PROGRAM BOOK

ACCRETION PROCESSES IN SYMBIOTIC STARS AND RELATED OBJECTS

FIRST CHILE-KOREA-GEMINI WORKSHOP ON STELLAR ASTROPHYSICS

La Serena, Chile

4-7 Dec 2016

KASI 한국천문연구원 Korea Astronomy & Space Science Institute

GEMINI OBSERVATORY
Exploring the Universe, Sharing its Wonders

세종대학교 SEJONG UNIVERSITY

UNIVERSIDAD DE LA SERENA CHILE

4-7 December 2016
Accretion Processes in Symbiotic Stars and Related Objects
First Chile-Korea-Gemini Workshop on Stellar Astrophysics
Salón Pentágono, Campus Andrés Bello, Universidad de La Serena, Chile
Abstract Book
www.kochil-2016.com

Scientific Organizing Committee

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Scientific Rationale

In the most recent years the Chilean and the Korean astronomical communities have started a journey that should bring them closer and closer despite their maximal physical distances on Earth. Several initiatives at various official levels are fostering the most diverse collaborations on all aspects of forefront astrophysical investigation between research groups usually sitting on the opposite side of the Pacific Ocean.
In the framework of such a vibrant collaboration we are organizing a three-days workshop to be held in La Serena, Chile, on Dec. 4-7, 2016. The workshop is organized by Gemini Observatory, Sejong University and University of La Serena, under the patronage of KASI. It aims at discussing various research activities on symbiotic stars and related objects, including theoretical and observational studies, with a particular emphasis on the characterization of accretion processes via high-resolution spectroscopy and fast photometry.

Mass loss is the single most important process that characterizes the late stage of stellar evolution. Being wide binary systems of a hot white dwarf and a mass losing giant, symbiotic stars are ideal objects to study the mass loss process and also provide a rare opportunity to investigate the mass transfer process through gravitational capture of a slow stellar wind. Unique spectral features are known in symbiotic stars and related objects, which are formed through Raman scattering by atomic hydrogen. These Raman features with broad and multiple peak profiles can be used to probe the geometry and the kinematics of the thick neutral region vividly revealing the mass loss and transfer processes.

This workshop has been organized to discuss various research activities on symbiotic stars and related objects, including theoretical and observational studies. The advent of 30-m class telescopes may open a new window showing a totally unexpected universe and forcing us to focus on more fundamental astrophysical principles that interconnect the variety of observed phenomena. In particular, G-CLEF, one of the first generation instruments for GMT, will lead us to a new world of high resolution spectroscopy. Korean and Chilean astronomers are seeking close collaboration despite their maximal physical distances on Earth. This workshop will be one aspect toward strengthening such collaborative relation between the two communities. With this workshop it is sincerely hoped that symbiotic stars and related objects will draw significant attention appropriate for their importance in astronomy.

Rodolfo Angeloni and Hee-Won Lee,
on behalf of the SOC/LOC

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I Program

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10:10 AM		**N. Nuñez** **G J. M. Luna**	**W.-J. De Wit** **J. Corral-Santana**	**M. Jones** **J.-J. Lee**
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11:20 AM		**A. Skopal** **(Invited talk)**	**H. Kim** **(Invited talk)**	**S. Margheim** **(Invited talk)**
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II Invited Talks

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- **Denis Gonçalves** (Valongo Observatory, Brasil)
  An Innovative and Efficient Technique to Search for Symbiotic Stars
- **Hyosun Kim** (ASIAA, Taiwan)
  Circumstellar Spirals/Shells/Arcs: the Messages from Binary Stars
- **Hee-Won Lee** (Sejong University, Korea)
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- **Mark Phillips** (Las Campanas Observatory, Chile)
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- **Miguel Roth** (Giant Magellan Telescope, Chile)
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- **Augustin Skopal** (Slovak Academy of Sciences, Slovakia)
  On the Mass Transfer and Accretion in Symbiotic Binaries

