheres of isolated magnetic white dwarfs. In the photospheres of strongly magnetized white dwarfs ($B>10^7$ G, $T\sim10^4$ K) the electron Larmor radius r_B becomes less than the characteristic impact parameter $r_s = e^2/E$ of the close Coulomb collisions in non-magnetized plasma [1-3] (here E is the electron thermal kinetic energy and e is the elementary electric charge). Thus, duration of all distant and the most part of close collisions becomes larger than the electron cyclotron period. The magnetic field effectively “freezes" electron motion in the plane transverse to magnetic field lines (in this plane, it allows only the well-known slow drift of a particle in the crossed electric and magnetic fields). The resulting nearly one-dimensional parallel to magnetic field motion of a particle induces strong linear polarization of the bremsstrahlung emissivity. Being attached to magnetic field line, an electron can not approach an ion as closely as in the case of magnetic field absence. Thus, the bremsstrahlung emissivity appreciably decreases. In summary, we propose analytic approximations for the spectrum of strongly linear polarized bremsstrahlung emissivity below the electron cyclotron frequency (infrared wave band). This work was supported by the Russian Foundation for Basic Research (project No. 08-02-00163), the Council of the President of the Russian Federation for Support of Young Russian Scientists and the Leading Scientific Schools of the Russian Federation (projects NSh-4485.2008.2 and MK-4925.2007.2), and the program “Origin and Evolution of Stars and Galaxies" of the Presidium of the Russian Academy of Sciences. References 1. V. V. Zheleznyakov, Radiation in astrophysical plasmas (in Russian), \S 13.1, Yanus-K (1997). 2. V. V. Zheleznyakov, S. A. Koryagin, A. V. Serber, Astron. Lett. 25, 437 (1999). 3. S. A. Koryagin, J. Exp. Theor. Phys. 90, 741 (2000).

32 - Peculiarities of electron-ion collisions in strong magnetic field of white dwarfs

Submitted by Sergey Koryagin
by V. V. Zheleznyakov, S. A. Koryagin

We consider electron-ion collisions in a strong magnetic field $B>10^7$ G of white dwarfs at a typical photospheric temperature $T\sim10^4$ K. In these unique conditions, the electron Larmor radius r_B becomes less than the characteristic impact parameter $r_s=e^2/E$ of the Coulomb collisions in non-magnetized plasma [1-3] (here E is the electron kinetic energy and e is the elementary electric charge). We analyze classic as well as strong quantum limits of electron motion which both can be observed in the photospheres of isolated white dwarfs. In both limits, the collision transport frequencies are determined by close collisions in which an electron passes over an ion for a time less than the cyclotron period. In these effective collisions, an electron returns to the ion many times. The final state of an electron non-regularly (chaotically) depends on its initial state [2-7]. As a result of our analysis, we put forward a simple analytic approximations for the basic collision transport frequencies which are applicable both in classis and quantum limits. The strong magnetic field significantly reduces the values of collision transport frequencies in comparison with analogous values in non-magnetized plasma. This work was supported by the Russian Foundation for Basic Research (project No. 08-02-00163), the Council of the President of the Russian Federation for Support of Young Russian Scientists and the Leading Scientific Schools of the Russian Federation (projects NSh-4485.2008.2 and MK-4925.2007.2), and the program “Origin and Evolution of Stars and Galaxies" of the Presidium of the Russian Academy of Sciences. References 1. V. V. Zheleznyakov, Radiation in astrophysical plasmas (in Russian), \S 13.1, Yanus-K (1997). 2. V. V. Zheleznyakov, S. A. Koryagin, A. V. Serber, Astron. Lett. 25, 437 (1999). 3. S. A. Koryagin, J. Exp. Theor. Phys. 90, 741 (2000). 4. G. Schmidt, E. E. Kunhardt, J. L. Godino, Phys. Rev. E. 62, 7512 (2000). 5. B. Hu, W. Horton, C. Chiu, T. Petrosky, Phys. Plasmas. 9, 1116 (2002). 6. B. Hu, W. Horton, T. Petrosky, Phys. Rev. E 65, 056212 (2002). 7. S. A. Koryagin, Radiophys. Quantum Electron. 51 (2008), in press.

