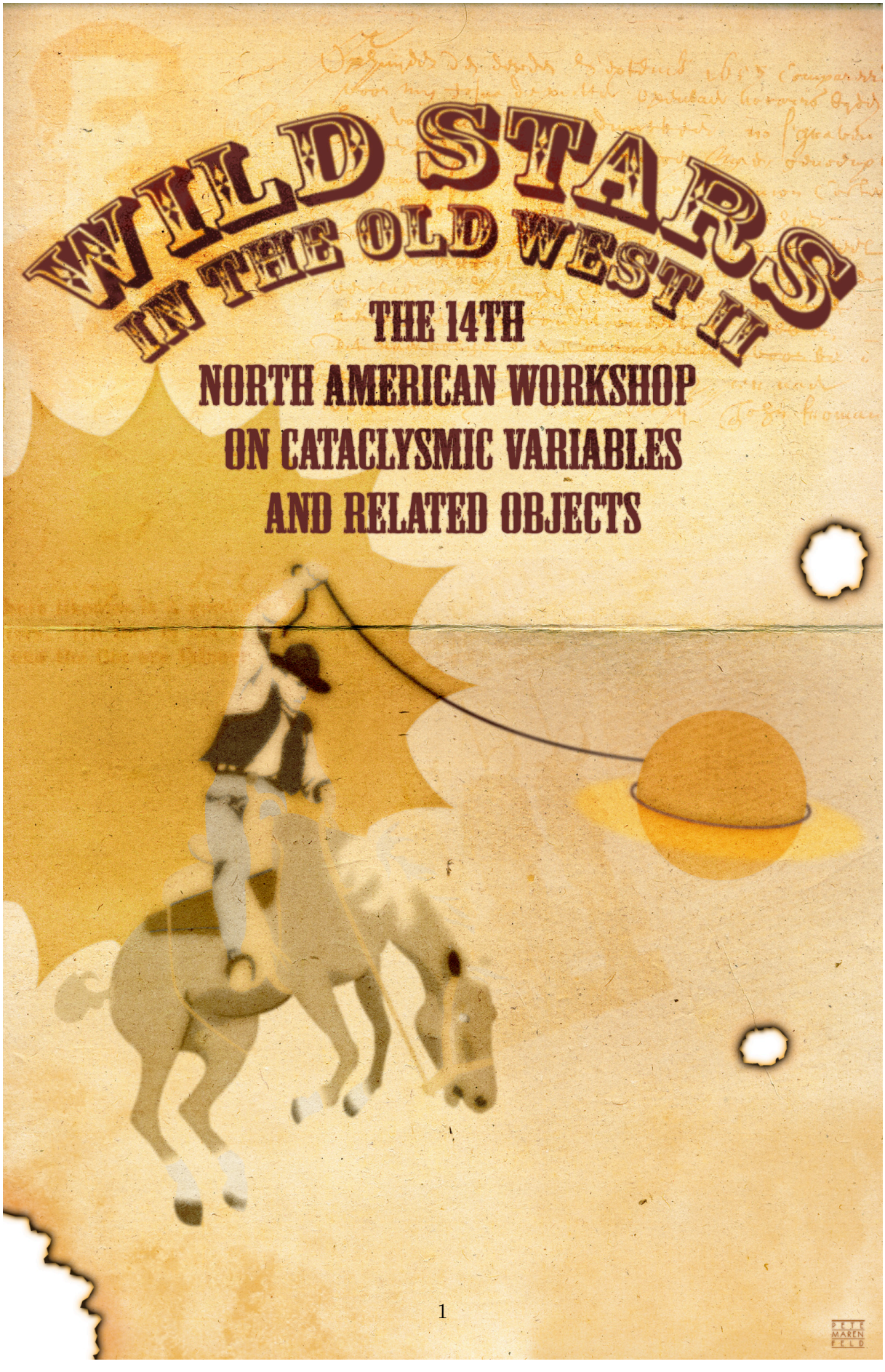
WILD STARS
IN THE OLD WEST II
THE 14TH
NORTH AMERICAN WORKSHOP
ON CATACLYSMIC VARIABLES
AND RELATED OBJECTS
PETE
MAREN
FELD

Program for Monday

"Primaries, Secondaries and Population Studies"

Talks

Time	Speaker	Topic
09:00 to 09:10	Welcome Remarks	Howdy!
09:10 to 09:50	Christian Knigge	The Secondary Stars of Cataclysmic Variables
09:50 to 10:10	Stuart Littlefair	The Donor Star Masses in Short Period CVs
10:10 to 10:30	Stella Kafka	Activity on Magnetic CV Secondaries
10:30 to 11:00	**Coffee & Posters**	
11:00 to 11:30	Christopher Watson	Roche Tomography of the Donor Stars
11:30 to 12:10	Paula Szkody	CVs with Pulsating White Dwarfs
12:10 to 12:30	Justin Steinfadt	Hydrogen Burning and Pulsations of He WDs
12:30 to 12:35	Poster Review	
12:35 to 01:45	**Lunch**	
01:45 to 02:15	Dean Townsley	Variations in T_{eff} for Quiescent CV WDs
02:15 to 02:45	Edward Sion	White Dwarf Heating in Nova-like Systems
02:45 to 03:05	James Liebert	The Paucity of Magnetic WDs in SDSS Binaries
03:05 to 03:35	**Coffee & Posters**	
03:35 to 04:05	Christopher Tout	Binary Star Origin of High Magnetic Field WDs
04:05 to 04:35	Matt Burleigh	Detached WD/BD Binaries as Progenitors of CVs
04:35 to 04:48	Ada Nebot	Post-CE Binaries from SDSS
04:48 to 05:01	Mattias Schreiber	Post-CE Binaries from SDSS & Magnetic Braking
05:01 to 05:21	Monica Zorotovic Fiebig	Post-CE Binaries from SDSS
05:21 to 05:34	Philip Davis	How Many CVs are Crossing the Period Gap?
05:34 to 06:00	**Posters & Cocktails**	

Posters

#1 Tom Marsh	#2 Edward Robinson	#3 Tom Harrison	#4 John Thorstensen
#5 Robert Smith	#6 Penelope Longa-Peña	#7 Metin Altan	#8 Chris Savoury
#9 Ryan Hamilton	#10 Gulnur ikis Gun	#11 Simon Tulloch	#12 Phil Evans
#13 Pablo Rodriguez-Gil	#14 Stylianos Pyrzas	#15 John Tayor	#16 Eric Schlegel
#17 Irina Voloshina	#18 Arne Henden	#19 Stephen Potter	#20 George Marshall
#21 Jeff Robertson	#22 Elena Mason		

Abstracts

The Secondary Stars of Cataclysmic Variables

Christian Knigge

University of Southampton

I will review what we know about CV secondary stars and their relation to CV evolution. As a result of the ongoing mass loss they experience, CV donors are larger and cooler than isolated main sequence stars of equal mass. Since the relationship between mass-loss rate and the degree of donor bloating is generally monotonic, the mass-radius relationship of CV secondaries can be inverted to determine the rates of mass and angular momentum loss as a function of orbital period. Thus observed donor properties can actually be used to construct a complete semi-empirical evolution track for CVs.

Donor Star Masses in Short Period Cataclysmic Variables

Stuart Littlefair

University of Sheffield

The discovery by Maxted et al. (2006) of WD0137−349, a binary consisting of a white dwarf and a 0.53 $M_{\odot}$ brown dwarf in a 116 minute orbit, showed that substellar objects could survive common envelope evolution and provide another channel for the formation of CVs. Subsequently, Littlefair et al. (2007) have argued that the 66 min period eclipsing CV SDSS J150722.30+523039.8 must have formed from a detached white dwarf + brown dwarf binary. I will present the latest results of our surveys for close, detached WD+BD binaries from UKIDSS and other datasets, including new systems, and place limits on the frequency of such pairs. I will also present our latest observations of WD0137−349 from Spitzer and ground-based telescopes.

Activity on Magnetic CV Secondaries: Nature or Nurture?

Stella Kafka

Spitzer Science Center/Caltech

Chromspheric Activity on the mass-losing secondary star in cataclysmic variables (CVs) is commonly invoked to explain sustained mass transfer caused by system angular momentum loss via a magnetized stellar wind. Such activity may also be responsible for the CV period gap, and for the widely differing mass transfer rates among CVs at the same orbital period. We present a spectroscopic monitoring campaign of magnetic CVs at times of reduced accretion, where unusual components in the H-alpha line reveal magnetically confined gas motions in large, long-lived loop prominence-like structures on the donor star. We discuss possible mechanisms leading to those structures which may reveal a new paradigm on magnetic activity in magnetic CVs.

Roche Tomography of the Donor Stars in CVs

Christopher Watson

Queens University

The secondary stars in CVs are key to our understanding of the origin, evolution and behaviour of this class of interacting binary. I will present a series of Roche tomography reconstructions of the donor stars in CVs, providing maps of their surfaces in unprecedented detail which clearly show the presence of large star spots. The distribution of these spots suggest that the buoyant magnetic flux tubes that form them are forced to arise at preferred longitudes - most likely due to tidal and/or Coriolis forces. I conclude with a discussion on the implications this may have on the accretion dynamics and observed properties of CVs.

Tantalizing Hints from CVs with Pulsating White Dwarfs

Paula Szkody

University of Washington

The past 6 years of HST and ground observations of the dozen CVs that contain pulsating white dwarfs reveal interesting data, yet confound total understanding. We now know some CV systems behave like single ZZ Ceti stars, while the majority are hotter (outside the normal instability strip for H pulsators) - is this a mass, composition or spin effect? While several CV pulsators show enhanced UV amplitudes (like ZZ Ceti), others show low or no UV pulse - is this related to past unseen outbursts or to beat phenomena? A long campaign on one system shows splitting that would indicate a very slow rotation period - is this really rotation or another effect? Our current knowledge of pulsating accreting white dwarfs will be reviewed.

Hydrogen Burning and Pulsations of Low Mass Helium White Dwarfs

Justin Steinfadt

University of California, Santa Barbara

Past studies of helium-core white dwarf (WD) evolution have revealed two very different behaviors in residual envelope hydrogen burning. For WDs with masses > 0.18 $M_{\odot}$ unstable hydrogen burning leads to several rapid flashes that destroy most of the hydrogen envelope and result in a rapid cooling evolution on 100's of Myrs. WDs of smaller mass undergo stable hydrogen burning that prolongs the cooling time to several Gyrs. By coincidence, these WDs spend much of their time in (or near) the extrapolated ZZ Ceti instability strip. We will present our He-core WD models with hydrogen burning envelopes and our initial work on their adiabatic oscillations. Seismology has the ability to probe WD mass and hydrogen envelope mass. The existence of pulsations for low mass He core WD may constrain theories of g-mode driving by extrapolating the instability strip down by an order of magnitude in gravity.

Long Term Variation of Quiescent Effective Temperatures of CV White Dwarfs

Dean Townsley

Department of Astronomy / Steward Observatory, The University of Arizona

Using time-dependent calculations of the envelope of an accreting white dwarf (WD), I investigate the sensitivity of the quiescent $T_{\rm eff}$ to long term variations in the accretion rate. The quiescent $T_{\rm eff}$ provides one of the best available tests of predictions for the angular momentum loss and resultant mass transfer rates, $\dot{M}$, which govern the evolution of CVs. Qualifying conclusions drawn from observed $T_{\rm eff}$ values is complex because the averaging time which $\dot{M}$ reflects depends on $\dot{M}$ itself, being as much as 10^5 years for low-$\dot{M}$ systems and as little as 10^3 years for high-$\dot{M}$ systems. I will discuss in detail the security of conclusions drawn about the CV population in light of these time scales and our necessarily incomplete sample of systems. Due to the time necessary for the quiescent $T_{\rm eff}$ to adjust, the consistency of measurements between different systems places significant constraints on possible long-timescale variation in $\dot{M}$. I will discuss the most decisive currently available measurements of the surface effective temperatures, $T_{\rm eff}$, of WD primaries in CVs during accretion quiescence, and use these as a diagnostic for their time averaged accretion rate, $\dot{M}$. While gravitational radiation is completely sufficient to explain the $\dot{M}$ of strongly magnetic CVs at all orbital periods, faster angular momentum loss is required to explain the temperatures of dwarf nova primaries (non-magnetic systems). This provides evidence that a normal stellar magnetic field structure near the secondary, providing for wind launching and attachment, is essential for the enhanced braking mechanism to work, directly supporting the well-known stellar wind braking hypothesis.

White Dwarf Heating in Nova-like Systems

Edward Sion

Villanova University

It has become possible to constrain the temperatures of of white dwarfs in nova-like variables at low orbital inclination, even among the UX UMa-type systems which remain in high optical brightness states. This has been possible through FUSE observations and FUSE data in combination with HST STIS spectra. The overall picture of white dwarf heating in nova-like systems, compared with dwarf novae, is discussed. This work is supported by NSF grant AST0807892.

The Paucity of Magnetic White Dwarfs Among Detached SDSS Binaries

James Liebert

University of Arizona

More than 1500 detached binaries have been found (mostly in the SDSS) with a white dwarf and M dwarf composite spectrum. In none of these cases does the white dwarf have a magnetic field of 2

megagauss or more. Yet these are the sources of cataclysmic variable progenitors. Yet ∼20% of CVs are polars or high field intermediate polars, even more if you include the low accretion rate polars. Chris Tout, Dayal Wickramasinghe and others have proposed a solution involving generating the magnetic field in a common envelope (MNRAS, 387, 897).

Binary Star Origin of High Field Magnetic White Dwarfs

Christopher Tout

University of Cambridge

The lack of evidence for Zeeman splitting of the hydrogen lines in the spectra of the 1,253 close but detached binary systems consisting of a white dwarf and a nondegenerate star (a sample that includes the pre-Cataclysmic Variables) identified in the Sloan Digital Sky Survey indicates that there are no identifiable progenitors for the Magnetic Cataclysmic Variables (MCVs), even though these comprise some 25 per cent of all Cataclysmic Variables (CVs). Indeed, all high-field white dwarfs appear to be either single stars or components of AM Her systems. This suggests that all such white dwarfs have a binary origin. We propose that this dilemma could be resolved if we postulate that the $10^6 - 10^8$ G magnetic fields that are observed, or deduced to be, in the white dwarfs in the MCVs, namely the Polars and the Intermediate Polars, are generated in the common envelope phase of pre-CV evolution in systems which almost merge. The more strongly magnetic systems emerge from the common envelope phase almost semi-detached or in contact and may not remain as pre-CVs long enough to be observed in this phase. Systems that merge in the common envelope phase yield a population of isolated magnetic white dwarfs with fields of $10^8 - 10^9$ G that may make up the entire single magnetic white dwarf population.

Close, Detached White Dwarf + Brown Dwarf Binaries as Progenitors of CVs

Matt Burleigh

Dept. of Physics and Astronomy, University of Leicester

The discovery by Maxted et al.(2006) of WD0137−349, a binary consisting of a white dwarf and a 0.53Msun brown dwarf in a 116 minute orbit, showed that substellar objects could survive common envelope evolution and provide another channel for the formation of CVs. Subsequently, Littlefair et al. (2007) have argued that the 66min period eclipsing CV SDSS J150722.30+523039.8 must have formed from a detached white dwarf + brown dwarf binary. I will present the latest results of our surveys for close, detached WD+BD binaries from UKIDSS and other datasets, including new systems, and place limits on the frequency of such pairs. I will also present our latest observations of WD0137−349 from Spitzer and ground-based telescopes.

Post Common Envelope Binaries from SDSS: White Dwarf/Main Sequence Binaries from SEGUE

Ada Nebot

Astrophysikalisches Institut Potsdam (AIP)

Detached white dwarf/main sequence binaries (WDMS) provide an excellent environment to study the evolution and formation of compact binaries in general (see also talks by M.R. Schreiber and M. Zorotovic). However, to clearly constrain current theories a large and well defined sample of systems covering the entire parameter space is required. In the pre-SDSS era, the sample of well-observed close WDMS contained only 30 systems and was also heavily biased towards young systems with hot white dwarfs and late spectral type secondary stars. Within the last years the Sloan Digital Sky Survey I (SDSS-I) turned out to efficiently discover large numbers of WDMS systems. However, most of these WDMS have been targeted as quasar candidates which again favours the identification of systems containing hot white dwarfs. As partners of SEGUE/SDSSII we carried out a dedicated program to identify the missing population of WDMS binaries containing cold white dwarfs. We here report the discovery of 279 new SEGUE-WDMS binaries, derive strict lower limits of the space density of WDMS binaries, and estimate the scale height of the galactic population. From the sub-exposures of each individual SEGUE-spectrum we constrain the fraction of post common envelope binaries (PCEBs) among our WD/MS binaries to be 20Finally, we present orbital period measurements for 10 of these PCEBs and discuss our findings in the context of close compact binary evolution.