Jets and Other Signs of Accretion in Planetary Nebulae

Romano Corradi
Gran Telescopio de Canarias, La Palma, Spain

Abstract

The origin of the wide variety of shapes displayed by planetary nebulae (PNe) is perhaps the most debated topic in the field during more the last three decades. Today, the commonly accepted paradigm is that interactions in binary systems are the cause of at least the most collimated morphologies. Recent observations indicate that indeed a significant fraction of PN central stars are binaries, and the presence of specific morphological features, such as rings and jets, are confirmed to be unambiguous indicators of binarity. I will present illustrative cases of PNe where accretion is supposed to play an important role in their formation, shaping and evolution. This includes the formation of (precessing) jets and polar outflows, or the evidence for inflated or chemically polluted companions. The link with symbiotic stars is also discussed.

An Innovative and Efficient Technique to Search for Symbiotic Stars

Denise R. Gonçalves
Valongo Observatory - Federal University of Rio de Janeiro, Brasil

Abstract

Symbiotic systems are among the contenders for Type Ia SN progenitors. Confirming this requires a census of symbiotics to unveil the relation between the SN rate in a given galaxy and the number of symbiotics at present-time. However, SySt share similar characteristics with planetary nebulae (PNe), T-Tauri stars, compact HII regions, B[e] stars, among others. The usual method to search for SySt -based on combinations of colour–colour diagrams-, is able to find SySt candidates, but a robust classification can only be achieved by costly spectroscopic follow–up. The spectroscopic analysis of recent Hα surveys in nearby galaxies found several SySt, a great number of them containing the optical emission lines, which primarily appear in symbiotic spectra: the O VI scattered Raman lines located at 682.5nm and 708.2nm. In this talk I will briefly review the extragalactic SySt and the number of the systems that show these Raman lines. My aim is to introduce the systematic survey of SySt we recently started in the Small Magellanic Cloud (SMC) based on the detection of the O VI 682.5nm line. The first results of this survey will be discussed. Noting that the presence of this Raman scattering line is an almost clear-cut proof of the presence of a symbiotic star, as it was detected in only an handful of non-symbiotic objects, such as young PNe and one B[e] star. This technique turned out to be very efficient.

Circumstellar Spirals/Shells/Arcs: the Messages from Binary Stars

Hyosun Kim
Academia Sinica Institute of Astronomy and Astrophysics, Taiwan

Abstract

A growing consensus has been developing in the past few decades that binarity is key in providing an understanding of the morphological diversities of the circumstellar envelopes (CSEs) surroudning stars in the Asymptotic Giant Branch (AGB) to Planetary Nebula (PN) phase. However, despite extensive efforts to detect companions of AGB stars and the central stars of PNe, the number of detected binaries in particular with their orbital properties derived are still small. As a consequence, the possible roles of binaries in the shaping of PN and in the CSEs of AGB stars have yet to be clarified. On the other hand, recurrent (ring/spiral/arc) patterns are often found in the CSEs of AGB stars and the outer halos of pre-PNe and PNe. Such patterns provide a fossil record and can be used to trace the temporal history of the mass loss dynamics during the AGB phase. In this regard, recent molecular line observations using radio interferometric facilities such as ALMA and JVLA have revealed the spatio-kinematics of such patterns. Numerical simulations of binary interactions producing spiral-shells have been extensively developed and are now becoming increasingly sophisticated, revealing new probes for extracting the stellar and orbital properties from these patterns. I will review the recent theoretical and observational investigations on the circumstellar spiral-shell patterns and discuss their implications in linking binary properties to the asymmetric ejection events in the post-AGB phase.