Disks, dust and planets around white dwarfs

33 - Observations of white dwarf / brown dwarf binaries

Submitted by Matt Burleigh

by Matt Burleigh (University of Leicester, UK), Jay Farihi (University of Leicester, UK), Pierre Maxted (University of Keele, UK), Ralf Napiwotzki (University of Hertfordshire, UK), Tom Marsh (University of Warwick, UK), Paul Dobbie (Anglo-Australian Observatory, Australia)

We present new optical and infra-red observations of the white dwarf / brown dwarf binaries WD0137-349 and GD1400. The brown dwarf WD0137-349B is being heated by the close (P=2hr) white dwarf companion, and displays distinct "day" and "night" hemispheres, just like some hot Jupiters. As with WD0137-349B, the brown dwarf GD1400B has survived common envelope evolution and emerged as a P=10hr binary.

34 - On the source of heavy element pollution in hot white dwarf photospheres

Submitted by Matt Burleigh

by Matt Burleigh (University of Leicester, UK), Martin Barstow (University of Leicester, UK), Jay Farihi (University of Leicester, UK), Paul Steele (University of Leicester, UK), Carolyn Brinkworth (Spitzer Science Center, USA), Don Hoard (Spitzer Science Center, USA), Tom Marsh (University of Warwick, UK), Boris Gaensicke (University of Warwick, UK)

Many hot white dwarfs show photospheres polluted with metals. Above 40-50,000K their continuing residence and their abundances can be readily explained by radiative levitation; the material may be "primordial" in origin. Below 20,000K this mechanism cannot support metals in white dwarf photospheres, and we now know that at least a dozen DAZs are accreting this material from surrounding dust and gas debris disks. Between 20-40,000K the picture is less clear. Are there stars in this temperature regime also accreting from orbiting debris disks? We present Spitzer mid-IR photometry and optical spectroscopy of hot white dwarfs, searching for any evidence of such disks. We suggest that it is likely that some of these stars are indeed accreting material from a surrounding disk, but the conclusive evidence in individual cases is elusive.

35 - Spectral synthesis of circumstellar disks - the application to white dwarf debris disks

Submitted by Simon Hügelmeyer

by Simon D. Hügelmeyer (Institut für Astrophysik Göttingen, Germany), S. Dreizler (Institut für Astrophysik Göttingen, Germany), D. Homeier (Institut für Astrophysik Göttingen, Germany), P. Hauschildt (Hamburger Sternwarte, Germany)

Gas and dust disks are common objects in the universe and can be found around various objects, e.g. young stars, cataclysmic variables, active galactic nuclei, or white dwarfs. The light that we receive from disks provides us with clues about their composition, temperature, and density. To better understand the physical and chemical dynamics of these disks, self-consistent radiative transfer simulations are inevitable. Therefore, we have developed a 1+1D radiative transfer code as an extension to the well-established model atmosphere code PHOENIX. We will show the potential of the application of our model spectra to white dwarf debris disks.

Pulsating white dwarfs

36 - Asteroseismic probing of internal rotation in hot B subdwarf stars: testing spin-orbit synchronism in two close binary systems

Submitted by Stephane Charpinet

by Valérie Van Grootel (OMP, UdeM), Stéphane Charpinet (Observatoire Midi-Pyrénées), Gilles Fontaine (U. de Montréal), Pierre Brassard (U. de Montréal)

We present internal rotation profiles derived from asteroseismology for the the hot pulsating B subdwarf stars PG 1336-018 and Feige 48. These two pulsators are primaries of close binary systems of known orbital period and, therefore, provide laboratories to test, for the first time, spin-orbit synchronization with depth. We show that PG1336-018 and Feige 48 clearly rotate as solid bodies with periods equal to their orbital periods from the surface down to at least ~0.5 and ~0.3 of their radius, respectively. Deep tidal locking has therefore developed within the relatively short lifetime of these stars (~ 10^8 years).

37 - Doubling the Pulsating DB White Dwarfs

Submitted by Atsuko Nitta

by Atsuko Nitta (Gemini Observatory), S.J. Kleinman (Gemini Observatory), J.Krzesinski (Mount Suhora Observatory, Cracow Pedagogical University), S.O. Kepler (UFRGS, Brazil), T.S. Metcalfe (High Altitude Observatory, NCAR), Anjum S. Mukadam (Univ.of Washington), Fergal Mullally (Princeton University), R.E. Nather (Univ. of Texas at Austin), Denis J. Sullivan (Victoria University of Wellington), Susan E. Thompson (Univ. of Delaware), D.E. Winget (Univ. of Texas at Austin)

We are searching for new DBVs based on the newly found white dwarf stars from the spectra obtained by the Sloan Digital Sky Survey. DBVs pulsate at hotter temperature ranges than their better known cousins, DAVs or ZZ Ceti stars. Since the evolution of white dwarf stars is characterized by cooling, asteroseismological studies of DBVs give us opportunities to study white dwarf structure at a different evolutionary stage than the DAVs. The hottest DBVs are thought to have neutrino luminosities exceeding their photon luminosities (Winget et al. 2004), a quantity measurable through asteroseismology. Therefore, they can also be used to study neutrino physics in the stellar interior. So far we have discovered nine new DBVs, doubling the number of previously known DBVs. Here we report the new pulsators' lightcurves and power spectra.