Post Common Envelope Binaries from the SDSS: Testing Disrupted Magnetic Braking

Matthias R. Schreiber

Universidad de Valparaiso, Chile

The orbital period gap, i.e. the deficiency of cataclysmic variables (CVs) in the orbital period range of ∼2-3hrs, is still the most striking feature of the orbital period distribution of CVs. The standard theory of cataclysmic variable evolution explains the orbital period gap by assuming that orbital angular momentum loss is driven by both gravitational radiation and magnetic wind braking above the gap and by only gravitational radiation for systems with orbital periods shorter than ∼3 hrs. The predictions of this disrupted magnetic braking scenario are in general agreement with the basic properties of the observed CV population. However, a discontinuity in the braking rate could not be identified in single stars and there is clear evidence that low mass stars are still active, even in close binaries. Therefore, independent tests of disrupted magnetic braking based on large samples of detached post common envelope binaries are required. As the SDSS is efficiently identifying large numbers of white dwarf/main sequence binaries (see e.g., the talk by A. Nebot Gomez-Moran), performing such tests is currently within reach. We here present the identification of ∼200 new post common envelope binaries of which 43 have orbital period measurements (see also the talk by M. Zorotovic). We discuss observational selection effects of our sample, reconstruct the post common envelope evolution of our systems, and conclude that we may indeed significantly progress

with our understanding of CV evolution by looking at their progenitors.

Post Common Envelope Binaries from SDSS: Constraining the Common Envelope Efficiency

Monica Zorotovic Fiebig

Pontificia Universidad Católica, Santiago

One of the fundamental problems related to compact binary evolution arises just during the formation of a compact binary star, i.e. when an initially wide main sequence binary star with long orbital period ($\geq$ years) evolves into a compact short orbital period ($\leq$ days) binary star. Once the more massive star evolves into a red giant, dynamically unstable mass transfer may lead to the formation of a gaseous envelope around the entire binary, and friction within this envelope is supposed to significantly reduce the binary orbit. Although widely accepted as formation scenario of compact binary stars, the detailed physics of this common envelope (CE) phase are still poorly understood and the efficiency of "using" the orbital energy (or angular momentum) to expel the envelope is highly unconstrained. We here present a well-defined sample consisting of 43 post common envelope binaries (PCEBs) identified from follow-up observations of SDSS white dwarf/main sequence binaries (see talks by M.R. Schreiber and Ada Nebot-Gomez Moran). We reconstruct the possible evolutionary histories of the PCEBs in our sample assuming various prescriptions of common envelope evolution and derive strong new constraints on the common envelope efficiency.

How Many Cataclysmic Variables are Crossing the Period Gap? A Test for the Disruption of Magnetic Braking

Philip Davis

Department of Physics & Astronomy Open University

We apply population synthesis techniques to calculate the present-day number of two types of white-dwarf main-sequence star (WDMS) binaries within the cataclysmic variable (CV) 2 to 3 h period gap. The first are post-common envelope binaries with secondary stars that have masses $0.17 \leq M_2/\mathrm{M}_\odot \leq 0.36$ (gap-post common envelope binaries; gPCEBs), such that they will commence mass transfer within the period gap. The second type are systems that were CVs at some point in their past, but detached once they evolved down in orbital period to ≈ 3 h as a consequence of disrupted magnetic braking, and are crossing the period gap via gravitational radiation (detached cataclysmic variables; dCVs). Full population synthesis calculations are performed where we either assume constant, global values of the common envelope ejection efficiency, α_{CE}, or consider α_{CE} as a function of secondary mass. Several forms of magnetic braking are also considered. We predict an excess of dCVs over gPCEBs within the period gap of ~ 4 to ~ 13 assuming $\alpha_{\mathrm{CE}} = 0.1 \sim 0.6$, and an initial mass ratio distribution of the form $n(q) = 1$. This excess is revealed as a prominent peak at the location of the period gap in the orbital period distribution of the combined gPCEB and dCV population. We suggest that if such a feature is observed in the orbital period distribution of an observed sample of short orbital period WDMS binaries, this would strongly corroborate the

disruption of magnetic braking.

A High Mass-Ratio for the Dwarf Nova IP Peg and Remarkable Variability of its White Dwarf

Tom Marsh

University of Warwick

Light curves of the dwarf nova IP Peg taken with ULTRACAM on the 4.2m WHT are presented which show the white dwarf with unusual clarity, including the first clear detection of its ingress which is seen just before the ingress of the bright-spot. The phase width of the white eclipse, at 0.0934 of the orbit, is significantly higher than the standard value of 0.0863 which dates back to the 1980s meaning either a higher orbital inclination or a higher mass ratio or some combination of the two. We show that model fits strongly favour a high mass-ratio solution, leading to $q \sim 0.55$ and a high donor mass of around 0.6 $M_\odot$. Remarkably, the white dwarf is seen to vary significantly in flux, even between consecutive eclipses. This is seen particularly in u−g which varies by over a magnitude, and is not the result of flickering. We discuss possible reasons for this and the likely temperature of the white dwarf as a rare long period constraint upon compressional heating of accreting white dwarfs in cataclysmic variable stars.

The Masses and Evolutionary State of the Stars in the Dwarf Nova SS Cygni

Martin A. Bitner and Edward L. Robinson

Department of Astronomy, University of Texas at Austin

We have analyzed new spectroscopic observations of the dwarf nova SS Cyg using our programs for synthesizing the rotationally broadened spectra of cool, Roche-lobe-filling stars. Fits of the synthetic spectra to the observed spectra yield the amplitude K of the lobe-filling star's radial velocity curve and the mass ratio q. We find $K = 162.5 \pm 1.0$ km/s and $q = 0.685 \pm 0.015$. The fits also show that the accretion disk and white dwarf contribute a fraction $f = 0.535 \pm 0.075$ of the total flux at 5500 Å. The orbital light curve of SS Cyg shows a double-humped ellipsoidal variation diluted by light from the disk and white dwarf. From an analysis of the ellipsoidal variations plus a measurement of the flux from the disk and white dwarf, we limit the orbital inclination to lie between 45 and 56 degrees. The resulting masses of the lobe-filling star and white dwarf are 0.55 $\pm$ 0.13 and 0.81 $\pm$ 0.19 solar masses respectively. The lobe-filling star is 10% to 50% larger than an unevolved star with the same mass and thus does not obey the mass-radius relation for ZAMS stars. Nor does it follow the ZAMS mass/spectral-type relation. Its mass and spectral type are, however, consistent with models in which the core hydrogen has been significantly depleted.

Infrared Photometry and Spectroscopy of VY Aqr and EI Psc: Two Short Period Cataclysmic Variables with Curious Secondary Stars

Tom Harrison

New Mexico State University

We present new K-band spectra of VY Aqr and EI Psc obtained with NIRSPEC on the *Keck* II telescope. We find a best-fitting spectral type of K4 for EI Psc, in agreement with the previous classification. The *Keck* spectrum of VY Aqr suggests an M0 spectral type, much hotter than previously derived. We re-reduce the original data for VY Aqr that were obtained using ISAAC on the *Very Large Telescope* and find a best-fitting spectral type of M6 for VY Aqr. We are unable to reconcile the two data sets. We analyze new phase-resolved optical spectroscopy of VY Aqr, obtained using UVES on the *Very Large Telescope*, to derive the mass ratio, and show that the mass of its secondary star is very likely below the stellar/substellar boundary. We also present and model phase-resolved JHK infrared light curves for both objects, and g- and I-band light curves for EI Psc. While the light curve models for EI Psc are consistent with its spectral type, we are unable to model the light curves of VY Aqr without assuming binary star parameters outside the published range for this object.

Tales from the Vault: Orbital Periods for Seven CVs Longward of the Gap

John Thorstensen, Julie Skinner, Christopher S. Peters, and Ann Kapusta

Dartmouth College

We report new orbital periods for seven cataclysmic binaries; the stars and their periods are V2289 Cyg = Cyg2 (0.142 d); V811 Cyg (0.156 d); VZ Aqr (0.161 d); V542 Cyg (0.181 d); V795 Cyg (0.181 d, nearly identical to V542 Cyg); V587 Lyr = Tk5 (0.274 d); and IPHAS J0345+53 (0.314 d). All are catalogued as dwarf novae save for IPHAS J0345+53, the variability type of which is as yet unkonwn. The mean spectra of VZ Aqr, V795 Cyg, V587 Lyr, and IPHAS 0345 show the donor-star contribution, and in IPHAS 0345 and V587 Lyr the donor's velocity curve is measurable. V542 Cyg also shows a late-type contribution, but its radial velocity remains essentially constant. This system may be a heirarchical triple, or it may be that the late-type component is a chance superposition.

Roche Tomography of RU Pegasi

A. Dunford, Robert C. Smith & C. A. Watson

University of Sussex

Roche Tomography is a powerful tool for mapping the surfaces of CV secondary stars. We present results of a campaign to image the surface of the secondary in the dwarf nova RU Pegasi. In addition to strong irradiation about the L1 point, we detect a large polar starspot deflected off-axis in the

same direction as similar polar spots found in studies of AE Aquarii and BV Centauri (Watson et al 2006, 2007). This may be suggestive of some mechanism (linked to the orbital motion) deflecting flux tubes as they rise. Roche Tomograhy also allows us to obtain optimal values for the stellar masses and the systemic velocity and inclination.

A Spectroscopy Study of the Cataclysmic Variable V1040 Cen

Penelope Longa-Peña

Universidad Catlòlica del Norte

Cataclysmic variables (CVs) are binary systems consisting of two stars orbiting so close to each other than quantities of material are transferred between them.

The estimate of orbital parameters of binary systems in general is very important since it is possible to know precisely their masses, being the best known stellar mass in the Universe. Besides the knowledge about the family of CVs is statistical, so that progress in the determination of orbital parameters of particular systems is a contribution to the construction of scientific knowledge of these systems.

The aim of this study is to estimate the orbital parameters of a star CV V1040 Cen. For this, we are counting with spectrometer data of about 3 orbits obtained with the UVES spectrograph on the Cerro Paranal Observatory which were reduced and analyzed with several software applications (Starlink, Molly, etc.). In order to estimate the parameters, we use techniques for measuring speeds and radio frequency analysis which we will briefly resume. From the data and using the techniques reviewed above, I estimate the orbital parameters of the system being defined as:

Orbital Period = 0.06049(10) days, Primary Star velocity = 73.3(4.5) km/s and mass center velocity = 40.4(3.4) km/s. Also, mass ratio are narrowing by $0.23 < q < 0.54$ and inclination angles by $71^\circ < i < 74^\circ$, respectively. Finally, we perform the first Doppler tomography analysis of this system and we report the preliminary results. This work is a paper in preparation, and followup observations have been approved for June 2009 in CTIO's SOAR.

X-ray Spectroscopy of Three Dwarf Novae SU UMa, WX Hyi and V426 Oph

Metin Altan

Anadolu University

In this work, we present our analysis of ROSAT and CHANDRA X-ray spectra of three dwarf novae SU UMa, WX Hyi and V426 Oph. A few models were used to fit the spectra. We try to get some knowledge about the spectral properties and to use X-ray observations to compare the near quiescence behaviors of the sources. Spectral analysis reveals some temperature distributions depending on models used in individual systems. We discuss the implications of the results in the framework of parameters obtained from models.

Mass Determinations of Short Period CV Donors

Chris Savoury

University of Sheffield

Observations of short period CVs both pre- and post-period minimum show that the donor stars' radii are 10-15% larger than expected. Given the mismatch between the observed and predicted period minimum this should not come as a surprise, but the reason for the discrepancy is still not clear. The mass-radius relationship of the donor stars can distinguish between different possible explanations, including enhanced mass transfer rates, or missing stellar physics. Here we present new, precise mass determinations for several CV donors, in systems with orbital periods between 100 and 120 minutes. Implications for CV evolutionary models are discussed.

Are Short Period CV Secondaries Normal?

Ryan Hamilton

New Mexico State University

We present the results of VLT ISAAC K-band spectroscopy of several short period cataclysmic variable (CV) systems: EX Hya, WX Hyi, V2051 Oph, and Z Cha. Recent studies of CV secondaries in the infrared have cast doubt on the standard paradigm of CV evolution, raising important concerns specifically about the evolution of the secondary star and its initial mass. Previous infrared spectroscopic surveys of CVs above the 2 to 3 hour "period gap" reveal that these secondaries suffer a universal deficit of C_{12}, enhanced levels of C_{13}, and unusual abundance patterns for other species (e.g., Mg, Si, Al, Ca). Infrared spectroscopy of short period magnetic CVs (polars) have shown that their secondary stars appear completely normal, and the secondaries in a sample of "pre-CVs" have normal carbon abundances. Further understanding of the evolutionary history of CVs requires spectroscopy of short period, non-magnetic CVs, which we present in this work. It is extremely difficult to see the secondary stars in short period systems, since the low luminosity secondaries are swamped by the accretion disks in these objects. But by the use of the VLT ISAAC, we have pierced the veil of the short period CVs and present firm detections of the the secondaries in these systems. Implications for CV evolution and formation scenarios will be discussed.

ROSAT X-Ray Spectral Analysis of EI Psc

Gulnar ikis Gunn

Çanakkale Onsekiz Mart Üniversitesi

We present here the X-ray spectral analysis of EI Psc using the archival ROSAT data. The raw data were fitted with various spectral models. Blackbody and Raymond-Smith models are found as the best fit models. The temperatures obtained for these models are kT = (0.07 ± 0.02) keV and KT = (0.13 ± 0.04) keV respectively. The model dependent luminosity values are in the range of log L = 29 erg/s for Raymond-Smith model and log L = 31 erg/s for Blackbody model. Using the

well fitted temperature values, the mass of the primary companion and the equations taken from the literature, the mass accretion rate in the boundary layer is obtained to be $(1.58 \pm 0.14) \times 10^{21}$ g/s for the blackbody model and $(2.2 \pm 0.052) \times 10^{19}$ g/s for Raymond-Smith model. We resulted that EI Psc system has a very high mass accretion rate. Because of the observed soft X-ray photons and high mass accretion rate it has an optically thick boundary layer and M-type secondary star which can be a Brown Dwarf.

Time Resolved Spectrocopy of SDSSJ1433

Simon Tulloch

Isaac Newton Group

The new technology of Electron Multiplying CCDs now allows time resolved spectroscopy of sources that were previously too faint for consideration. We have used a new EMCCD camera to observe the $g = 18.5$ eclipsing CV SDSSJ1433 with a time resolution of 30s and have measured the radial velocity of the white dwarf primary as 33.5 ± -4 km/s. This result agrees with that of a previous photometric light curve fitting technique which implied that the mass donor in this system is a brown dwarf below the hydrogen burning limit.

The Unusual 2006 Outburst of GK Per

Phil Evans

X-ray and Observational Astronomy Group, University of Leicester

In November 2006 GK Per began its most recent dwarf-nova-like outburst. We obtained regular Swift ToO observations throughout the outburst, giving us an unprecedented multiwavelength dataset in X-rays (0.3-10 keV) and the UV ($\sim$2600 Å), in addition to the superb AAVSO light curve. This outburst proved to be an unusual one, peaking 1.5 magnitudes fainter in the optical/UV than for most outbursts of this source, although the X-ray flux was consistent with previous outbursts. This dichotomy presents a significant challenge to existing models for dwarf-nova outbursts. We present the dataset in full, and discuss the implications for the standard outburst models.

Fighting for Accretion: the 2008-2009 Low State of BB Doradus

Pablo Rodriguez-Gil

Isaac Newton Group of Telescopes

We present time-resolved optical spectroscopy of BB Doradus in the low state. The line profiles are mainly dominated by emission from the donor star, although the spectral features of the white dwarf and a M-dwarf secondary star are also detected. For the first time, we detected episodic accretion events which radically changed the emission line profiles within a timescale of tens of

minutes. The implications of this observation for the origin of low states are discussed.