Raman O VI Spectroscopy and Polarimetry of Asymmetric Accretion Flows and Bipolar Jets in Symbiotic Stars

Hee-Won Lee
Sejong University, Republic of Korea

Abstract

Being binary systems of a mass losing giant and a hot white dwarf, symbiotic stars are unique objects to exhibit various activities linked to the accretion of the slow stellar wind from the giant companion. About a half of symbiotic stars are known to exhibit broad emission features at 6825 and 7082 formed through inelastic or Raman scattering of far UV O VI 1032 and 1038 with atomic hydrogen. The profiles of Raman features are mainly determined by the relative motion of the O VI emission region with respect to the H I region and independent of the observer's line of sight, allowing one to take an edge-on view of the accretion stream from the vantage point established in front of the mass donor. Raman O VI features usually exhibit double or triple peak profiles with much stronger red peak than the blue counterpart. A natural interpretation is provided by invoking asymmetry in the accretion flow around the white dwarf, where the O VI density is higher on the entering side than on the opposite side. Moving away from the giant, the entrance side is responsible for the formation of the red part. One further complication found in Raman O VI features is that their profiles differ in such a way that the blue part is relatively more suppressed in Raman 6825 than in Raman 7082. This profile difference is also attributed to the same asymmetry in the accretion stream around the white dwarf. Raman O VI features are also strongly polarized with the polarization flipped in the red wing part. The polarization flip is consistent with the presence of the bipolar structure aligned in the direction perpendicular to the binary orbital plane. In this presentation, I proved an overview of how high resolution spectroscopy and linear polarimetry of Raman scattered O VI features can be used to probe the mass transfer processes that take place in symbiotic stars.

GHOST: The Gemini High-Resolution Optical Spectrograph

Steve Margheim
Gemini Observatory, Chile

Abstract

The Gemini High-Resolution Spectrograph (GHOST) is the next facility instrument for the Gemini Observatories. It is being developed in collaboration with the Australian Astronomical Observatory (AAO), NRC-Herzberg, and the Australian National University (ANU). GHOST will provide R=50,000 and R=75,000 spectroscopy with simultaneous wavelength coverage between 363 and 950 nm. GHOST supports simultaneous observation of two objects at R=50,000 and a single object at R=75,000. I will present the design of the spectrograph, and report on the status of the instrument, currently in the build phase.

Type Ia Supernovae and Symbiotic Stars

Mark Phillips
Las Campanas Observatory, Chile

Abstract

Type Ia supernovae (SNe Ia) are thought to be the result of the explosion of a carbon-oxygen white dwarf that has reached the Chandrasekhar limit. This could be due to a merger or collision of the white dwarf with another white dwarf, or due to mass transfer from a non-degenerate companion (a main sequence or larger star). The power law dependence of the delay time between the birth of the progenitor system and the explosion as a SN Ia (the delay time distribution) and the unsuccessful search for evidence of the companions to normal SNe Ia would seem to favor the double-degenerate model. However, a rare subclass of SNe Ia, the so-called "SNe Ia-CSM", shows evidence of strong interaction with a hydrogen-rich circumstellar medium. In this talk, I review the observational properties of the SNe Ia-CSM, and discuss the evidence that the progenitors of these events are symbiotic recurrent nova systems.

Progress in the Construction of the GMT

Miguel Roth
Giant Magellan Telescope, Chile

Abstract

It has been a year since the "Rock Ringing" ceremony which marked our groundbreaking, and it has been a very active year. I will describe the advance of the infrastructure on the Las Campanas peak and preparations for the real groundbreaking for the foundations. I will also describe the developments in the US-side of the project, the mirrors, the mechanical structure to support them and some recent discussions on the instruments.

On the Mass Transfer and Accretion in Symbiotic Binaries

Augustin Skopal
Astronomical Institute, Slovak Academy of Sciences, Slovakia

Abstract

My contribution will be focused to the principal interaction between the binary components of symbiotic stars - the mass transfer via the wind, which is responsible for the appearance of the symbiotic phenomenon. I will briefly introduce the way how to estimate the mas-loss rate from the giant, and point the long-standing problem between the high luminosity of the burning white dwarf and its deficient fueling by the giant in the canonical Bondi-Hoyle accretion mechanism. Possible solution of this mass-transfer problem by focusing the giant wind towards the orbital plane will be discussed.