38 - Measuring the Evolution of ZZ Ceti

Submitted by Anjum S. Mukadam

by Anjum S. Mukadam, Oliver Fraser, Agnes Kim

We will report on our analysis of the stability of periods observed in the pulsating hydrogen atmosphere white dwarf ZZ Ceti (R 548) based on observations that span 37 years from 1970 to 2007. Our preliminary results indicate a measurement of the rate of change of period with time dP/dt for the dominant period 213.13s. The characteristic stability timescale implied for the pulsation period 213.13s is comparable to the theoretical cooling timescale of the star, and also consistent with the measurement of dP/dt (3.57 $\pm$ 0.82) x10^{-15} s/s for the period 215.2s observed in another pulsating white dwarf G117-B15A (Kepler et al. 2005).

39 - New nonadiabatic pulsation computations on full DB white dwarf evolutionary models: the theoretical DBV (V777 Her) instability strip revisited

Submitted by Alejandro H. Córsico

by A. H. Córsico, L. G. Althaus, M. M. Miller Bertolami, and Enrique García-Berro

We reexamine the theoretical instability domain of pulsating DB white dwarfs (DBV or V777 Her variables). We performed an extensive g-mode nonadiabatic pulsation analysis on DB evolutionary models with a wide range of stellar masses, for which the complete evolutionary stages of their progenitors from the ZAMS, through the thermally pulsing AGB and born-again phases, the domain of the PG1159 stars, and then the DB white dwarf stage have been considered. We explicitly account for the evolution of the chemical abundance distribution due to time-dependent chemical diffusion processes. In particular, we examine the impact of the different prescriptions of the MLT theory of convection and also the full-spectrum turbulence theory of convection (CGM theory) on the precise location of the blue edge of the DBV instability strip.

40 - Introducing SPA, the Stellar Photometry Assistant

Submitted by James Dalessio
by J. Dalessio, J.L. Provencal, A. Kanaan

SPA, the “Stellar Photometry Assistant”, is a stand alone software package for time series photometry reduction and analysis. The goal of SPA is to combine proven reduction techniques with an intuitive GUI (Graphical User Interface). SPA was born out of of complications in studying the pulsating DB white dwarf EC20058-5234 (QuTel) due to the proximity of its companions. SPA also addresses the Whole Earth Telescope's (WET) demand for large scale rapid data reduction from multiple sites. SPA is being developed in MATLAB by the Delaware Asteroseismic Research Center (DARC) in collaboration with the University of Delaware and the Mount Cuba Astronomical Observatory.

41 - Nonadiabatic Asteroseismology of GW Vir Stars

Submitted by Pierre-Olivier Quirion
by Pierre-Olivier Quirion, Gilles Fontaine, Pierre Brassard

The pulsating GW Vir stars are lying directly on the knee connecting the post-AGB branch to the white dwarf cooling track. They are composed of the hottest hydrogen deficient white dwarfs and hydrogen deficient post-AGB stars. Quantitative spectroscopy, based on detailed NLTE model atmospheres and synthetic spectra, reveals that GW Vir stars occupy a wide domain in the surface gravity-effective temperature plane, with objects in the ranges $5.5 < \log g < 7.5$ and $80{,}000\ \mathrm{K} < T_{\rm eff} < 170{,}000\ \mathrm{K}$. In addition, the inferred atmospheric abundances vary largely from one star to another, and the main atmospheric constituents are found in the intervals $0.33 < X(\mathrm{He}) < 0.76$, $0.16 < X(\mathrm{C}) < 0.55$, and $0.00 < X(\mathrm{O}) < 0.17$. Unfortunately, at these very high $T_{\rm eff}$, the uncertainties on the derived values of $T_{\rm eff}$ and $\log g$ remain relatively large with typical values of 5 to 10% for $T_{\rm eff}$, and 0.5 dex for $\log g$. We show that it is possible to infer the atmospheric parameters of GW Vir stars with a higher accuracy by exploiting nonadiabatic asteroseismology. Nonadiabatic asteroseismology is based on a comparison of the observed ranges of excited periods with ranges predicted from nonadiabatic models. We point out that a systematic nonadiabatic study of GW Vir stars permit a remarkable consistency test between pulsation theory and the art of atmosphere modelling.