Post Common Envelope Binaries from SDSS: Four Eclipsing White Dwarf Main Sequence Binaries

Stylianos Pyrzas

Isaac Newton Group of Telescopes, University of Warwick

We report the identification and follow-up observations of four eclipsing white dwarf plus main sequence binaries from the Sloan Digital Sky Survey. We determine the physical parameters of the stellar components using combined constraints from a decomposition of the SDSS spectra, radial velocity data and light curve modeling. Three of the systems contain low mass DA white dwarfs ($M_{wd} \sim 0.4 - 0.6$ $M_{\odot}$), while the fourth system contains a DC white dwarf with $M_{wd} \sim 0.8 - 0.9$ $M_{\odot}$, unusually massive for a post-common envelope system. The companion stars in all four systems are M-dwarfs with spectral type M4 or later. These additions raise the number of known eclipsing WDMS binaries to fourteen, and we find that the average mass in this sample is $\langle M_{wd} \rangle = 0.57 \pm 0.16$ $M_{\odot}$, only slightly lower than the average mass of single white dwarfs. The past and future evolution of the systems are also discussed.

A VLT Spectroscopic Survey of Faint SDSS Cataclysmic Variables

John Taylor

University of Warwick

The SDSS sample of cataclysmic variables runs to much dimmer magnitudes than all previous spectroscopic surveys, yielding a rich population of intrinsically faint objects. Each of these old systems has its own tale to tell, and together they may just be the large population of short-period CVs whose existence theorists have been predicting for many years. I present results from a VLT spectroscopic survey of these objects, including one with weird triple-peaked Halpha emission, another whose Halpha emission changew by a factor of ten even in quiescense, and finally a new 4.5-hr period CV which exhibits eclipses with very variable depth.

The Chandra Grating Spectra of Cataclysmic Variables

Eric M. Schlegel

University of Texas at San Antonio

We will present an overview of all of the HETG observations to date of CVs including the time-resolved spectroscopy of EX Hya from the 500 ksec observation.

Study of Superhumps by CCD Observations of V1251 Cyg, KP Cas and UW Tri

Irina Voloshina and V. Metlov

Sternberg Astronomical Institute, Moscow State University

The results of time-series photometry for three dwarf nova systems during recent outbursts are presented. Observations were performed on the 60 cm telescope of Sternberg Astronomical Institute in Crimea and 38 cm telescope of Crimean Astrophysical Observatory in October-November 2008. Superhumps were detected for all dwarfs novae and development of superhumps was followed up. Amplitudes and superhumps periods were derived from these observations.

A Study of SDSS Cataclysmic Variables

Arne Henden

American Association of Variable Star Observers

Approximately 200 quiescent time-series of SDSS cataclysmic variables were obtained using the USNO-Flagstaff 1.0m telescope during the course of initial discovery and publication of these stars. This talk will present highlights from those time series and discuss low-accretion rate behavior at quiescence.

High Speed Photo-Polarimetry of QPOs and Eclipses in Magnetic CVs

Steve Potter

South African Astronomical Observatory

2008 saw the successful commissioning of the SAAO's new high speed 2 channel photo-polarimeter. We present new results from observations made of magnetic Cataclysmic Variables. These include the discovery of polarized quasi-periodic oscillations and resolving accretion regions during eclipses. In addition we will present preliminary observations made with the BVIT (Berkeley Visible Imaging Tube) on the SALT (Southern African Large Telescope).

The Discovery of New Low Accretion Rate CVs in the WASP Transient Survey

George Marshall

University of Warwick

Using data from the Wide Angle Search for Planets observatories (WASP) we have been carrying out an all sky survey for transient objects. We have identified f ive previously unknown dwarf

novae which are all low accretion rate systems. Th is suggests that WASP is finding systems from a population of CVs that may have been under represented in previous surveys. Although WASP was originally conce ived as a means of locating extra-solar planets, WASP's wide field of view and high cadence makes it ideal for a survey of this type. This survey will allow us to test population models of CVs and other transients without some of the systematics that have affected previous surveys.

Time-Resolved Spectroscopy of RZ LMi

Jeff Robertson

Arkansas Tech University

Orbit-resolved spectroscopy of RZ LMi from 1997 January with the WIYN-Hydra/MOS instrument (∼400-700 nm; 0.14 nm/pix) is presented. An orbital period is not available with the radial velocities of H-alpha or H-beta emission lines and could be due to a low-inclination for the system or a very extreme mass ratio.

VLA Observations of Recent Southern Transient Systems

Elena Mason

ESO

We present new spectroscopy of several recent transient systems.

NOTES

Program for Tuesday

"AM CVn's, Helium White Dwarfs, Pre-CVs and More!"

Talks

Time	Speaker	Topic
09:00 to 09:40	Danny Steeghs	The Galactic Population of AM CVn Binaries
09:40 to 10:00	Ken Shen	Unstable He Shell Burning on Accreting White Dwarfs
10:00 to 10:20	Marc van der Sluys	Magnetic Capture and the Formation Channel for AM CVn
10:20 to 10:50	**Coffee Break**	
10:50 to 11:20	Lars Bildsten	Where are the Helium Core White Dwarfs in CVs?
11:20 to 11:40	Irit Idan	Classical Novae on Low Accretion Rate Helium WDs
11:40 to 11:53	Claus Tappert	LTT 560 and Mass Transfer in Pre-CVs
11:53 to 12:13	Tiago Ribeiro	Studying Activity in Pre-CVs Secondaries
12:13 to 12:18	Poster Review	
12:18 to 01:28	**Lunch**	
01:28 to 01:41	Howard Bond	HST Observations of the Pre-CV Binary V471 Tauri
01:41 to 02:01	Dmitry Bisikalo	3D Modeling of the Circumbinary Envelope in Close Binaries
02:01 to 02:31	Don Hoard	What's Cool About Hot Stars? CVs in the Infrared
02:31 to 03:01	Linda Schmidtobreick	The Role of SW Sex Stars in the Evolution of CVs
03:01 to 03:31	**Coffee Break**	
03:31 to 04:01	Boris Gänsicke	SDSS Unveils the Predicted Population at the Minimum P_{orb}
04:01 to 04:31	Ulrich Kolb	Recent Population Synthesis Results
04:31 to 05:01	Lorne Nelson	Population Synthesis Models with Interrupted Braking
05:01 to 05:31	Magaretha Pretorius	The Space Density of Cataclysmic Variables
05:31 to 06:00	**Poster Viewing**	
06:00 to 07:00	NOAO Reception	

Posters

#31 Kurtis Williams	#32 Vadim Burwitz	#33 Paul Barrett	#34 Justus Vogel
#35 Steve Howell	#36 Iris Trauslen	#37 Nicola Masetti	#38 Kunegunda Bell
#39 Jesus Corral-Santana	#40 Stefanie Wachter	#41 Jillian Bornak	#42 Cristina Zurita
#43 Kieran O'Brien	#44 Marissa Kotze	#45 Teo Muñoz-Darias	#46 Manuel Torres
#47 Robert Schwarz	#48 Marco Mantraga	#49 Ladislav Hric	#50 Daniela Barria Diaz
#51 Julie Skinner	#52 Fergus Wilson	#53 Peter Hoeflich	#54 Allesandro Ederoclite
#55 Akira Imada			

Abstracts

The Galactic Population of AM CVn Binaries

Danny Steeghs
University of Warwick

I discuss some of our recent efforts concerning the galactic population of AM CVn binaries and related objects. This relatively obscure CV sub-class has seen renewed interest thanks to the discovery of new and extreme systems with very short orbital periods as well as their prominence as low-frequency gravitational wave sources. Fast photometry and spectroscopy using relatively large telescopes has allowed us to characterise fundamental system parameters while surveys and parallax distances are starting to question the expected space density of these objects.

Unstable Helium Shell Burning on Accreting White Dwarfs

Ken Shen

University of California, Santa Barbara

AM Canum Venaticorum (AM CVn) binaries consist of a helium donor and a white dwarf accretor with accretion rates $\dot{M} = 1 \times 10^{-13}$ to 1×10^{-5} $M_\odot$/yr. For $\dot{M} = 3 \times 10^{-8}$ to 1×10^{-6} $M_\odot$/yr, the helium ignites unstably after $1 \times 10^{-3} - 0.1$ $M_\odot$ has been accreted, resulting in the growth of a convective helium-burning shell. The most massive of these shells have nuclear burning rates rapid enough that the envelope evolves faster than the local dynamical time, possibly yielding helium Ia supernovae as outlined in Bildsten et al. (2007). In this talk, we explain the evolution of these flashes until the onset of dynamical burning. We calculate the minimum envelope mass required for dynamical burning, finding that AM CVn's with accretor masses > 0.7 $M_\odot$ will undergo a dynamical flash. Compositional influences and outcomes are also discussed, as these set the initial conditions of future hydrodynamical calculations and affect the resulting nucleosynthesis. We also comment on the core helium flash in RGB stars and describe the least massive helium WD that can undergo a dynamical flash.

Magnetic Capture and the CV Formation Channel for AM CVn Stars

Marc van der Sluys

Northwestern University

A binary in which a slightly evolved star starts mass transfer to a white dwarf can evolve towards ultra-short orbital periods under the influence of magnetic braking. This is known as magnetic capture. We present a detailed investigation on the initial orbital periods and the initial donor masses that allow CVs to evolve to periods less than 60 minutes, lose most of their hydrogen envelopes and form AM CVn stars. We will discuss the efficiency of the magnetic-capture scenario

for different magnetic-braking laws. In addition, we present possible observational differences for AM CVn stars that evolved through different formation channels.

Where are the Helium Core White Dwarfs in CVs?

Lars Bildsten

Kavli Institute for Theoretical Physics, UCSB

Binary evolution predicts a population of Helium core white dwarfs that are accreting hydrogen-rich material from low mass main sequence (or brown dwarf) donors. Four binaries are known in our galaxy that will reach such a mass-transferring state in a few Gyrs. Despite these predictions, there are still no secure cases of low mass WDs ($M < 0.48 M_\odot$ to clearly be a Helium core) in the mass transferring cataclysmic variables. Whether the predictions are in conflict with the observations remains an unanswered question, however the question led us to calculate the fate of such low mass He WDs once accretion begins. Presuming only gravitational-wave losses, the mass transfer rates in these binaries is expected to be low $\dot{M} \approx 10^{-11} M_\odot \mathrm{yr}^{-1}$. We will report the expected classical novae outburst rate from these systems, discuss the very long supersoft phase, and note how these systems may be found when in quiescence between dwarf novae outbursts.

Classical Novae on Low Accretion Rate Helium WDs

Irit Idan

Technion, Haifa

Evolution scenarios predict and existing pre-CVs show that there must be a population of low accretion rate ($\approx 10^{-11} M_\odot \mathrm{yr}^{-1}$) helium white dwarfs in binaries with $< 0.3 M_\odot$ main sequence companions. This motivated our study of the Classical Novae from such an unusual system. We find that the the low core temperatures and accretion rates results in large ignition masses of the order of $10^{-3} M_\odot$ on a $0.4 M_\odot$ Helium white dwarf. Semi-analytical models were calculated together with multi-cycles models from the Prialnik and Kovetz evolution code. We will present the long-term accreting WD evolution of up to 200 nova cycles, and discuss the nature of the CN outbursts, the role of chemical diffusion and the onset of WD thermal equilibrium.

LTT 560 and Mass Transfer in Pre-CVs

Claus Tappert

Pontificia Universidad Católica de Chile, Santiago

The presence of metal absorption lines in the UV spectra of pre-CVs shows that the transfer of mass prior to the semi-detached CV phase is a common phenomenon in these systems. However, there are only two currently known non-magnetic pre-CVs that show emission line components

originating on, or close to, the white dwarf. I will present new Echelle data on one of these systems, LTT 560, and discuss the results in the context of mass transfer in pre-CVs.

Studying Activity in Pre-CVs Secondaries: The Case of EC13471−1258

Tiago Ribeiro

Universidade Federal de Santa Catarina, Brazil

We present analysis of $VRIJH$ photometry and phase resolved optical spectra of the eclipsing DA+dMe binary QS Vir. Previous analysis of the system shows that it is an eclipsing close binary with an orbital period of 3.62 hrs containing an active secondary star almost filling its Roche lobe. Light curve modeling is provided and constrain orbital parameters of $i = 74.9 \pm 0.6$ and $q = 0.50 \pm 0.05$. Images of the secondary star are obtained through a light curve inversion method to investigate the appearence of flares in its optical light curves. Using this thechinique we are able to determine the region, on the face of the secondary, responsible for the observed flare. Doppler tomogram are constructed and shows that the majority of the neutron Hidrogen emission lines comes from the inner face of the active secondary. In addition, there is also evidence of material corrotating with the secondary star outside its Roche lobe. Roche tomography was also used to map the bightness distribution of the secondary star on Ca_{II} H&K doublet, also in emission. Comparing the results of both imaging thechniques promisses to provide interesting new results behind the mechanism generating the magnetic field of donnor stars in CVs.

HST Observations of the Pre-Cataclysmic Binary V471 Tauri

Howard E. Bond

Space Telescope Science Institute

We will report an analysis of the available Hubble Space Telescope archival UV spectroscopic data on the eclipsing binary V471 Tauri, prototype of the pre-cataclysmic binaries. Subjects to be covered include a refined double-lined orbital solution, dynamical masses of the dK and DA components, time-resolved spectroscopy on the 9.25-min rotation period of the white dwarf, and direct measurement of Zeeman splitting of photospheric lines of the magnetic WD. Although a detached binary at present, V471 Tau appears destined to become a DQ Her-type magnetic CV.

Circumbinary Envelope in Close Binaries: Results of 3D Gas Dynamic Modeling

D.V. Bisikalo

Institute of Astronomy of the Russian Academy of Sciences, Moscow, Russia

In case of non-conservative mass transfer in a close binary, part of the matter should leave the

system and form an extended circumbinary envelope around the binary. For typical values of turbulent viscosity in accretion disks of close binaries (in terms of Shakura-Syunyaev parameter $\alpha = 0.01$) the efficiency of accretion is about 50%, so half of the matter leaving the donor star will be accumulated in the envelope.

Three-dimensional numerical simulations of gas dynamics are used to study the flow pattern in a close binary system after it has reached the steady-state accretion regime. It is shown that shape and position of a substantial part of the disk is specified by the precessional density wave. This spiral wave is due to the retrograde precession of flow lines in the binary system. On timescales comparable to the orbital period, this precessional wave (and hence an appreciable fraction of the disk) will be virtually stationary in the observer's frame, whereas positions of other elements of the flow will vary due to the orbital rotation. The periodic variations of positions of the disk and the bow shock formed when inner parts of the circumbinary envelope flow around the disk result in variations in both the rate of angular-momentum transfer to the disk and the flow structure near the Lagrange point L_3. As a consequence, outer parts of the circumbinary envelope are replenished by periodic ejections from the accretion disk and circum-disk halo through the vicinity of the Lagrange point L_3.

Studying circumbinary envelopes is of great importance, first and foremost, because of their possible observational manifestations. Results of simulations show that matter distribution in envelope is substantially non-uniform in phase and in time. As a consequence the radial concentration of gas will vary depending on the phase, and this should be seen as variations of the system brightness.

What's Cool About Hot Stars? Cataclysmic Variables in the Infrared

Don W. Hoard

Spitzer Science Center, California Institute of Technology

I will present an overview of recent results from mid-infrared observations of cataclysmic variables with the Spitzer Space Telescope. These include infrared spectra and light curves, as well as UV-to-infrared spectral energy distributions for both disk-accreting and magnetic cataclysmic variables, obtained with all three of Spitzer's scientific instruments. In general, these observations have revealed mid-infrared excesses, above the level expected from the stellar components and accretion disk, in numerous systems. This excess can be modeled as originating from circumstellar and/or circumbinary dust. I will discuss the implications for the formation, structure, and evolution of cataclysmic variables.

The Role of SW Sex Stars in the Evolution of CVs

Linda Schmidtobreick

European Southern Observatory

Recent surveys have shown that that all eclipsing novalike stars in the in the 3−4 h period range

seem to be of SW Sex nature. While being an eclipsing star is part of the original definition for SW Sex stars, the intrinsic physical properties are of course independent of the system's inclination. Hence it seems likely that all non- or weakly-magnetic CVs in the 3−4 h period range are physically similar to the SW Sex stars. We have tested this hypothesis by looking for typical SW Sex features in a sample of non-eclipsing novalike stars in the 3−4 h period range. Indeed, we find evidence for an SW Sex nature in the majority of these stars. This is extremely important as this is the period range just above the period gap, hence these stars can be considered as pre-gap CVs. We will discuss some implications of these findings and in particular the idea whether the physical properties of SW Sex stars, i.e. the extremely high mass transfer, is a necessary step for a CV to lose contact and thus evolve into the gap.