III Contributed Talks

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- **Jesus Corral-Santana** (ESO, Chile)
  Hunting Stellar-Mass Black Holes
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- **Gerardo Juan Manuel Luna** (IAFE/Conicet, Argentina)
  On the Source of Power in Symbiotic Stars: Nuclear Burning vs Accretion
- **Natalia Nuñez** (ICATE-UNSJ, Argentina)
  X-rays from Symbiotic Stars: A Glimpse on Their Source of Power
- **Claudia Rodrigues** (Instituto Nacional de Pesquisas Espaciais, Brasil)
  The Accretion Column of AE Aqr
- **Matej Sekeras** (Slovak Academy of Sciences, Slovakia)
  Investigating Physical Processes in the Symbiotic Nova V1016 Cyg
- **Natalia Shagatova** (Slovak Academy of Sciences, Slovakia)
  Properties of the Wind Outflow from the Cool Components in Symbiotic Binaries

T 1 Akras, Stavros

National Observatory of Rio de Janeiro & MCTI, Brazil

Reclassifying Symbiotic Stars Using the 2MASS and WISE Catalogs: An Atlas of Symbiotic Star Spectral Energy Distribution

We present a new catalogue of galactic and extragalacitc symbiotic stars (SySts). Since the last catalogue of SySts (Belczynski et al. 2000), the number of known SySts has almost doubled in the last 16 years. In particular, there are 297 known SySts in our Galaxy and 39 in other galaxies. Adding WISE colors to the 2MASS photometry, we are able to build infrared spectral energy distributions for 331 (known and candidate) symbiotic stars. We have used these SEDs to provide an accurate classification (S, D and D' type) for all of them with available 2MASS and WISE data. Fitting a black-body to all these SEDs, we get a rough indication of the temperature either for the cold giant or the dust. The SED of S-type SySts peaks between 0.8 and 2 mu and these of D-type between 2 and 5 mu. For a small number of SySts, probably the D'-type, the peak occurs at even longer wavelengths and they deserve further investigation. Preliminary analysis has revealed a number of candidate SySts with a giant companion of spectral type K or G.

T 2 Corral-Santana, Jesus

ESO, Chile

Hunting Stellar-Mass Black Holes

Since the beginning of the X-ray astronomy era, we have detected nearly 60 Galactic stellar-mass black hole (BH) candidates in transient X-ray binaries, a type of interacting X-ray binaries with low-mass companions, and 2 other systems with high-mass companion stars. However, only 17 out of the 60 have been dynamically confirmed since 1966. Actually, during this decade, we have confirmed only one black hole (XTE J1859+226; Corral-Santana+2011) and establish strong constrains in two more systems (Swift J1357.2-0933; Corral-Santana+2013, Mata Snchez+2015 and KY TrA; Zurita+2015). The formed has been established as the largest black hole ever measured in our Galaxy with more than 9 Msun. In BlackCAT, the catalogue of stellar-mass black holes; Corral-Santana+2016, we present a thorough compilation of all the dynamical parameters of the BH transients and show a statistical analysis of the expected population of BH transients in our Galaxy based on observations. Thus, we estimate 1300 systems in the Milky Way which imply that we have only detected the tip of the iceberg on a hidden population of black hole transients. In this contribution, we will summarise the status of this type of interacting binaries and present the latest relations that will eventually allow us to increase the current sample of black hole systems.

T 3 de Wit, Willem-Jan

ESO, Chile

The Accretion Process in Young and Evolved Objects: A Comparison

We will present the latest observational results for the formation of single and multiple high-mass stars (¿8Msol). By means of optical interferometry using the newly commissioned instrument Gravity at the VLT-I, we show the discovery of a young, embedded, 170AU-wide binary. The binary components have a mass of around 20Msol with which the system is the most massive and most compact accreting young binary to date. This discovery opens up an exciting new window on star-disk interaction in young massive stars. The massive stars up to 20Msol form by disk accretion is by now reasonably well established. As a further confirmation, we will present the results of a multi-site multi-epoch follow-up campaign of the first well studied accretion outburst in a massive young stellar object.