42 - Seismological constraints on the high-gravity GW Vir stars PG2131+066 and PG 1707+427

Submitted by Alejandro H. Córsico
by A. H. Córsico, L. G. Althaus, M. M. Miller Bertolami, and Enrique García-Berro

We present an asteroseismological study on the two high-gravity pulsating PG1159 stars PG2131+066 and PG 1707+427. We employ the set of full PG1159 evolutionary models recently presented by Miller Bertolami & Althaus (2006). We perform extensive adiabatic computations of g-mode pulsation periods on PG1159 evolutionary models with stellar masses ranging from 0.530 to 0.741 $M_\odot$. These models take into account the complete evolution of progenitor stars, through the thermally pulsing AGB phase and born-again episode. We constrain the stellar mass of PG2131+066 and PG 1707+427 by comparing the observed period spacing of each star with the theoretical asymptotic period spacings and with the average of the computed period spacings. We also employ the individual observed periods (taking the WET data) to find representative seismological models for both stars.

43 - Radiative levitation: An explanation for the existence of pulsations in the unique hot sdO star SDSS J1600+0748

Submitted by Gilles Fontaine
by G. Fontaine, Université de Montréal, P. Brassard, Université de Montréal, E.M. Green, University of Arizona, P. Chayer, Space Telescope Science Institute, S. Charpinet, Université de Toulouse

SDSS J1600+0748 is the only hot sdO star for which unambiguous multiperiodic luminosity variations have been reported so far (a highlight of the Leicester meeting in 2006). These rapid variations, with periods in the range from 60 s to 120 s, are best qualitatively explained in terms of pulsational instabilities, but the exact nature of the driving mechanism has remained a puzzle. Models with uniform metallicity are unable to excite pulsation modes in the range of interest as demonstrated most eloquently by Cristina Rodriguez-Lopez in her Ph.D. thesis at the Universidad de Vigo in 2007. We confirm her results here, but also show that the inclusion of radiative levitation in the equilibrium models changes the picture dramatically. We find indeed that p-mode pulsations with periods overlapping the observed ones in J1600+0748 can be excited in models in which radiative levitation is taken into account. This process provides the needed boost to the opacity driving mechanism. This is the first quantitative explanation for the very existence of pulsations in this unique star.

44 - Testing the stationarity of white dwarf light-curves

Submitted by Margit Paparo
by L. Molnar, Z. Kollath, E. Plachy and M. Paparo

Long period white dwarfs show changes in their frequency spectra from one observing season to another, i.e. their light-curves cannot be considered as stationary multi-periodic variations on long timescales. However, due to the complex frequency spectra of these stars and the narrow frequency spacing, it is still unknown, what the shortest time scale is, where real physical modulation exists. We present tests on artificial data, resembling the observations, using time-frequency distributions (TFDs) and Fourier-analysis. We demonstrate that TFDs, (e.g. Gabor-transform, Choi-Williams Distribution) can reveal differences between stationary and non stationary multi-periodic data even for single night observations, when certain conditions are satisfied. We have performed Monte-Carlo simulations based on published frequencies of pulsating white dwarf stars. While the frequencies and amplitudes were fixed in these tests, we have checked the effects of the other quantities, randomizing the sampling and the phase relations. The different realizations of multi-periodic data provide the most probable ranges of observable quantities (TFD properties, Fourier peak locations, etc.). Then the same parameters, reduced from limited time-span observations, can be compared to these ranges, to provide a check on the stationarity of the experimental data. We provide examples of these techniques based on the observations of GD 154

45 - Wqed: A new tool for light curve analysis

Submitted by Fergal Mullally
by F. Mullally, S. E. Thompson

We present a set of tools for processing time-series astronomical data. Observations of white dwarf and sub-dwarf stars typically need to be corrected for atmospheric effects - clouds and other transparency variations - before being analysed with tools such as Period04. The Whole Earth Telescope developed a new package for this task, called Wqed, that was successfully used in our spring campaign. Wqed is a Linux package (written in C and Perl) that contains a graphical interface for lightcurve division, smoothing, bad point removal, and other common tasks. It also provides a script for extracting necessary header information from fits files. A modular design and ASCII formats simplifies the adaptation of Wqed to a new telescope or reduction pipeline, and has been successfully used on all 25 telescopes that participated in XCov26. We have found these tools useful and easy to use, and make them available to the general community in the hopes that you do too.