SDSS Unveils the Predicted Population of Intrinsically Faint Cataclysmic Variables at the Minimum Orbital Period

Boris T. Gänsicke

University of Warwick

We discuss the properties of 116 cataclysmic variables (CVs) which are included in the Sloan Digital Sky Survey (SDSS) spectroscopic data base, and for which accurate orbital periods have been measured. 82 of these systems are new discoveries from SDSS and were followed-up in more detail over the past few years. 44 systems were previously identified as CVs because of the detection of optical outbursts and/or X-ray emission, and subsequently re-identified from the SDSS spectroscopy. The period distribution of the SDSS CVs differs dramatically from that of all the previously known CVs, in particular it contains a significant accumulation of systems in the orbital period range 80–86 min. We identify this feature as the elusive "period minimum spike" predicted by CV population models, which resolves a long-standing discrepancy between compact binary evolution theory and observations. We show that this spike is almost entirely due to the large number of CVs with very low accretion activity identified by SDSS. The optical spectra of these systems are dominated by emission from the white dwarf photosphere, and display little or no spectroscopic signature from the donor stars, suggesting very low-mass companion stars. We determine the average absolute magnitude of these low-luminosity CVs at the period minimum to be $< M_g >= 11.6 \pm 0.7$. Comparison of the SDSS CV sample to the CVs found in the Hamburg Quasar Survey and the Palomar Green Survey suggests that the depth of SDSS is the key ingredient resulting in a break-through in observational CV population studies.

Recent Population Synthesis Results

Ulrich Kolb

The Open University

SDSS follow-up work has delivered a breakthrough in the study of the CV and pre-CV populations. I will describe recent population synthesis work interpreting the new samples. One focus is on the long-sought after period minimum spike, and the other is on the first comprehensive models of the

post-common envelope (CE) population. Davis, Kolb, & Willems reconstruct the common envelope efficiency of observed post-CE systems and investigate the significance of a potential relation between this efficiency and system parameters.

Population Synthesis Models with the Assumption of Interrupted Magnetic Braking

Lorne Nelson

Bishop's University

Under the paradigm of interrupted magnetic braking, we carry out an extensive population synthesis analysis wherein the theoretical orbital distribution of Cataclysmic Variables is compared with the observational one. Using the latest generation of input physics, we have created an extensive grid of evolutionary tracks for a multitude of initial conditions for systems at the onset of mass transfer (e.g., the mass of the donor, its state of nuclear evolution, and the mass of the accreting white dwarf). By interpolating this grid it is possible to comprehensively explore the many dimensions of parameter space associated with initial properties of the primordial binary itself and the common envelope evolutionary process. We find that nuclear evolution of the donor star can have the effect of smearing out the edges of the period gap and location of the minimum orbital period. Unlike some previous population syntheses, we do not see a pronounced spike in the distribution at the minimum orbital period. The implications of this analysis with respect to the observations will be discussed in detail.

The Space Density of Cataclysmic Variables: New Constraints from the ROSAT Bright Survey

Margaretha Pretorius

South African Astronomical Observatory

In order to make progress in understanding the formation and evolution of cataclysmic variables (CVs), quantitative constraints on the parameters predicted by theoretical models are needed. The most fundamental of these parameters is the overall space density of CVs. Existing observational estimates differ by more than two orders of magnitude, and little effort has been made to quantify the uncertainties affecting these estimates. The dominant uncertainty probably stems from systematic errors caused by selection effects. These errors can only be quantified in the case of CV samples with simple, well-defined selection criteria; the sample constructed from the purely X-ray flux-limited ROSAT Bright Survey is an example. We present a new estimate of the CV space density using this survey. The resulting measurement is an order of magnitude smaller than we previously found with the much deeper ROSAT North Ecliptic Pole survey. However, the two measurements are consistent, because different CV populations dominate in surveys with different flux limits. We will also illustrate the advantage in terms of observational bias of X-ray over optically selected CV samples.

EU Cnc: Studies of the Polar in the Open Star Cluster M67

Kurtis Williams

University of Texas

EU Cnc is a magnetic CV (polar) with a 2.09 hr photometric period in the core of the 4Gyr-old open star cluster Messier 67. If a member of the star cluster, EU Cnc provides us with a rare opportunity to constrain the formation and past evolution of this system, including the total age, progenitor metallicity, and precise distance of the system. We have obtained serendipitous time-resolved spectroscopy of EU Cnc with the Keck Telescope covering one complete photometric period. Based on our findings, we revisit the question of whether EU Cnc is a member of M67, or if we are the victims of an unfortunate line-of-sight to this star.

The Chandra LETGS High Resolution X-ray spectrum of AM Herculis

Vadim Burwitz

Max-Planck-Institut für extraterrestrische Physik (MPE)

We present a detailed time and spectrally resolved analysis of the Chandra LETGS high resolution X-ray spectrum of the prototype magnetic cataclysmic variable star AM Herculis. Diagnostics using the OVII He-like triplet allows us to constrain the temperature and densities of the hard X-ray emitting regions of the accretion funnel close to the white dwarf. The LETGS gives us a unique picture of the complex soft X-ray component which mainly originates from reprocessed bremsstrahlung from the surface of the white dwarf. This optically thick spectrum shows many interesting absorption features.

Far Ultraviolet Line Emission of the Polar V884 Her

Paul Barrett

US Naval Observatory

We present far ultraviolet phase resolved spectroscopy of the high-field polar V884 Herculis. Strong broad ($\sim$1700 km/s) emission lines of He II, C III, N III, and O VI are present in the spectrum and show radial velocity variations at the orbital period. C III and O VI show broad, weak self absorption lines at orbital phase 0.3$-$0.4, which is attributed to the accretion column. The spectrum also shows interstellar absorption due to C II. The ratio of molecular to atomic hydrogen is rather high at 0.34.

Analysis of Polars in the XMM Archive

Justus Vogel

Astrophysikalisches Institut Potsdam

In the early times of X-ray observations of polars the energy output of the reprocessed component was found to be much larger than expected from the standard accretion model. This is known as the 'soft X-ray puzzle' and was thought to be a general property of those systems. Later investigations with XMM found ratios between shock and reprocessed component more consistent with the standard accretion model, although some systems show large deviations. We used the XMM science archive to re-analyze all observations of polars made during the lifetime of XMM with regard to the spectral energy distribution to verify the status of the soft X-ray excess. Using the largest sample of objects and the latest instrument calibration gives a better answer whether this excess and thus an accretion scenario different from the standard model is the "normal state" or an exception.

A Model for Emission Line Production in Polars

Steve Howell

NOAO

Polars produce emission lines which have many components: Broad, narrow, and "satellite". The origin of each component is discussed using dynamical information and the example systems VV Pup, AM Her, EF Eri, and ST LMi. A cartoon model is presented showing the origin of each emission line component in the context of the binary system.

X-ray Diagnostics of Accretion Plasmas in Selected Soft Polars

Iris Traulsen

Institut für Astrophysik, Georg-August-Universität Göttingen

With the X-ray satellite XMM-Newton, we investigate selected polars which have shown an extreme soft-to-hard X-ray flux ratio in the ROSAT All-Sky Survey and study the spectral components, their flux contributions, and the physical structure of the accretion regions. In this context, we present XMM-Newton observations of the two soft X-ray dominated polars AI Tri and QS Tel in a high state and an intermediate high state of accretion respectively, ammended by quasi-simultaneous optical monitoring. We employ multi-temperature black body and plasma emission models for the mean and phase-resolved X-ray spectra. The long-period polar AI Tri shows highly variable soft X-ray flux over about 70% of the binary orbit, in addition to a weak hard component. Its spectrum consists of mildly absorbed blackbody-like emission from the heated white-dwarf surface plus an additionally absorbed plasma component with a peak temperature of 20keV and a slight underabundance of metals. The dominating contribution to the X-ray data of QS Tel, known to

switch between one-pole and two-pole accretion, is the soft component at energies below 2keV. In addition, a fainter, relatively cool plasma at temperatures between 0.2 and 5keV gives rise to rich metal lines. The shape of the light curves is explainable with a single active pole at the time of observation. Both systems show a dip in their flaring soft X-ray light curves during the bright phases, which can be interpreted as a self-eclipse of the accretion region.

Time-Resolved Optical Photometry of Hard X-ray Emitting Cataclysmic Variables

Nicola Masetti

INAF/IASF-Bologna

Thanks to the combination of hard X-ray data data afforded with the INTEGRAL satellite and optical spectroscopy at various telescopes, a number of new, possibly magnetic, Cataclysmic Variables (CVs) has recently been discovered. We here report on the preliminary analysis of B-band optical photometry performed with the 2.15m 'Jorge Sahade' telescope at CASLEO (Argentina) on 5 CVs discovered at hard X-rays with INTEGRAL and which show features of a magnetic white dwarf (WD) in their optical spectra. The aim of these observation is to derive the orbital period of these systems and the spin periodicity of their accreting WD.

White Dwarfs in Intermediate Polars

Kunegunda Belle

Los Alamos National Laboratory

Intermediate polars (IPs), magnetic cataclysmic variables (CVs) in which the white dwarf (WD) has an intermediate strength magnetic field (B $\leq$ 5 MG), present an interesting laboratory for the study of the evolution of CVs as they contain elements of both non-magnetic and magnetic systems. Do magnetic CVs and IPs evolve in the same manner as non-magnetic systems? One answer in this puzzle may come from understanding the nature of the white dwarf in a magnetic CV. Standard CV evolution theory predicts a white dwarf temperature for a given CV orbital period and accretion rate. By investigating the temperature of white dwarfs in IPs and comparing the temperatures to those predicted from theory, we can learn where IPs fit into the model of CV evolution. Here we present the results of our continued study of the nature of WDs in IPs. We compare temperatures derived from model fits to UV spectra with temperatures calculated based on the accretion rate and binary orbital period. Our preliminary results indicate that IPs follow the general trend of magnetic CVs containing cooler WDs than non-magnetic CVs.

Unveiling New Quiescent Black Holes

Jesus Corral-Santana

Instituto de Astrofisica de Canarias

X-ray transients provide the best evidence for the existence of stellar-mass BHs, with almost 20

confirmed cases based on dynamical studies. However, these are only the tip of the iceberg of an estimated population of a few thousand BH binaries, which slowly reveal themselves through secular X-ray outbursts. Therefore, new strategies aimed at unveiling this dormant population are clearly needed. We propose to use the IPHAS catalogue, together with several diagnostic diagrams in IR, X-rays or radio, as a shorcut to unveil the brightest members of the Galactic population of BH binaries. We also propose to use filters centered in lines (HeI 5876, Halpha, Hbeta,...) and continuous to distinguish between BHs and the rest of objects with Halpha emission.

Spitzer Space Telescope Observations of Low Mass X-ray Binaries

Stefanie Wachter

Spitzer Science Center, Caltech

We are conducting a systematic study of the mid-IR properties of compact objects utilizing both archival data and targeted observations obtained with the Spitzer Space Telescope. Here we present selected results for the low mass X-ray binaries. We combine the Spitzer detections with data at other wavelengths to characterize the SED of these sources and to search for the signatures of jets or circumbinary material.

Synchrotron "Jets" in Unexpected Places: GX 17+2 and V1223 Sgr

Jillian Bornak

New Mexico State University

The neutron star X-ray binary GX 17+2 is an important object for it is one of only eight Z sources, which are thought to be neutron star binaries accreting near or at the Eddington rate. We have spent the past three years monitoring GX 17+2 in the infrared, and we found IR brightening events which recur on a period of 3.01 days and last approximately four hours. We suspect the emission is synchrotron radiation from a jet, for other processes are unable to affect the IR flux without similarly affecting the soft X-rays, which show no periodicities. In addition, we have obtained additional Spitzer IRS spectroscopy of the intermediate polar V1223 Sgr and find that this object was very bright during our first (14 to 21 μm) spectrum and rapidly declined thereafter. The spectrum resembles that of AE Aqr in that it rises to the red. Such a short-lived event with this type of spectrum can only logically be due to synchrotron emission. This suggests that synchrotron emission from IPs might be quite common.

Recent Observations of KY TrA

Cristina Zurita

Instituto de Astrofisica de Canarias

We present recent observations of the historical X-ray Transient KY TrA in quiescence.

Echo-Mapping the Optical Emission from X-Ray Binaries

Kieran O'Brien

European Southern Observatory

In Low-mass X-ray Binaries much of the optical emission arises from the reprocessing of X-rays into lower energy photons. The time-delayed optical echoes can be used to indirectly image (echo-map) the system, with the ability to determine fundamental physical parameters of the system, such as the binary separation and inclination of the system. We have exploited a novel, EMCCD-based detector, ULTRASPEC, mounted on EFOSC2 at ESO's 3.6m telescope to perform photon-counting, optical spectro-photometry. These observations were simultaneous with pointed RXTE observations, giving us unprecedented time resolved, multi-wavelength observations. Our optical spectra have a time resolution of 1-second and cover the continuum and emission lines in the region encompassing the Bowen-blend. This group of lines is particularly interesting as they are generated via fluorescence and appear to originate from the surface of the donor star. We have measured the time-delayed optical echoes of 4 Type-I X-ray bursts observed in the lightcurves of the Low-mass X-ray Binary EXO 0748-676. I will present the results from these observations, which show a clear correlation between the X-ray and optical lightcurves and discuss the future for this technique.

Long-Term Superorbital Periodicities During Active States of LMXBs: IGR J17098-3628 and EXO 0748-676

Marissa Kotze

South African Astronomical Observatory

We compare the recently discovered INTEGRAL X-ray transient, IGR J17098−3628, with the well-known X-ray burster, EXO 0748−676, and establish that, during their "active" states, both display long-term quasi-periodic modulations of ∼163 days and ∼181 days, respectively. These must be "superorbital" modulations, as the orbital period of EXO 0748−676 is well established (3.8 hr), and hence we interpret both object's long periods as representing some intrinsic properties of the accretion disc (such as coupled precessional and warping effects). By analogy, we therefore suggest that IGR J17098-3628 is likely to have a <1 d orbital period.

The Mass of the Neutron star in the LMXB X1822−371

Teo Muõz-Darias

Instituto de Astrofísica de Canarias

High excitation emission lines arising from the donor star have been detected in several X-ray active Low Mass X-ray Binaries (LMXBs) during the last few years (see Cornelisse et al. 2008 for details). We have computed the K-correction for these emission lines formed on the irradiated face of the donor, which can provide accurate mass determinations for either neutron stars or black holes.

Here we review previous results obtained by using this technique and present 10 km/s resolution VLT+UVES data on the LMXB X-ray pulsar X1822−371. We measure an emission line velocity of Kem = 280 ± km s^{-1}. The application of the K-correction to this K_{em} value, together with previous determinations of system parameters, yields 1.52 $M_\odot$ < M_1 < 1.85 $M_\odot$. This result strongly suggests the presence of a massive neutron star in this binary.

The Galactic Bulge Survey

Manuel Torres

Harvard-Smithsonian Center for Astrophysics

The Galactic Bulge Survey is an ongoing X-ray and optical survey aiming at characterising the population of compact stellar X-ray sources in the Galactic Bulge. In order to achieve this goal we are observing with *Chandra* a 0.5° × 0.5° area centered at 0.25° above and the same area below the Galactic Center (GC). With a limiting X-ray luminosity of $L_X \sim 3 \times 10^{32}\,\mathrm{erg\,s^{-1}}$ at the distance of the GC (taking absorption into account), we sample the most populous compact stellar X-ray sources: Cataclysmic Variables (CVs) and (quiescent) low-mass X-ray binaris (qLMXBs). To allow for optical identifications we have obtained deep optical (r', $i' < 23.5$ at 3σ and Hα) images covering the GBS area. We expect to discover > 400 and ∼ 500 optical counterpats to CVs and qLMXBs, respectively. Here we report on the status of this survey and present the first results.