T 4 Heo, Jeong-Eun

Gemini Observatory & Sejong University, Republic of Korea

A Profile Analysis of Raman-scattered O VI Bands at 6825 Å and 7082 Å in Sanduleaks Star

We present a detailed modeling of the two broad bands observed at 6825 Å and 7082 Å in Sanduleak's star, a controversial object in the Large Magellanic Cloud. These bands are known to originate from Raman-scattering of O VI $\lambda\lambda$ 1032 and 1038 photons with atomic hydrogen and are only observed in bona fide symbiotic stars. Our high-resolution spectrum obtained with the Magellan Inamori Kyocera Echelle (MIKE) spectrograph at the Magellan-Clay Telescope reveals, quite surprisingly, that the profiles of the two bands look very different: while the Raman 6825 Å band shows a single broad profile with a redward extended bump, the Raman 7082 Å band exhibits a distinct triple-peak profile. Our model suggests that the O VI emission nebula can be decomposed into a red, blue and central emission regions from an accretion disk, a bipolar outflow and a further compact, optically thick region. We also perform Monte Carlo simulations with the aim of fitting the observed flux ratio $F(6825)/F(7082) \sim 4.5$, which indicate that the neutral region in Sanduleak's star is characterized by the column density $N_{HI} \sim 1 \times 10^{23}$ cm^{-2}.

T 5 Jones, Matias

Pontificia Universidad Católica de Chile, Chile

The FIDEOS High Resolution Spectrograph: Instrument Description and Early Scientific Results

We have developed a high resolution spectrograph called FIDEOS (Fiber Dual Echelle Optical Spectrograph) in the Center of Astro-Engineering (AIUC), at the Pontificia Universidad Católica in Chile. The spectrograph covers the wavelength range of $\sim$ 4200-8600 Å, delivers a mean resolution of 42'000 and is mechanically stabilized and thermally controlled. The instrument is optimized for precision radial velocities (RV), with the aim of detecting exoplanets via RV measurements. In this talk I will describe the optical design and the main characteristics of the spectrograph. I will also present the early results obtained during the commissioning and I will discuss about the upcoming challenges.

T 6 Lee, Ho-Gyu

Korea Astronomy and Space Science Institute, Republic of Korea

Circumstellar Material Around Massive Star Implied by Supernova Remnant Observations

Massive stars suffer strong mass-loss during their evolutionary period. The released material carried by stellar wind piles-up circumstellar material (CSM) around the star. The CSM itself is usually hard to observed due to dilution into surrounding space and lack of effective heating mechanism, contrasted with the bright central star. Interestingly, such structure can sometimes be revealed by the illumination of SNR shock. In this talk, I will introduce some observational examples.

T 7 Lee, Jae-Joon

Korea Astronomy and Space Science Institute, Republic of Korea

Immersion Grating Infrared Spectrograph (IGRINS) and Its View of V1016 Cyg

The Immersion Grating Infrared Spectrometer (IGRINS) is a revolutionary instrument that exploits broad spectral coverage at high-resolution in the near-infrared. IGRINS employs a silicon immersion grating as the primary disperser and volume-phase holographic gratings cross-disperse the H and K bands onto Teledyne Hawaii-2RG arrays, providing simultaneous wavelength coverage from 1.45 - 2.5 microns with R $\sim$ 45,000. In this talk, I will report the performance of IGRINS and its current status. I will also report IGRINS observations of V1016 Cyg and the preliminary results.