XMM Observations of the Super-Soft X-Ray Source Cal 83

Robert Schwarz

Astrophysikalisches Institut Potsdam (AIP)

CAL 83 is the canonical close-binary supersoft X-ray source and also among the two rare systems to show repeated on/off X-ray states. These systematic changes are anti-correlated with the optical brightness and closely connected to dynamical processes occuring at near Eddington accretion rates. We present results of an optically triggered XMM monitoring campaign of CAL 83 following its evolution through different phases of its state transition. Contrary to the regular and quasi-periodic variation of RXJ0513−69, the variability pattern of CAL 83 is much more complex showing intermediate brightness states and temporary re-brightenings. This is also reflected by the X-ray variability of the source, which instead of a simple on/offpattern, displays a wide luminosity range. Low-resolution X-ray spectra during the intermediate brightness state can be well fitted by a blackbody. There is indication for a correlation of the blackbody temperature with the observed X-ray flux. Such temperature changes are expected for limit-cycle models that include variations of the effective radius of the white dwarf. We find no evidence for absorption in the X-ray spectra, which would support models that propose the existence of a strong variable wind.

Discovery of Accretion-Driven X-rays from the Nearby Post Common Envelope Binary EC 13471-1258

Marco Matranga

Harvard-Smithsonian Center for Astrophysics

Short-period binaries containing a white dwarf primary and a late-type star as secondary are of fundamental importance to astrophysics as they are progenitors of cataclysmic variables and candidate progenitors of SNe1a explosions. Stellar evolution theory predicts that these systems are the outcome of a common envelope evolutionary phase in which frictional drag leads to a rapid spiraling down of the orbit of an initially wide binary. Here we present the discovery of eclipsing X-ray signatures of accretion in the nearby "pre-cataclysmic" short-period (P = 3.62 h) binary EC 13471-1258. The EPIC pn light curve X-ray eclipses are offset in phase by 0.25 cycles with respect to the optically-derived ephemeris and we explain this disagreement in terms of period drift. Interpreting the X-rays in terms of emission from the boundary layer of an accretion disk, we obtain a mass transfer rate of $\dot{M} = 1.7 \times 10^{-13} M_{\odot}$/yr—one of the lowest mass accretion rates found for a CV. With a distance of 55 pc EC 13471-1258 becomes the nearest such accreting object known. We conclude that EC 13471-1258 is either a newly-accreting CV or one that has recently emerged from a hibernation episode.

Pre-Cataclysmic Variable V471 Tau – Striking (O−C) Diagram

Ladislav Hric

Astronomical Institute of the Slovak Academy of Sciences

V471 Tau was discovered as a spectroscopic binary and is a prototype post-common envelope system and cataclysmic binary progenitor. The system consists of the cool red dwarf K2V or main sequence star and the hot white dwarf. The exact distance of V471 Tau system with the value of 47 pc was derived from the Hipparchos satellite data. The object was classified as the eclipsing binary star with orbital period around 0.5 day. Wave-like feature on the light curves with the period of 191 days was interpreted as moving large spots on the surface of the cool component. We have monitored the system photoelectrically in U, B, V and R colours since 1994. The new times of minima have been derived. They suggest that the cause of the (O−C) curve may be more complicated than the curve corresponding to the light-time effect only. Timing variations can be explained by perturbations of third body in the system or by apsidal motion.

Analysis of Interacting Binaries Using the PHOEBE Program

Daniela Barria Diaz

Universidad de Concepción

Double Periodic Variables stars (DPVs) are a group of close interacting binaries recently discovered

in the Magellanic Clouds (Mennickent et al. 2003) exhibing two types of photometric variabilities: a shorter one which reflects the binary period with typical amplitude ~ 0.05 mag. and an aditional longer periodicity (or quasi periodic) with much larger amplitude ~ 0.2 mag., still unknown. Due to geometrical and kinematic properties of eclipsing binaries the study of these systems is important for revealing fundamental properties of the stars. This work is based on the modeling of eclipsing DPVs which could help to understand its nature and the long-term variability. PHOEBE (PHysics Of Eclipsing BinariEs) is a software package design for modeling eclipsing systems which allowed for a set of experimental light curves and radial velocity curves estimates physical parameters that theorically best matches the data. We are showing the results in the modeling of some eclipsing DPVs with the best fits and final parameteres using PHOEBE.

The Eclipsing Cataclysmic Variable SDSS 154453+2553

Julie Skinner

Physics and Astronomy, Dartmouth College

This newly-identified CV was found by Boris Gaensicke in an inspection of the SDSS data. It eclipses, with a period of just over 6 hours. The H-alpha emission shows a strong rotational disturbance during the eclipse, indicating that it arises in an accretion disk. The spectrum shows a contribution from an M-type secondary star. We present spectroscopy through the orbit, eclipse photometry taken by Eve Armstrong and Steve Brady, and an up-to-date ephemeris.

Smoothed Particle Hydrodynamic Simulations of Accretion Flows in Long-Period Binaries

Fergus Wilson

University of Leicester

I present 3D smoothed particle hydrodynamic simulations of accretion flows in long period binaries containing white dwarf primaries and red giant secondaries, with mass transfer via Roche lobe overflow or stellar wind capture. In particular, I address the accretion disc formation conditions and the structure of the disc. I also present the results of simulations of late asymptotic giant branch stars in binaries and examine the morphology and structure of the pre-/planetary nebulae phase.

Multi-dimensional Radiation Transport in Rapidly Expanding Envelopes

Peter Hoeflich

Florida State University

We focus our discussion on our current implementation of multi-dimensional, non-relativistic radiation transport into our radiation-hydro code for rapidly expanding, low density envelopes commonly

found in core collapse and thermonuclear supernovae (+ novae and WR stars). Line opacities are treated in the narrow line limit and consistency with the rate equations is achieved iteratively in each time step via 'accelerated lambda iteration'.

The solution of the transport is based on a hybrid scheme between the Eddington-Tensor and a Monte-Carlo method. The latter is used to calculate the geometry terms/Tensor elements. We use this approach to reduce problems related to a grid-imposed directional dependence of the speed of light and related to formal in discretized systems based on short or long characteristics, namely, that the frequency or directional errors increase with resolution or runs out of control with respect to computational feasibility and memory requirements. However, there is no free lunch: Based on some test problems, we discuss the drawback and implicit limitations of our approach, in particular, with respect to highly dynamic systems, the accuracy in the rate equations, and AMR. The principle and current limitations are shown at the example of some practical and 'impractical' applications.

Using OSIRIS on the Gran Telescopio de Canarias to Study CVs

Alessandro Ederoclite

Instituto de Astrofisica de Canarias

OSIRIS is the first instrument attached to the Gran Telescopio de Canarias (GTC). OSIRIS is a multi-mode instrument, operating in the optical, capable of direct imaging (using Sloan filters as well as Tunable Filters), long-slit spectroscopy and Multi-Object spectroscopy. OSIRIS'CCDs have also a charge shuffle mode and a frame transfer mode. GTC/OSIRIS represents a new and unique opportunity for CV-related studies because of the diameter of GTC, its very good sensitivity and the fast modes (charge shuffling and frame transfer). In this poster we present the characteristics of GTC/OSIRIS and some CV-related science cases.

The Kagoshima University 1m telescope

Akira Imada

Department of Physics, Faculty of Science, Kagoshima University

Kagoshima University 1m telescope (KU1m) was established in 2001 for the purpose of photometric monitoring of variable stars. The telescope has $UBVR_{\rm c}I_{\rm c}JHK_{\rm s}K$ filters and the limiting magnitudes are 20.5 in V and 16.3 in $K_{\rm s}$, respectively. Here we present basic properties and recent scientific results of KU1m.

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Program for Wednesday

"Magnetic CVs, Accretion Disks, and Symbiotic Stars"

Talks

Time	Speaker	Topic
09:00 to 09:30	Iris Traulsen	X-Ray Emission of Polars
09:30 to 10:00	Axel Schwope	XMM Observations of Polars
10:00 to 10:30	David Buckley	Observations of CVs with SALT
10:30 to 11:00	**Coffee Break**	
11:00 to 11:20	Fred Walter	The Downside of EF Eri
11:20 to 11:50	Paul Mason	Radio Observations of CVs
11:50 to 12:20	Domitilla de Martino	X-Ray Observations of IPs
12:20 to 12:25	Poster Review	
12:25 to 01:35	**Lunch**	
01:35 to 01:48	Gerardo Luna	Chandra Observations of EX Hya
01:48 to 02:01	Christopher Mauche	Multiwavelength Observations of AE Aqr
02:01 to 02:31	Knox Long	Geometry and Structure of CV Winds
02:31 to 03:01	Peter Wheatley	Origin of DNe Outburst X-Rays
03:01 to 03:31	**Coffee Break**	
03:31 to 03:51	Ronald Mennickent	Supercycles in Double Periodic Variables
03:51 to 04:21	Graham Wynn	Outrageous Outbursts
04:21 to 04:51	Jennifer Sokoloski	Do Disks Survive Novae Explosions?
04:51 to 05:11	Joanna Mikolajewska	Symbiotic Stars: Challenges to Evolution Theory
05:11 to 05:24	Ladislav Hric	AG Dra - A Symbiotic Mystery
05:24 to 06:00	**Posters & Cocktails**	
06:30	Buses leave for banquet	from NOAO building

Posters

#60 Tom Harrison	#61 Rob Seaman	#62 Viktor Malanushenko	#63 Risako Matsui
#64 Brad Schaefer	#65 Drahomir Chochol	#66 Akira Arai	#67 Akira Imada
#68 Solen Balman	#69 Allen Shafter	#70 Auni Somero	#71 Augustin Skopal
#72 Augustin Skopal	#73 Attay Kovetz	#74 Dina Prialnik	#75 Pierluigi Selvelli
#76 Antonio Bianchini	#77 Kevin Moore	#78 Marina Orio	#79 Mariko Kato
#80 Dai Takei	#81 Jan-Uwe Ness	#82 Jim Lyke	#83 Tomasz Kaminski
#84 Gagik Tovmassian	#85 Andres Aviles	#86 Sergey Zharikov	#87 Koji Mukai

Abstracts

X-ray Emission of Polars: What Have We Learned with XMM-Newton and Chandra?

Iris Traulsen (for Klaus Reinsch)

Universität Göttingen

Magnetic white dwarfs in accreting close binaries (polars) are among the brightest soft X-ray sources on the sky. The large number of systems discovered during the ROSAT All-Sky Survey has laid a basis for systematic follow-up studies of polars and their physical properties. With XMM-Newton and Chandra sufficient sensitivity and spectral resolution power have become available for detailed diagnostics of the continuum and line emission components. We compare the main results obtained from dedicated soft X-ray observations of polars with ROSAT, XMM-Newton, and Chandra over almost two decades and discuss their implications on the physical structure and parameters of the accretion region and the relevant radiation processes.

XMM-Newton Observations of Polars

Axel Schwope

Astrophysikalisches Institut Potsdam (AIP)

We present results of our ongoing multiwavelength study targeting the brightest Polars with XMM-Newton. Comprehensive data sets with simultaneous X-ray and optical spectroscopy and photometry were collected. We investigate the physics of the hard X-ray emitting shock by X-ray plasma diagnostics and optical cyclotron spectroscopy. We discuss the phase-dependent strength of absorption and reflection components in the X-ray spectrum. We perform line spectroscopy with the RGS searching for Doppler shifts. Finally we discuss the spectral energy distributions from X-rays to the IR addressing the questions of accretion mode and energy balance.

High Time Resolution Observations of CVs with SALT

David Buckley

SAAO

The Southern African Large Telescope (SALT), and its first generation instrument suite, have unprecedented capabilities for high signal-to-noise time resolved studies of CVs, including high-speed photometry, spectroscopy and polarimetry. This talk discusses these in detail and high-lights recent results on eclipsing polars and intermediate polars. We discuss the potential for time resolved spectropolarimetric observations of magnetic CVs with SALT, due to begin later in 2009.

The Downside of EF Eri

Fred Walter

Stony Brook University

The polar EF Eridani has been in a prolonged low state since 1997. Since 2003 we have been monitoring the system with the SMARTS 1.3m and 1.5m telescopes both photometrically and spectroscopically. This prolonged low state offers the opportunity to search for the secondary, and probe the interaction between the secondary's winds and the magnetic field of the white dwarf. The system has rebrightened three times, briefly in March 2006 and March 2008, and again in October 2008. I shall give an overview of the long term behavior of EF Eri, and question whether it is returning to the halcyon days of the 1970's and 80's when it was one of the brightest soft X-ray sources in the sky.

Radio Observations of Cataclysmic Variables

Paul A. Mason

UTEP/NMSU

Results from a radio survey are reported as well as the results from a multi-wavelength study of the high field polar AR UMa. Most CVs are not radio emitters. Only magnetic CVs have been detected outside of outburst. I review models for radio emission mechanisms and examine what constraints observations currently place on models. The presence of an accretion disk may quench radio emission. Prospects for future studies are discussed.

Magnetic CVs in the XMM-Newton Era: the Intermediate Polars

Domitilla de Martino

INAF Osservatorio Astronomico di Capodimonte Napoli

I will summarize main results on Intermediate Polars as obtained from X-ray observations with XMM-Newton. Temporal and spectral properties suggest that this group of magnetic CVs share some commonalities with the Polars. The increasing number of new IPs discovered in hard X-rays may suggest that Intermediate Polars are still a hidden, but important, population of galactic accreting X-ray binaries.

A 500 ks Chandra/HETG observation of EX Hya

Gerardo Luna

Harvard

The intermediate polar EX Hya was observed with Chandra/HETG for 500 ks in 2007 May, resulting in a very high signal-to-noise X-ray spectrum. This long observation allows us to explore with unprecedented accuracy the emission lines formed in the accretion column. In addition to the already known collisionally-excited narrow emission lines formed in the shock's cooling-flow, for the first time in the X-ray band we detect an additional broad component in the line profiles, which we believe arises from photoionization of the accretion column by the shock's radiation field. Moreover, this component appears to be occulted by the body of the white dwarf, introducing additional contraints on the size of the accretion spot and the height of the shock. We develop photoionization and electron scattering models for the broad component of OVIII 18.97, Si XIV 6.18, Mg XII 8.42, and Fe XVII 16.78 Angstrom. We also report progress on modeling the shock spectrum.

A Campaign of Multiwavelength Observations of AE Aqr

C.W.Mauche, M.Abada-Simon, J.F.Desmur, M.J.Dulude, Z.Ioannou, D.Neill, A.Price, N.Sidro*, W.F.Welsh, and members of the AAVSO and CBA

*For the MAGIC collaboration

We will describe, in 10 minutes or less, results of a multiwavelength (radio, optical, UV, X-ray, and TeV gamma-ray) campaign of observations of AE Aqr conducted in 2005 August.

The Geometry and Structure of the Winds of Cataclysmic Variables

Knox Long

Space Telescope Science Institute

The UV spectra of dwarf novae in outburst and nova-like variables exhibit blue-shifted and/or P-Cygni like profiles of resonance lines, such as OVI, NV, Si IV and CIV, which are understood to arise from a wind emanating from the disk. Individual lines, principally CIV, have been modelled in terms resonant scattering of disk photons in winds with mass loss rates from 1-10% of the mass accretion rate. Here I describe our recent attempts to determine the ionization structure and geometry of the winds in a group of such systems, including SS Cyg and VW Hyi, from FUSE and HST spectra using a radiative transfer code (Long & Knigge 2002) that simulates the entire UV spectra of such systems based on a kinematic description of a bipolar outflow. It is straightforward to produce spectra that qualitatively resemble those of observed cataclysmic variables, and to model individual lines in detail. It is difficult to however to find a single model spectrum that fits all of

the lines in an observed spectrum with precision, especially when the observed spectrum includes prominent features from ions with very different ionization thresholds. To do better, one appears to need both a better kinematic model of the wind near the disk and a wider range of ionization states in the high velocity portion of the wind. I close with a summary of what what this and related analyses have revealed about CV winds thus far, and suggest a path forward.

The Origin of Outburst X-ray Emission

Peter J. Wheatley

Dept. of Physics, University of Warwick

In this talk I will review X-ray observations of dwarf novae and discuss, in particular, the origin of the hard X-ray emission seen during outburst. I will argue that this emission does not arise in the boundary layer and instead originates in the magneto-rotational instability in the disc.

Supercycles in Double Periodic Variables

Ronald Mennickent Cid

Universidad de Concepción, Chile

We investigate the nature of the supercycles observed in Double Periodic Variables (DPVs). We explore the possibility that the supercycles indicate the quasi- periodic depletion of a circumprimary disc into a circumbinary envelope. We review the observational evidence for hot circumprimary discs, matter outflows and circumbinary discs in DPVs and discuss the DPV evolutive stage.

Outrageous Outbursts: Accretion Disc Formation and Stability in Long Period CVs and CV-like Binaries

Graham Wynn

University of Leicester

Long period binaries containing a white dwarf accreting from a giant secondary may contain very large and massive accretion discs. Dwarf nova type outbursts in these extreme discs would involve very high mass transfer rates close to the nuclear burning limit and may provide a significant formation channel for type Ia supernovae. I will present the results of 3-D, smooth particle hydrodynamics simulations of the mass transfer and accretion processes in long period systems. I consider mass transfer from the giant to the white dwarf by Roche lobe overflow and stellar wind capture, examine the disc formation process in both cases and address the stability of the disc. Using the recurrent nova RS Ophiuchi as an example system I show that both hot and cold steady-state disc models face a number of problems in explaining observed system properties and theoretical expectations. I suggest a number of possible accretion solutions to drive the dramatic outbursts of

this intriguing object.

What if Accretion Disks Survive Nova Explosions?

Jennifer Sokoloski

Columbia University

Novae are the most common major eruptions in the universe. Despite this fact, many basic questions about these events remain unanswered. For example, what does the explosion do to the white dwarf's accretion disk, and what role (if any) does the accretion disk play after the start of the thermonuclear runaway? Although little theoretical work has been done on this topic, it is often assumed that the ejecta sweep away the accretion disk. I will review observational evidence that both small and large accretion disks can survive nova explosions. The survival of an accretion disk throughout a nova explosion could have implications for, e.g., the production of jets, the shaping of the ejecta, and even the evolution of the mass of the white dwarf.

Symbiotic Stars: Challenges to Binary Evolution Theory

Joanna Mikolajewska

N. Copernicus Astronomical Center

Symbiotic stars are interacting binaries with the longest orbital periods and so the largest component separations, and their study is essential to understa nd the evolution and interaction of detached and semi-detached binaries. In thi s contribution we will present and discuss some recent observational results wh ich may have important implications for our understanding of very late binary e volution. In particular, we will concentrate on orbital parameter estimates and their distribution, as well as mass transfer mode and activity.

AG Dra - A Symbiotic Mystery

L. Hric

Astronomical Institute of the Slovak Academy of Sciences

AG Dra is well known bright symbiotic binary with the white dwarf and pulsating red giant. Long-term photometry monitoring and new behaviour of the system are discussed. In the system of Ag Dra were detected two periods of variability. The longer 549.73 day is connected with orbital motion and the shorter 355.27 one was interpreted in our older paper as the pulsation of the red giant. Moreover we found resonance between both periods. We understand that this resonance can produce an activity of the system. Nevertheless, many questions are still open and it is also worth noting them: where is the recent stage of quiescence?, why the maximum of brightness during the year 2008 was occured 60 days earlier?, how many types of outbursts are present in the system?

Observing Interacting Binaries with SIM-Lite

Tom Harrison

New Mexico State University

SIM-Lite will allow for astrometric measurements of the masses for a wide variety of interacting binary star systems. Nearly all interacting binaries are too distant for ground-based astrometric measurements of their reflex motions, thus other techniques must be used to estimate component masses. But for interacting binaries, the presence of on-going accretion makes it difficult to apply such techniques. SIM-Lite will be a powerful tool that will be used to directly measure the reflex motion of the components in distant, astrophysically interesting binaries. But the presence of accretion disks, streams, and "hotspots" in the majority of the systems of interest imposes some uncertainty in the derived astrometric orbits. We have undertaken a study to determine the best SIM-Lite observing procedure for each class of interacting binary.

Hotwiring the Transient Universe

Rob Seaman

NOAO

"Time discovers truth" - Seneca

Empirical studies of time varying celestial phenomena date back to Galileo and Tycho. Telegrams conveying news of time varying and transient phenomena have been key astronomical infrastructure since the 1800s. Recent time domain studies have been key to a succession of exciting discoveries, but massive new surveys will soon overwhelm our nineteenth century transient response technologies.

Meeting this challenge demands a new autonomous architecture for astronomy. Systems must interoperate from the proposal of new research, through experimental design and the scheduling of telescope operations, to the archiving and pipeline processing of data to compile light curves, to the publishing of derived data products, through automated follow-up observations via robotic and ToO assets, and to the display and analysis of scientific results. All leading to adaptive adjustment of time domain investigations.

The VOEvent protocol of the International Virtual Observatory provides the engine for this flexible and rapidly responsive astronomical architecture. Theoretical, observational and logistical issues will be discussed in the context of the numerous community projects that are benefiting from VOEvent.

IVOA transient alert working group meeting at the end of April in Santa Cruz:

`http://www.cacr.caltech.edu/hotwired2`

The WZ Sge-type Dwarf Nova SDSS J080434.20+510349.2

Viktor Malanushenko

Apache Point Observatory, NMSU

The cataclysmic variable star SDSS J080434.20+510349.2 (J0804) is a WZ Sge type star which had an outburst in 2006. Previous observations of this object covered the terms before, during, and after the outburst. Light curves show two-humped orbital light modulation, and first and second series of rebrightenings (Szkody et al. AJ 2006, 131,973; Pavlenko E.P. et al, ASP Conf. Ser.,2007,372,511; Zharikov et al, A&A 486, 505, 2008). In 8 - 9 months after the outburst happened, the white dwarf pulsation has been detected for the first time (Pavlenko, 2009, in press). We studied the behavior of J0804 on the time scale from a few minutes to several months. We concentrated on the later stage of the outburst decline, profiles of the orbital light curves, and the white dwarf pulsation. We used photometric observations with the Photometric Telescope at Apache Point Observatory (r'-filter), both the 2.6 meter Shajn Telescope and Cassegrain 38-cm Telescope at Crimean Astrophysical Observatory, Ukraine (R-filter and white light), and a series of published observations by Zharikov et al., 2008. We got the coverage from December 2006 to May 2008 for 2 years after the outburst happened. We found out that: (1) The third series of $\sim$ 0.05mag rebrightenings with a 50 - 55 days period has been detected in January - May, 2008. (2) 2006-2008 periodogram shows the orbital period P_{orb} = 84,97 min, period of the white dwarf pulsation, P_{puls} = 24.68 min, and two others periods P_2 = 21.24 min and P_3 = 12.1-12.3 min. Period P_2 corresponds to fourth harmonic of orbital period and P_3 corresponds to the superposition of orbital period and white dwarf pulsation. We found significant drift of P_{puls} over 2006 - 2008.

Optical and Infared Photometric Observations of V455 And

Risako Matsui

Hiroshima University

We report optical and infrared photometric observation of WZ Sge-type dwarf nova, V455 And during the superoutburst in 2007. Our 6-band simultaneous observations allow us to estimate the temporal variation of temperature and size of the emitting region associated with early and ordinary superhumps. The mechanism of early superhumps, which are only seen in WZ Sge stars, has poorly been understood. Our photometric observations were performed with the KANATA (V, J, and Ks bands) and MITSuME (g, Rc, and Ic bands) telescopes. A hot ($>$ 11000K) optically-thick accretion disk suddenly disappeared when the superoutburst finished, while the disk still remained optically thick with a moderately high temperature ($\sim$ 8000K) even after the outburst. Our superhump analysis shows a heating and a subsequent expansion-cooling processes. The temperature maximum preceded the superhump maximum. In the early-superhump analysis, on the other hand, the object was bluest at the hump minimum and no clear heating process was observed. This indicates that the temperature of the early superhump light source is lower than those of underlying components.

Comprehensive Light Curves for Recurrent Nova Eruptions: The Data

Brad Schaefer

Louisiana State University

I collect virtually all photometry of the ten known galactic recurrent novae (RNe) and their 37 known eruptions. This consists of my modern measures of nearly all archival plates (providing the only data for half of 37 known eruptions), my own 10,000 CCD magnitudes from 1987 to present (providing virtually all of the magnitudes in quiescence for seven RNe), over 140,000 visual magnitude estimates recorded by amateur astronomers (who discovered half the known eruptions), and the small scattering of magnitudes from all the literature. From this, I produce various uniform products; (1) BVRIJHK comparison star magnitudes and BV comparison star sequences to cover the entire range of eruption, (2) complete light curves for all eruptions, (3) best fit B and V light curve templates, (4) orbital periods for all-but-one RN, (5) exhaustive searches for all missed eruptions, (6) measured discovery efficiencies since 1890, (7) true recurrence time scales, (8) predicted next eruption dates, (9) variations on time scales of minutes, hours, days, months, years, decades, and century, (10) uniform distances and extinctions to all RNe, (11) BV colors at peak and UBVRIJHK colors at minimum all with extinction corrections, and (12) the spectral energy distributions over UBVRIJHK. Highlights of this work include the discoveries of one new RN, seven previously-undiscovered eruptions, and five new orbital periods. I have also measured the orbital period change of two RNe across recent eruptions with accuracies of 0.5 ppm, and I have determined the RN death rate in our Local Group to an accuracy of a factor of 3. An important utility of this work is for determining whether RNe can be the progenitors of Type Ia supernovae. In particular, whether there are enough RNe to produce the observed supernova rate and whether the RN white dwarf is gaining mass over each eruption cycle.

Superoutbursts of V466 And and Dwarf Nova Tri 2008 - New WZ Sge Type Objects

Chochol, D., Andreev, M., Katysheva, N., Shugarov, S., Volkov, I.

Astronomical Institute, Slovak Academy of Sciences

New WZ Sge-type dwarf novae: V466 And and OT J023839.1+355648 in Triangulum were discovered in September 1, 2008 and October 25, 2008, respectively. Multicolour CCD UBV(RI)c photometry of both objects during their superoutbursts is presented. The periods of early and ordinary superhumps were determined. The evolution of both objects in a two colour (U-B, B-V) diagram is compared. The blackbody temperatures of the objects at the time of their brightness maxima were in the range 14 000 - 15 000 K. The interstellar extinction in the direction of both dwarf novae seems to be negligible.

Peculiar Rebrightening Event in WZ Sge Star 1RXS J023238.8-371812

Akira Arai

Hiroshima University

Several short period SU UMa-type dwarf novae, in particular, WZ Sge-type stars tend to exhibit rebrightenings after superoutbursts. The rebrightening phenomenon is problematic for the disk instability theory of dwarf novae since it requires a large amount of remnant matter in the disk even after superoutbursts. We, here, report on our photometric results of 1RXS J023238.8-371812. 1RXS J023238.8-371812 is a WZ Sge type dwarf nova which was discovered in 2007 September in its superoutburst. We observed a late phase of the outburst, then discovered two types of rebrightening stages after the superoutburst. The fist stage was a plateau type, long lasting rebrightening, as observed in AL Com. It was followed by the second stage in which consecutive short flares were observed, like EG Cnc. The coexistence of two types of rebrightenings had never been seen in dwarf nova outbursts. Based on these results, we suggest that the plateau type rebrightening require the remnant gas more than the periodic type. We report our optical and near-infrared observation of a classical nova V5579 Sgr. V5579 Sgr (= Nova Sagittarii 2008 #1) was discovered on 2008 April 18 by K. Nishiyama and F. Kabashima at 8.4 mag (IAUC 8937). We started observations of the nova in B–Ks bands using the KANATA telescope just after the IAUC alert. The object reached the maximum on $\sim$JD 2454580. The Ks-band light curve shows a bump around JD 2454600, although the optical flux keeps a steep fading after the maximum. After the bump, the spectral energy distributions in the near-infrared regime can be described by 1500-1000 K blackbody radiation. It indicates the occurrence of the dust formation in V5579 Sgr. The dust-forming event in V5579 Sgr occurred only about 15 days after the maximum. It is much earlier than that of typical dust-forming novae, in which it takes > 30 days. A notable twin of V5579 Sgr is V1280 Sco, which experienced the dust formation only about 10 days after the visual maximum. In this presentation, we discuss the diversity of the dust fromation event in novae comparing V5579 Sgr to the other dust-forming nova.

Superhump period changes in SU UMa-type dwarf novae

Akira Imada

Department of Physics, Faculty of Science, Kagoshima University

We present progress in our understanding of superhump period changes in SU UMa-type dwarf novae. Recent observations have shown that the superhump period abruptly changes by a few percent near the supermaximum, which cannot be reproduced by the most sophisticated simulation. Here we report on photometry of recent confirmed SU UMa stars exhibiting an abrupt shift of superhump periods, and discuss on its nature.

Detection of Extended Emission from the Nova Remnant of T Pyxidis

Solen Balman

Middle East Technical University, Ankara, Turkey

We report the marginal detection of an extended nebulosity out to 8-10 arc sec in a radial profile and imaging of the recurrent nova T Pyx using XMM-Newton EPIC PN data. We calculate that the nebulosity has a count rate of 0.004-0.006 c/s at an absorbed X-ray flux of 5.4×10^{-14} erg cm^{-2} s^{-1} with a luminosity of 5.7×10^{32} erg s^{-1}. The source spectrum is not consistent with a blackbody emission model as a single model or part of a two component model fitted to the XMM data. The spectrum is best described by a double MEKAL model at 0.16 and 1.24 keV with neutral hydrogen column density about 10 times more in the hotter X-ray component than the cooler one. The central source is most likely not detected in the X-rays (see Selvelli et al. 2008) together with the fact that the radial profile shows mostly no point source distribution. These results suggest that the detected X-ray emission is dominated by shock-heated gas due to interaction of shells from different outbursts of the recurrent nova. We will compare the existing optical data on the shells of T Pyx with the X-rays including a discussion of the X-ray results from other detections of circumstellar interaction in nova remnants.

The Recurrent Nova Population in M31

Allen W. Shafter

Department of Astronomy, San Diego State University

More than 800 nova candidates have been reported in M31 over the past century, and their observed positions have been tabulated by Pietsch et al. (2007, A&A, 465,375). We searched these data for spatial coincidences (for different assumed positional uncertainties) to estimate the fraction of the observed nova events that may represent repeated outbursts of the same system (i.e., Recurrent Nova candidates). Then, using different models for the spatial distribution of novae outbursts in M31, we estimate, both analytically and through a series of Monte Carlo simulations, what fraction of these recurrent nova candidates are likely to be real, and what fraction are expected to result from chance positional coincidences.

The Nature of Accretion in RS Ophiuchi - Optical Monitoring Campaign at the NOT

Auni Somero

University of Leicester

RS Ophiuchi is an enigmatic symbiotic variable and a recurrent nova consisting of a white dwarf primary and a mass donating M giant secondary. This object is of particular interest as it is a very strong candidate type Ia supernova progenitor. The nature of the mass transfer in the system is

unknown and the long orbital period (455 days) poses a challenge for both accretion disc fed and stellar wind fed accretion models.

In order to shed light on the accretion mechanism of RS Oph we are conducting a monitoring campaign at the Nordic Optical Telescope. We aim to obtain high resolution optical spectra covering the complete orbital period and will compare the observed emission line profile variability to theoretical line profiles computed from smooth particle hydrodynamical simulations. We will describe the idea behind the monitoring campaign and present a preliminary analysis of the data.

The SSS Phase of RS Ophiuchi: Super-Eddington Luminosity and Strong Nebular Emission.

Augustin Skopal

Astronomical Institute, Slovak Academy of Sciences, SK-059 60 Tatranská Lomnica, EU

I will present results of modeling the SED in the supersoft X-ray to mid-IR continuum, emitted by the recurrent symbiotic nova RS Oph during the SSS phase of its 2006 outburst. The model SEDs revealed the presence of a strong stellar as well as nebular component of radiation in the composite spectrum. The former was characterized with a very high luminosity that exceeded the Eddington one by a factor of around 50, and the latter corresponded to a large emission measure of about $2.5 \times 10^{61}\,\mathrm{cm}^{-3}$ for the distance of 1.6 kpc. The nebular emission and the super-Eddington luminosity, determined directly from the SED, and the volume of the emitting region, as imaged by the VLA at day 55, are mutually consistent. Consequences of the high luminosity for the growing the white dwarf envelope are discussed.

Recent Outbursts of the Symbiotic Prototype Z And: Evidence for a Disk, Bipolar Wind and Transient Jets

Augustin Skopal

Astronomical Institute, Slovak Academy of Sciences, SK-059 60 Tatranská Lomnica, EU

From 2000 September Z And started a series of outbursts with the main optical maxima in 2000 December and 2006 July. During the initial stages and maxima of these outbursts the hot active object was characterized by a two-temperature spectrum (a warm stellar radiation and a strong nebular emission) with signatures of a mass-outflow at moderate (∼100-200 km/s) and very high (∼1000-2000 km/s) velocities. This suggests the presence of an optically thick, slowly-expanding disk encompassing the accretor at the orbital plane and a fast optically thin bipolar wind at higher latitudes. In addition, during the maximum of the 2006 outburst, highly collimated bipolar jets from Z And were detected for the first time. Their presence was transient, they disappeared by the end of 2006. Evolution in the rapid photometric variability and asymmetric ejection of jets could be explained by a disruption of the inner parts of the disk caused by radiation-induced warping of the disk.