T 8 Lucy, Adrian

Columbia University, United States

Symbiotic Outflow and the 26th Anniversary Outburst of MWC 560

I will present results from a 2016 Chandra/VLA/Swift/optical campaign monitoring the optically-brightest outburst of MWC 560 = V694 Mon, an unusual system which first attracted attention with transient 6000 km/s outflows during its 1990 outburst. This system is widely believed to possess the only jet known to be aligned with our line of sight to a symbiotic star, though it could instead host the fastest wind from a symbiotic star. Widened optical absorption troughs, order of magnitude -enhanced outflow shock X-rays, and the first radio detections of this system suggest a strengthened and expanding outflow. With multi-wavelength monitoring, we watch both the outflow and the accretion disk as they co-evolve. If time and nature allow, I may describe a novel method for finding non-burning symbiotic stars with SkyMapper, and discuss the possibility that MWC 560 is a holotype for an unappreciated class of windy symbiotics.

T 9 Luna, Gerardo Juan Manuel

IAFE/Conicet, Argentina

On the Source of Power in Symbiotic Stars: Nuclear Burning vs Accretion

Nuclear burning on the surface of a white dwarf produces roughly 50 times more energy per nucleon than accretion. In turn, accretion produces flickering on time scales of minutes to hours. We will present the results of our ongoing program to study the source of power on a sample of symbiotic stars through their UV emission. To this aim, we have observed a sample of 60 symbiotics with the Swift/UVOT instrument during 4 years, for more than 1 megasecond. Preliminary results will be discussed about the statistics of our survey and the usage of UV photometry as a proxy to determine the source of power in symbiotic stars.

T 10 Nuñez, Natalia

ICATE-UNSJ, Argentina

X-rays from Symbiotic Stars: A Glimpse on Their Source of Power

After the detection of more than 40 symbiotic stars in X-rays, they are now recognized as a significant X-rays population. Their high energy emission allow us to unveil the accretion mechanism onto the WD and we are starting to estimate what is their main source of power, i.e. accretion versus nuclear burning. Our observational program aimed to detect X-rays using different satellites such as Suzaku, Chandra, XMM-Newton and Swift indicates that X-ray emitting symbiotics are accretion and burning-powered in about equal proportions. At the same time, our program is allowing us to uncover a previously unknown population of hard X-ray emitting symbiotics. In this talk, I will review our main results and comment on their likelihood of symbiotics to become SNIa progenitors.

T 11 Rodrigues, Claudia

Instituto Nacional de Pesquisas Espaciais, Brazil

The Accretion Column of AE Aqr

AE Aqr is a magnetic cataclysmic variable, whose white dwarf rotates at the very fast rate of 33 s modulating the flux from high-energies to optical wavelengths. There are many studies of the origin of its emission, which consider emission from a rotating magnetic field or from an accretion column. Recently, MAGIC observations have not found emission from AE Aqr in very high energy gamma-rays discarding non-thermal emission. Furthermore, soft and hard X-ray data from Swift and NuSTAR were reproduced using thermal models. Here we present a successful modelling of AE Aqr X-ray spectra and light curve considering the emission of a magnetic accretion column using the Cyclops code. The model takes into consideration the 3D geometry of the system, allowing to properly represent the white-dwarf auto eclipse, the pre-shock column absorption, and the varying density and temperature of a tall accretion column. To our knowledge, we present the first physical modelling of AE Aqr light curve in high energies.