Evolution Runs for Several Hundred Consecutive Model Nova Outbursts

Attay Kovetz

Tel Aviv University

Evolution runs for several hundred consecutive nova outbursts are presented, with emphasis on long-term evolution trends, both for the white-dwarf (WD) nova progenitor and for the nova characteristics. Different WD masses and accretion rates are considered.

Long-term Evolution of Classical Nova Systems

Dina Prialnik and Attay Kovetz

Tel Aviv University

Evolution runs for several hundred consecutive nova outbursts are presented, with emphasis on long-term evolution trends, both for the white-dwarf (WD) nova progenitor and for the nova characteristics. Different WD masses and accretion rates are considered.

The UV and Optical Properties of Old Novae

Pierluigi Selvelli

INAF-Astronomical Observatory of Trieste

The UV and optical properties of all of the old novae observed with IUE are examined. The new determinations of E_{B-V} have led to new estimates of the distances and to more accurate values for the UV luminosities. The de-reddened UV continuum energy distribution is well described by a power-law $F_\lambda \sim \lambda^{-\alpha}$ with α in the range 0.3-2.7. We have also found that the emission equivalent width of the CIV 1550 line shows a tight correlation with the system inclination angle, and that a definite relation exists between log t2 and the outburst amplitude.

The Slow, Late Decline of Nova RW UMi (1956)

Antonio Bianchini

Dept. of Astronomy, University of Padova, Italy

Nova RW UMi (1956) is still about 2 mag brighter than the pre-nova. It seems to be decaying at a rate of about 0.03 mag/y. Systematic observations obtained in the period 1995-2001 suggested the presence of 1.419 h superhumps. However, the observations collected by us since 1999 suggest the presence of QPOs with main periods that may vary and are systematically longer than the assumed superhump period. It is possible that the nova is an intermediate polar and that the decreasing

mass thansfer rate is responsible for the changes in the observed QPOs.

Using Classical Novae to Clear the Globular Cluster ISM

Kevin Moore

University of California, Santa Barbara

We examine nova shell driven winds as a method of clearing the interstellar medium (ISM) from globular clusters (GCs) We model the shell evolution with a simple three-stage model and compute the shell cooling times for metallicities ranging from Z= 1 to Z = 10^{-3}. We find that the velocities at the end of the Sedov phase are large enough to escape the GC and carry away much of the ISM.

What the X-rays Tell us on Post-Outburst Novae

Marina Orio

INAF - Osservatorio Astronomico di Padova

I will present a review of recent results on Galactic and M31 novae observed in X-rays after the outburst. I will show both statistics and a few detailed cases. I will present overwhelming evidence that white dwarf rotation and magnetic fields are very important in shaping the outburst, and I will compare the statistics of Galactic Novae with those of M31 novae. There is some evidence of a bimodality in the X-ray light curves of M31 novae, with either very short duration of hydrogen burning post-outburst, or very long lasting compared to the Galactic novae.

Light Curve Analysis of Classical Nova V838 Her – A Very Massive White Dwarf

Mariko Kato

Keio University, Japan

I present a unified model of optical and UV light curves for one of the fastest classical novae, V838 Her, based on an optically thick wind theory. The optical light curves are modeled with free-free emission and the UV 1455 Å light curve with blackbody emission. Our models of $1.35 \pm 0.02 M_\odot$ WD reproduce simultaneously the optical and UV 1455 Å observations. The mass lost by the wind is $2. \times 10^{-5} M_\odot$. The distance is estimated to be 2.7 ± 0.5 kpc for $E(B-V) = 0.53 \pm 0.5$.

Suzaku observations of the Classical Nova V2491 Cygni

Dai Takei

Rikkyo University, Japan

An optical nova was discovered on 2008 April 10.728 UT (54566.73 MJD) in the constellation of Cygnus (S. Nakano, IAUC 8934). The nova showed a brightness of 7.7 mag at the discovery, and it suddenly brightened by more than ∼10 mag. It was named "V2491 Cygni" (N. N. Samus, IAUC 8934), and suggested to be a classical nova.

Classical novae are known to be X-ray emitters at some stage of their evolution. The X-ray telescope onboard the Swift satellite monitored V2491 Cygni, and detected X-rays from day 5 of the outburst (Kuulkers et al. 2008; Page et al. 2008; Osborne et al. 2008). We requested follow-up X-ray observations with the Suzaku satellite under Director's discretionary time, and ∼20 ksec observations were performed 9 and 29 days after the outburst. An emission line from Fe and a hard X-ray component were found in the first observation. The spectrum can be represented by a combination of a optically-thin thermal plasma and a power-law model with an interstellar extinction of $\sim 10^{23} cm^{-2}$. In contrast, emission lines from O, Ne, Mg, Si, S, and Ar and a hint of a soft excess was found in the second observation. The spectrum of the second observation can be fitted by a combination of ∼0.06 keV blackbody and thin-thermal plasma models. We present the results of the Suzaku observations, and we discuss ideas to explain these complex spectra and the evolution of the nova.

Swift Observations of the Classical Nova V2491 Cygni

Jan-Uwe Ness

European Space Astronomy Centre (ESAC)

The Classical Nova V2491 Cyg was monitored in X-ray and UV with Swift. Based on the Swift X-ray light curve it was possible to accurately schedule two XMM-Newton observations at strategically important times during the SSS phase. The X-ray brightness has decreased by a factor of six from day 39.9 to day 49.7 after outburst. The spectral shape is similar with a bright continuum with absorption lines of highly ionized elements. The most prominent absorption lines originate from oxygen, while the nitrogen lines are weaker than in other SSS spectra. Shortwards of the continuum, weak neon lines can be identified that hardly change in brightness. On behalf of a larger collaboration, I present the X-ray spectra and light curves and the UV light curves from the OM.

An Expansion Parallax for V723 Cas Using OSIRIS on Keck

Jim Lyke

W. M. Keck Observatory

We use the expansion parallax as observed over 4 years with OSIRIS and the laser guide star adaptive optics (LGSAO) system on Keck II to directly determine a distance of 3.8 ± 0.25 kpc to V723 Cas (Nova Cas 1995). An integral field spectrograph, OSIRIS records a near diffraction-limited (K-band) image at a spectral resolution of R ∼3500. These data use the 35 mas pixel scale of OSIRIS. OSIRIS data allow us to spatially resolve the spectrum of an extended object and create custom narrowband filters after the fact. We describe the instrument, the data, and the data reduction process that yield this highly accurate distance and represent an unprecedented capability in the study of classical novae.

High Resolution Spectroscopy of the Merger Remnants in V838 Monocerotis

Tomasz Kaminski

N. Copernicus Astronomical Center, Poland

V838 Mon erupted at the beginning of 2002 becoming an extremely luminous star with L=$10^6\,L_\odot$. The remarkable brightening was accompanied by mass loss. Displaying an F-type spectrum in the maximum light, the object evolved to progressively later spectral types and eventually became the coolest super-giant ever observed ('later-than-M10'). The most promising scenario explaining the outburst and later evolution of the object is a stellar merger. The eruptive star V838 Mon has a B3V companion which recently started to interact with the matter lost during the 2002 eruption. We present high resolution spectroscopy obtained with HIRES/Keck and UVES/VLT in the post-outburst phase. The observations reveal a very complex system where a number of interesting components have been recognized: (i) a very rich molecular spectrum associated with the cool star; (ii) outflow/infall signatures; (iii) the spectrum of the B3V companion; (iv) emission line spectrum of the ejecta that is interacting with the hot component. The analysis of those features enables us to construct a model of the complex system.

The Long-Term Behavior of the Enigmatic FS Aur

Gagik Tovmassian

Instituto de Astronomia, UNAM

The selection of cataclysmic variables has an unprecedented variety, where every two or three species constitute a special class. However even among cataclysmic variables FS Aur is a unique case thats stands out. It has been known for having a long periodic variability observed in its light curve. The long 205 min period is stable and coherent and its echo was also observed in the wings of emission lines, which otherwise vary in accordance to the 86 min orbital period. We demonstrate here that

FS Aur appears to have even larger period in its light curve, which only can be of very exotic nature.

Cyclic Brightening in the Short Period CV SDSS J123813.73-033933.0

Andres Aviles

Observatorio Astronomico Nacional, IA UNAM

SDSS J123813.73-033933.0 (SDSS1238) is a faint short-period WZ Sge-type cataclysmic variable with orbital period P=0.05592d. The light curve of SDSS 1238 shows a 40.25 min periodic variability with an amplitude of ∼0.15 mag, which is half the spectroscopic orbital period, and a sudden and fast rise in the magnitude of the system up to ∼0.45 mag during a time about half of the orbital period after that a slow brightness decrease lasts ∼3-4 hours till a quiescence level. Such brightening happens cyclically about every 8-12h. Amplitude of 40-minutes variability depends of the system brightness. The similar behavior was found also in another short period CV SDSS J080434.20+510349.2. Interested by the similarity between the systems, we conducted a new multi-longitude, time-resolved, photometric study of SDSS J123813.73-033933.0 to establish the reasons behind their common nature, understand the origin of the cyclic brightening and its relation to the amplitude of the double-humped light curve.

Time-Resolved Photometry and Spectroscopy of the Short Period WZ Sge-type CV SDSS J080434.20+510349.2 in quiescence

Sergey Zharikov

Instituto de Astronomia, UNAM

We observed WZ Sge-type CV SDSS 080434.20+510349.2 to study the origin of long-term variability found in its light curve. Time-resolved photometric and spectroscopic observations in quiescence state of the system were carried out to conduct period analysis and Doppler tomography mapping of accretion disc structure. The preliminary results of the 2008 and 2009 years observations will be presented.

Joint Spectral/Temporal Analysis of X-ray Data on Intermediate Polars

Koji Mukai

NASA/GSFC/CRESST and USRA

The observed X-ray spectra of intermediate polars are complex, and a physical model must include multi-temperature emission, complex and time-variable absorbers, and reflection. This is a daunting task and the data are not good enough to constrain the multitude of free parameters in such a physical model. However, the spin modulations at different energies give us extra handle on the complex geometry that must be taken into account in a full model of the emission region. I will

discuss some preliminary results based on combined analysis of light curves and spectra of X-ray observations of selected intermediate polars.

NOTES

Program for Thursday

"TOADs, Recurrent and Classical Novae"

Talks

Time	Speaker	Topic
09:00 to 09:15	Kent Honeycutt	Characteristics of the Wind in BZ Cam
09:15 to 09:28	Lieke van Spaandonk	Ca II Spectroscopy of Short Orbital Period CVs
09:28 to 09:41	Kristiina Byckling	A Unique Insight into a Rare Outburst of GW Lib
09:41 to 10:01	Daisaku Nogami	Superoutburst Evolution of WZ Sge, GW Lib, and V455 And
10:01 to 10:14	Gagik Tovmassia	Simultaneous Observations of the 2007 Outburst of V455 And
10:14 to 10:27	Michele Montgomery	The Source of Negative Superhumps
10:27 to 10:52	**Coffee Break**	
10:52 to 11:05	Sergey Zharikov	Wanted: The True Bounce Back Systems
11:05 to 11:25	Brad Schaefer	Recurrent Nova Photometric Histories
11:25 to 11:45	Ashley Pagnotta	V2487 Oph: A Test of RNe Identification Criteria
11:45 to 11:58	Helena Uthas	The X-Ray Emission and Binary Parameters of T Pyx
11:58 to 12:11	Randy Campbell	Morphology of the Ejecta from the Classical Nova V723 Cas
12:11 to 12:24	Ting-Ni Lu	The Counterparts of X-Ray Sources in the Globular Cluster M12
12:24 to 01:35	**Lunch**	
01:35 to 02:15	Julian Osborne	Swift Observations of Recent Novae
02:15 to 02:35	Magarita Hernanz	The Recovery of Accretion in Novae as Seen in X-rays
02:35 to 02:48	Gloria Sala	XMM-Newton Observations of V5116 Sgr (N Sgr 2005#2)
02:48 to 03:08	Michael Shara	Recovery of the Ultraluminous Red Nova in M31
03:08 to 03:35	**Coffee Break**	
03:35 to 03:48	Martin Henze	The First Two Transient SSS in M31 Globular Clusters
03:48 to 04:08	Elena Mason	V1309 Sco: Not a THEA System
04:08 to 04:38	Izumi Hachisu	A Prediction Formula of Supersoft X-ray Phase of CNe
04:38 to 04:51	Roger Wesson	V458 Vul - A Classical Nova Inside a Planetary Nebula
04:51 to 05:00	Closing Remarks	(Next stop Kyoto!)

Abstracts

Characteristics of the Wind in BZ Cam

Kent Honeycutt

University of Indiana

Multiple epochs of time-resolved spectroscopy of the profiles of the red He I lines and H-alpha in BZ Cam are used to characterize the time evolution of wind events (or activity episodes) in this system, and to compare with concurrent time-resolved photometry. The evolution of the profiles is discussed in terms of wind scenarios and models.

Ca II Spectroscopy of Short Orbital Period CVs

Lieke van Spaandonk

University of Warwick

We are conducting a spectroscopic survey of short orbital period CVs to probe the diagnostic advantages provided by the traditionally overlooked CaII triplet in the I-band. The chief motivation is to exploit these features and derive binary parameters that are sorely needed for short period systems. Compared to the more commonly used emission lines, the lower ionisation energy, smaller thermal widths and reduced pressure broadening effects in CaII provide a sharper and more sensitive view of the emission line sources. One of the targets that was observed was the dwarf nova GW Lib which underwent a large amplitude outburst in 2007, only its second known after earlier activity in 1983. We obtained phase-resolved spectroscopy of the system shortly after it had returned to quiescence and resolved multiple components in the CaII emission lines. The GW Lib spectra clearly demonstrate the diagnostic advantages and Doppler tomograms show not only a sharp signature from the accretion disc but also a well-defined emission spot associated with the donor star. We present the first solid dynamical constraint on the component masses in GW Lib thanks to the detection of the mass donor star in emission. We also present preliminary results of other systems in our sample.

A Unique Insight into a Rare Outburst of GW Lib

Kristiina Byckling

University of Leicester

GW Lib was discovered in outburst in 1983. The second known outburst took place over 20 years later. This timescale is in sharp contrast to those dwarf novae (DNe) which outburst more frequently, i.e., every few months. The extremely long interoutburst timescale of GW Lib, and of the few other known WZ Sge type stars, remains a puzzle. We present simultaneous optical, UV and X-ray lightcurves and the results of X-ray spectral analysis of the 2007 outburst of the WZ Sge type dwarf nova GW Lib. These unique data represent the first study of a complete outburst of

a WZ Sge type system. The recurrence times of these systems are known to be decades and the physics of the accretion process in these objects still remains a mystery. We have compared the outburst lightcurves of GW Lib to the only comparable set of DN outburst lightcurves, those of SS Cyg and U Gem. The behaviour of these systems differs markedly, especially in X-rays. We comment on the implications of these observations for accretion disc models.

Comparison of the Spectral Evolution in WZ Sge, GW Lib, and V455 And in Superoutburst

Daisaku Nogami

Hida Observatory, Kyoto University

We have carried out optical spectroscopic campaigns of WZ Sge-type dwarf novae, WZ Sge (2001), GW Lib (2007), and V455 And (2007) during their superoutbursts. Spectra were obtained from the superoutburst maximum (or before the maximum) to the rebrightening, or the fading tail in all these systems. WZ Sge and V455 And are nearly edge-on, eclipsing systems, and GW Lib is a nearly pole-on star. We compare the spectral evolution in these systems, and discuss the status of the accretion disk during the superoutbursts.

Simultaneous Spectroscopic and Photometric Coverage of 2007 Outburst of V455 And (HS2331+3905)

Gagik Tovmassian, Abdiel Ramirez-Torres, Boris Gänsicke, Sergey Zharikov, Juan Echevarria, Raul Michel, Rafael Costero, Anjum Mukadam

Instituto de Astronomia, UNAM

In 2005 Araujo-Betancor et al. (2005) published the discovery paper of V455 And entitled "HS 2331+3905: The cataclysmic variable that has it all". However at that time the object lacked one significant feature characteristic of cataclysmic variable, its outburst. In 2007 the star fulfilled its promise to has it all and went into a spectacular 8 mag amplitude outburst. We report here dense coverage of the entire outburst by means of spectroscopy and photometry. We discuss the similarity of the V455 And with WZ Sge objects and also differences setting them apart. One of the important and unique feature of V455 was its long spectroscopic period observed in the wings of the emission lines, which vanished during outburst and does not re-appear one year after. We also discuss problems related to that phenomenon.

The Source of Negative Superhumps

Michele Montgomery

University of Central Florida Physics Department

Using smoothed particle hydrodynamics, we simulate negative superhumps and retrograde precession by tilting quasi-steady state accretion disks various degrees out of the orbital plane. We study these tilted disks to find the source of modulated light in light curves known as negative superhumps. In this talk, we discuss some of our findings: the minimum disk tilt needed to generate negative superhumps in light curves, parameters that affect negative superhump signal strengths, and location within the disk that significantly contributes to this type of modulated light. If time permits, we compare our numerical simulation results with observational data.

Wanted: The True Bounce Back Systems

Sergey Zharikov & Gagik Tovmassian

Instituto de Astronomia, UNAM

The bounce - back system are considered to be abundant, yet they are very difficult to detect. Direct measurements of mass or spectral type of the secondary are extremely difficult. We will present an overview of observational fetaures which let to identify bounce - back systems and discuss their origins. The talk will focus primarily on characteristics of two recently discovered systems SDSS J123813.73-033933.0 and SDSS J080434.20+510349.2.

Recurrent Nova Photometric Histories

Brad Schaefer

Louisiana State University

I collect virtually all photometry of the ten known galactic recurrent novae (RNe) and their 37 known eruptions. This consists of my modern measures of nearly all archival plates (providing the only data for half of 37 known eruptions), my own 10,000 CCD magnitudes from 1987 to present (providing virtually all of the magnitudes in quiescence for seven RNe), over 140,000 visual magnitude estimates recorded by amateur astronomers (who discovered half the known eruptions), and the small scattering of magnitudes from all the literature. From this, I produce various uniform products; (1) $BVRIJHK$ comparison star magnitudes and BV comparison star sequences to cover the entire range of eruption, (2) complete light curves for all eruptions, (3) best fit B and V light curve templates, (4) orbital periods for all-but-one RN, (5) exhaustive searches for all missed eruptions, (6) measured discovery efficiencies since 1890, (7) true recurrence time scales, (8) predicted next eruption dates, (9) variations on time scales of minutes, hours, days, months, years, decades, and century, (10) uniform distances and extinctions to all RNe, (11) BV colors at peak and $UBVRIJHK$ colors at minimum all with extinction corrections, and (12) the spectral energy

distributions over $UBVRIJHK$. Highlights of this work include the discoveries of one new RN, seven previously-undiscovered eruptions, and five new orbital periods. I have also measured the orbital period change of two RNe across recent eruptions with accuracies of 0.5 ppm, and I have determined the RN death rate in our Local Group to an accuracy of a factor of 3. An important utility of this work is for determining whether RNe can be the progenitors of Type Ia supernovae. In particular, whether there are enough RNe to produce the observed supernova rate and whether the RN white dwarf is gaining mass over each eruption cycle.

V2487 Oph: A Test of Recurrent Nova Identification Criteria

Ashley Pagnotta

Louisiana State University

Due to low discovery efficiencies, it is likely that many recurrent novae (RNe) are currently mislabeled as classical novae (CNe) because only one eruption has been observed. An examination of the set of CNe for nova eruptions displaying certain characteristics provides a set of probable RNe; these RN candidates can be tested with increased monitoring of the systems for future outbursts. A better alternative is to search through archival plate collections for previously-undiscovered eruptions in the last century. V2487 Oph (Nova Oph 1998) was identified as a probable recurrent nova based on its high expansion velocity, the presence of high excitation lines in its outburst spectrum, and its location on the Duerbeck amplitude/t_3 plot. Hachisu et al. also identified this system as a likely RN based on characteristics of its eruption light curve. We tested our prediction that V2487 Oph is recurrent by searching for previous eruptions on archival photographic plates dating from 1891 to 1994 at Harvard College Observatory and Sonneberg Observatory. An eruption of V2487 Oph was found on Harvard plate AM 505, which was taken on 1900 June 20. Thus V2487 Oph becomes the tenth known galactic recurrent nova. This successful test of our prediction provides confidence in our selection criteria and in the idea that it is possible to find RNe that are currently masquerading as CNe because of a lack of outburst detection. We continue to test other CN systems which have strong indicators that they are RNe. A central result of our research is that a substantial fraction (likely around one-third) of the cataloged CNe are actually RNe, with multiple thermonuclear nova eruptions in the last century.

Luminous Super-Soft X-ray Emission and Binary Parameters of the Recurrent Nova T Pyx

Helena Uthas

University of Southampton

T Pyx is an intriguing recurrent nova that appears to accrete at a much higher rate than expected given its short orbital period of 1.8 hours. It has a history of eruptive behavior with a mean recurrence time of 22 year, but last erupted in 1966, over 40 years ago. T Pyx has a high excitation emission-line spectrum and a significant period derivative, supporting the idea of a high mass accretion rate. In order to explain the unusual high luminosity and accretion rate

of the system, it has been suggested that T Pyx is a wind-driven super-soft X-ray source. The implied high mass-transfer rate, in combination with a short orbital period, can be devastating for the system, as it could cause the donor to be completely evaporated and/or the white dwarf to exceed the Chandrasekhar limit. In the latter case, the system may become a type Ia supernovae.

We present phase-resolved spectroscopy of T Pyx obtained with the VLT and Magellan telescopes. This is the best optical spectroscopic data of T Pyx obtained to date and provides the first spectroscopic confirmation of its short orbital period. We also present a detailed study of the kinematics and origin of the emission features, using Doppler tomography and other techniques. In particular, we discuss our search for the emission from the donor star in the system, which might be detectable via irradiation-induced Bowen-blend emission. We also discuss deep XMM X-ray observations in order to determine whether the expected X-ray emission produced in the wind-driven super soft model can be detected.

Morphology of the Ejecta from the Classical Nova V723 Cas

Randy D. Campbell and James E. Lyke

W. M. Keck Observatory

We present observations of the spatially resolved velocity structure of the V723 Cas (Nova Cas 1995) expanding nova shell detected in the coronal emission lines, [Si VI], [Al IX], and [CaVIII]. V723 Cas was observed with the integral field spectrometer, OSIRIS, on Keck II with the laser guide star adaptive optics (LGSAO) over a four year span from 2005 to 2008. The PSF/continuum subtracted data cubes reveal the morphology of the nova shell in 3 dimensions. The different species of emission lines are inhomogeneous and arise from distinct regions of the ejecta. The shell has a prolate spheroid shape in the case of the [Al IX] feature and has radially symmetric torus shape with polar knots in the case of [Si VI] and [CaVIII] emission. The 3-D shape of the V723 Cas shell is revealed by converting the velocity dimension of the OSIRIS data into a spatial dimension.

X-ray Sources and Their Optical Counterparts in the Galactic Globular Cluster M12 (NGC 6218)

Ting-Ni Lu

Institute of Astronomy, NTHU, Taiwan

We study a Chandra X-ray Observatory ACIS-S observation of the Galactic globular cluster M12. With the 26 ks exposure time, we detect 6 X-ray sources inside the half-mass radius (2.16 arcmin) and two of them are inside the core radius (0.72 arcmin) of the cluster. If we assume these sources are all within the globular cluster M12, the luminosity L_X among these sources between 0.3-7.0 keV varies roughly from 10^{30} to 10^{32} ergs s^{-1}. For advanced identification, we also analyzed the Hubble Space Telescope (HST) Advanced Camera for Surveys (ACS) data and identified the optical counterparts to some X-ray sources out of the five sources inside the HST field of view. According to the X-ray and optical features and some conditions of classification, we found candidates of 3-5

active binaries (ABs) or cataclysmic variables (CVs) and 0-2 background galaxies within the HST ACS field of view. CVs dominate in the population of low luminosity ($L_X \leq 10^{34.5}$ ergs s^{-1}) X-ray sources in globular clusters. According to previous study, the formation mechanisms of CVs in globular clusters could be close encounter or primordial origin. Studying the population of X-ray sources in globular clusters can help us to understand more about their physical properties (especially for CVs) and also their formation mechanism. Based on the assumption that the number of X-ray sources scales with the encounter rate, we expect no X-ray source inside M12. The existence of the identified X-ray sources (possible CVs and ABs) in M12 suggests the primordial origin of X-ray sources in globular clusters, which is in agreement with previous study.

Swift Observations of Recent Novae

Julian Osborne

University of Leicester

Swift has performed major observing campaigns on a number of recent novae, exploring the X-ray behaviour of these objects in unprecedented detail. I will provide some historical and more recent context, and then will focus on V2491 Cyg (Nova Cyg 2008) and the proposed O/Ne nova CSS 081007. The flexibility of Swift scheduling allows observations tuned to the behaviour of the targets. I show the surprising evolution of these two objects and discuss their interpretation.

The Recovery of Accretion in Novae as Seen in X-rays

Margarita Hernanz

Institut de Ciències de l'Espai (CSIC-IEEC), Barcelona, Spain

We have been monitoring post-outburst classical novae with XMM-Newton, (around 2 years after explosion), with the aim of understanding both the turn-off of hydrogen burning and the reestablishment of accretion. A review of the results obtained will be presented, with a special emphasis on a particular case (V2487 Oph 1998), which behaved as a cataclysmic variable of the intermediate polar type. This is an interesting object, because accretion onto a magnetic white dwarf is not the standard scenario for nova explosions. In addition, this nova has been recently claimed to be recurrent, which makes it specially interesting as a possible type Ia supernova candidate. From our XMM-Newton observations it is concluded that post explosive stages of classical novae are far from being uniform, but show instead a variety of behaviors not known prior to XMM-Newton era.

XMM-Newton Observations of the Supersoft Classical Nova V5116 Sgr

Gloria Sala Cladellas

Universitat Politecnica de Catalunya, (UPC-IEEC)

The Nova V5116 Sgr 2005 No. 2, discovered on 2005 July 4, was observed with XMM-Newton

in March 2007, 20 months after the optical outburst. The X-ray spectrum shows that the nova had evolved to a pure supersoft X-ray source, indicative of residual H-burning on top of the white dwarf. The X-ray light-curve shows abrupt decreases and increases of the flux by a factor ~ 8 with a periodicity of 2.97 h, consistent with the possible orbital period of the system. The EPIC spectra are well fit with a LTE ONe white dwarf atmosphere model, with the same temperature both in the low and the high flux periods. This rules out an intrinsic variation of the X-ray source as the origin of the flux changes, and points to a possible partial eclipse as the origin of the variable light curve. In addition to the EPIC spectra and light curves, we present here the RGS high resolution spectra, showing a number of absorption and emission features, some of them evolving between the low and the high states.

HST Recovery of the Ultraluminous Red Nova in M31: Classical Nova or Merger?

Michael Shara

Astrophysics/American Museum of Natural History

A handful of extremely luminous red eruptive variables have been detected in our Galaxy (e.g. V838 Mon) and in nearby galaxies since 1988. These ultraluminous eruptive variables are much redder, and eject much more mass than conventional classical novae. They are often suggested to be a new class of astrophysical phenomenon: "mergebursts", arising from the merger of a pair of stars. We have recovered (with HST imagery) the fading remnant of the first ultraluminous red variable ever found: M31-RV. The longterm predictions of the mergeburst and classical nova models are very different, and I will show that the HST observations strongly favor one model over the other.

The First Two Transient Supersoft X-ray Sources in M 31 Globular Clusters and the Connection to Classical Novae

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Classical novae (CNe) have been found to represent the major class of supersoft X-ray sources (SSS) in our neighbour galaxy M 31. We determine the properties and evolution of the two first SSSs ever discovered in the M 31 globular cluster (GC) system. We have used XMM-Newton, *Chandra* and *Swift* observations of two GCs near the bulge region of M 31 to discover both SSS and to determine their X-ray light curves and spectra. We performed detailed analysis of XMM-Newton EPIC PN spectra of the source in Bol 111 (SS1) using blackbody and NLTE white dwarf (WD) atmosphere models. For the SSS in Bol 194 (SS2) we used optical monitoring data to search for an optical counterpart. Both GC X-ray sources were classified as SSS. We identify SS1 with the CN M31N 2007-06b recently discovered in a M 31 GC. For SS2 we did not find evidence for a recent nova outburst and can only provide useful constraints on the time of the outburst of a hypothetical nova. The only known CN in a M 31 GC can be identified with the first SSS found in a M 31 GC. We discuss the impact of our observations on the nova rate for the M 31 GC system.

V1309 Sco: Not a THEA System

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ESO

In the period 2003-2006 we collected FEROS spectra of 14 classical novae in outburst. Their analysis has shown that ∼80-85 per cent (if not all) of the classical novae show narrow, low radial velocity absorption lines from singly ionized heavy elements which we named THEA (transient high excitation absorption) system. With the aim of characterizing, in abundances and origin, these high excitation absorption lines, we observed, in September and October 2008, the new nova V1309 Sco whose maximum spectra showed an extraordinary THEA system.

In this talk I will briefly introduce the THEA system in classical novae and present the preliminary analysis/results about V1309 Sco spectra. Our UVES spectra of V1309 Sco show that it is not a classical nova but possibly a more rare and peculiar "red-nova".

A Prediction Formula of Supersoft X-ray Phase of Classical Novae

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On the basis of the recently developed universal decline law of classical novae, we propose a simple relationship between t_3 time (3 mag decay-time from the optical maximum in units of day) and turn-on/turnoff time of supersoft X-ray of classical novae, i.e., $t_{\rm X-on} = (21 \pm 3)(t_3)^{0.77}$ days and $t_{\rm X-off} = (15 \pm 2)(t_3)^{1.12}$ days for $8 < t_3 < 100$ days. These relationships statistically predict onset of a supersoft X-ray phase from the early optical/infrared light curves. We also present light curve analyses of recent eight X-ray detected classical novae, V598 Pup (Nova Pup 2007 No.2), V382 Vel (Nova Vel 1999 No.1), V4743 Sgr (Nova Sgr 2002 No.3), V1494 Aql (Nova Aql 1999 No.2), V5116 Sgr (Nova Sgr 2005 No.2), V574 Pup (Nova Pup 2004), V458 Vul (Nova Vul 2007), and V2467 Cyg (Nova Cyg 2007); here we model the optical and infrared light curves with free-free emission, and supersoft X-ray light curves with blackbody emission. The best fit models that reproduce simultaneously the optical and supersoft X-ray observations are ONeMg white dwarfs (WDs) with $1.28 \pm 0.03\ M_\odot$ (V598 Pup), $1.23 \pm 0.03\ M_\odot$ (V382 Vel), $1.15 \pm 0.05\ M_\odot$ (V4743 Sgr), $1.08 \pm 0.05\ M_\odot$ (V1494 Aql), $1.05 \pm 0.05\ M_\odot$ (V5116 Sgr), $1.05 \pm 0.05\ M_\odot$ (V574 Pup), and CO WDs with $0.95 \pm 0.05\ M_\odot$ (V458 Vul), and $0.85 \pm 0.05\ M_\odot$ (V2467 Cyg). The newly proposed relationships are consistent with the emergence/decay epoch of the supersoft X-ray phase of these eight novae. We also discuss the mechanism of shock-origin hard X-ray component.

V458 Vul - A Classical Nova Inside a Planetary Nebula

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The classical nova V458 Vul was discovered on 8 August 2007. It lay in a field imaged shortly beforehand as part of IPHAS (the INT Photometric H-alpha Survey), and this revealed that the progenitor star was surrounded by an extended nebula. Follow-up observations showed that the nebula has a high ionised mass and low expansion velocity, and thus is not nova ejecta but a planetary nebula. This is only the second known example of a classical nova erupting inside a planetary nebula. V458 Vul and its nebula can provide a powerful tool for understanding the common envelope phase of close binaries. We have been monitoring the nova and nebula since the eruption, and have recently observed dramatic changes in the nebula as the nova flash passes through it. The system appears to have an orbital period of about 95 minutes - the shortest known for a PN binary central star.