T 12 Sekeras, Matej

Astronomical Institute of Slovak Academy of Sciences, Slovakia

Investigating Physical Processes in the Symbiotic Nova V1016 Cyg

In 1964, V1016 Cyg underwent a nova-like outburst. Since then its brightness was slowly fading from its peak V 10.6 mag (1967 - 1970) to V 11.4 mag (2016). V1016 Cyg is a D-type symbiotic star. The dust emission dominates the near-IR spectrum. It can be fitted by a model of two dust shells of different temperature heated by both the hot component and the Mira-variable. Environment of V1016 Cyg can be investigated throughout the observed effects of the Thomson and Raman scattering processes. Thomson scattering produces very broad and shallow wings of most intense emission lines. Modelling the line profile of OVI 1032, 1038 Å resonance doublet, we determined the optical depth and electron temperature of the nebula in V1016 Cyg. Investigating Raman scattering of the HeII 1025 A emission line into the emission feature at 6545 Å we determined the efficiency of this process, and using a simplified ionization model of symbiotic stars, we estimated the mass-loss rate of the Mira-variable to around of 1E-6 solar masses per year. Using only the optical spectrum represents a strong advantage of this method to determine the mass-loss rate in D-type symbiotic stars. The symbiotic nebula of V1016 Cyg can be investigated by analyzing the optical spectrum, which consists of strong Balmer emission lines, forbidden emission lines, low excitation permitted lines of metals and emission lines of highly ionized elements. Most of the forbidden lines have double-peaked profile, suggesting a bipolar structure of the low density emitting region in the binary.

T 13 Shagatova, Natalia

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Properties of the Wind Outflow from the Cool Components in Symbiotic Binaries

Mass outflow from the majority of cool components in symbiotic binaries is still not understood well mainly due to unknown mechanism of the wind acceleration for the red giants. Here, we present the wind velocity profiles derived from measured column densities of neutral hydrogen for two symbiotic systems, EG And and SY Mus. The obtained velocity profiles represent an important restriction for the theoretical models of mass outflow from red giants in symbiotic binaries. Moreover, our column density models provide an indication of the wind focusing towards the orbital plane in S-type symbiotic binaries. Further, we use the wind velocity profiles to investigate the origin of the asymmetric UV light-curve profiles of the symbiotic star SY Mus and the asymmetric distribution of the absorption in the H-alpha line along the orbital phase as observed in the symbiotic star EG And.

IV Contributed Posters

- **Stavros Akras** (National Observatory of Rio de Janeiro/MCTI, Brazil)
  O VI 6830 Å Imaging Polarimetry of Symbiotic Stars
- **Seok-Jun Chang** (Sejong University, Korea)
  Rayleigh and Raman Scattering in Active Galactic Nuclei
- **Francesco Di Mille** (Las Campanas Observatory, Chile)
  Classical Novae in Nearby Galaxies
- **Young-Min Lee** (Sejong University, Korea)
  A Monte Carlo Study of Flux Ratios of Raman Scattered O VI Features at 6825 Å and 7082 Å in Symbiotic Stars
- **Flavia Lovos & Leila Yamila Saker** (Observatorio Astronómico de Córdoba, Argentina)
  SDSS J122339.61-005631.1: A Short Period Eclipsing Binary with a White Dwarf Component
- **Claus Tappert** (Universidad de Valparaíso, Chile)
  A Tale of Two Shells

P 1 Akras, Stavros

National Observatory of Rio de Janeiro / MCTI, Brazil

O VI 6830Å Imaging Polarimetry of Symbiotic Stars

Almost 50-60% of the Galactic symbiotic exhibit the Raman scattered OVI lines. The detection of these lines provide strong indications of the presence of a symbiotic star. We present here the first results from our ongoing pilot project with the 1.6m telescope at the OPD, Brasil, aimed at the detection of the OVI λ6830 line. Our goal is to demonstrate that OVI imaging polarimetry can be a very efficient technique for discovering SySts/OVI emitters. The presence of OVI line is detected at 3σ in 5 out of 9 cases, whereas three new Systs candidates have been found.

P 2 Chang, Seok-Jun

Sejong University, Republic of Korea

Polarization of Rayleigh Scattered Ly alpha in Active Galactic Nuclei

The presence of a thick molecular torus is essential in the unification model of active galactic nuclei, which is powered through accretion onto a supermassive black hole. The illuminated side of the molecular torus may be photodissociated by strong far UV radiation from the central AGN, forming an HI region with a high neutral column density. We propose that the Rayleigh scattering optical depth of this HI region with $N_{HI} > 10^{20}\mathrm{cm}^{-2}$ can be significant for most broad Ly alpha line photons with the Doppler factor not exceeding $10^{4}\mathrm{km\ s}^{-1}$. Rayleigh scattered Ly alpha photons can be characterized by strong linear polarization depending on their scattering optical depth. We performed Monte Carlo simulations of polarized radiative transfer of Ly alpha adopting simple scattering geometries relevant to the unification model of AGN. We find that for a low torus the Rayleigh scattered Ly alpha is polarized in the direction parallel to the symmetry axis with the polarization degree dependent on wavelength. In the case of a high torus, the core part of Ly alpha is polarized in the direction perpendicular to the symmetry axis whereas the wing part is parallelly polarized. We conclude that careful spectropolarimetry around Ly alpha can be useful in testing the AGN unification model.

P 3 Di Mille, Francesco

Las Campanas Observatory, Chile

Classical Novae in Nearby Galaxies

The total energy released during the outburst of a classical nova is only exceeded by gamma ray bursts supernovae and some luminous blue variables. By virtue of their high luminosity, classical novae can be detected well outside the Local Group, up to the nearest large Galaxy clusters.During the first phase of the outburst, novae exhibits a strong H-alpha emission that usually has a decline rate much slower of the optical broad-band light curve. Therefore, narrow band imaging centered on H alpha can be used to facilitate a search whenever a frequent monitoring is not possible. In this poster we present some preliminary results of an extragalactic nova survey that we are conducting at Las Campanas Observatory.

P 4 Lee, Young-Min

Sejong University, Republic of Korea

A Monte Carlo Study of Flux Ratios of Raman-scattered O VI Features at 6825 Å and 7082 Å in Symbiotic Stars

Symbiotic stars are known to exhibit unique spectral features at 6825 and 7082, which are formed from O VI 1032 and 1038 through Raman scattering with atomic hydrogen. In this Monte Carlo study we investigate the flux ratios of 6825 and 7082 in a neutral region with a geometric shape of a slab, cylinder and sphere. By varying the amount of neutral hydrogen parametrized by the column density along a specified direction, we compute and compare the flux ratio of Raman scattered O VI 6825 and 7082. We compare our high resolution CFHT data of HM Sge and AG Dra with the data simulated with finite cylinder models confirming that S type symbiotic tend to be characterized by thicker H I region that D type counterparts.

P 5 Lovos, Flavia & Saker, Lelia Yamila

Observatorio Astronmico de Crdoba, Argentina

SDSS J122339.61-005631.1: A Short Period Eclipsing Binary with a White Dwarf Component

SDSS J122339.61-005631.1 (hereafter SDSS J1223-0056) is a detached short period (P = 2.1 h) post-common envelope eclipsing binary, formed by a white dwarf plus a main-sequence star. In this work, we present new optical photometry of SDSS J1223-0056, obtained with the 2.15 m Jorge Sahade telescope at Complejo Astronómico El Leoncito (CASLEO, Argentina) and the 1.54 m telescope at Estación Astrofísica de Bosque Alegre (EABA, Argentina), in order to better characterize its light curve. SDSS J1223-0056 and other binary systems, containing a white dwarf component, are being observed as part of a thesis project, with the aim of detecting eclipsing time variations (ETVs). In particular, in this contribution, we report a new analysis of this binary system and confront the derived parameters with those obtained by other authors and with those of other systems with similar characteristics from the literature. In addition, we perform an ETV analysis combining our times of eclipses with those previously reported.

P 6 Tappert, Claus

Universidad de Valparaíso, Chile

A Tale of Two Shells

The classical novae V368 Sct and V1229 Aql both erupted in 1970, from which both declined at the same rate. 45 years later, the ejected material in both objects is still visible as a nova shell, which even show quite similar spatial structure. The compositions, however, appear to be markedly different, with one shell still showing a significant contribution of the optically thin material, while in the other only the optically thick material is visible. We here present spectroscopy do analyze the differences in detail.

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