THE AGB NEWSLETTER

An electronic publication dedicated to Asymptotic Giant Branch stars and related phenomena

Official publication of the IAU Working Group on Abundances in Red Giants

No. 218 — 1 September 2015

http://www.astro.keele.ac.uk/AGBnews

Editors: Jacco van Loon, Ambra Nanni and Albert Zijlstra

Editorial

Dear Colleagues,

It is our pleasure to present you the 218$^{\rm th}$ issue of the AGB Newsletter.

It is with great sadness that we learnt about the passing of two giants in our field: Ernst Zinner – meteoritic scientist extra-ordinaire (though unrelated to the Ernst Zinner of comet fame), and Jean-Paul Zahn – who helped us understand non-radial processes within stellar interiors. Apart from being outstanding scientists they were also great mentors and have inspired generations – they are the shoulders on which all future knowledge in these fields will stand on. They will be sorely missed, but they will live on, in our minds and our work. They will become stardust again and parts of stars, to be studied themselves in a distant future.

The Cloudy workshop roadshow is coming to Shanghai this time (June 2016), and the equally long-running Fizeau programme is again inviting applications for its mobility initiative within interferometric research.

The next issue is planned to be distributed around the 1$^{\rm st}$ of October.

Editorially Yours,
Jacco van Loon, Ambra Nanni and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

What is the difference between convection and turbulence?

Reactions to this statement or suggestions for next month's statement can be e-mailed to astro.agbnews@keele.ac.uk (please state whether you wish to remain anonymous)

Refereed Journal Papers

An X-Shooter view of the symbiotic star [JD2002] 11

Marcin Hajduk[1], *Mariusz Gromadzki*[2,3], *Joanna Mikołajewska*[1], *Brent Miszalski*[4,5] *and Igor Soszyński*[6]

[1]Nicolaus Copernicus Astronomical Center, ul. Bartycka 18, 00-716, Warsaw, Poland

[2]Millennium Institute of Astrophysics, Av. Vicuña Mackenna 4860, 782-0436, Macul, Santiago, Chile

[3]Universidad de Valparaíso, Av. Gran Bretaña 1111, Playa Ancha, Casilla, 5030, Chile

[4]South African Astronomical Observatory, P.O. Box 9, Observatory, 7935 Cape Town, South Africa

[5]Southern African Large Telescope Foundation, P.O. Box 9, Observatory, 7935 Cape Town, South Africa

[6]Warsaw University Observatory, Al. Ujazdowskie 4, 00-478 Warszawa, Poland

We aimed to verify the nature and derive the basic parameters of the symbiotic star candidate [JD2002] 11. For this purpose, we obtained and analysed an X-Shooter spectrum of [JD2002] 11. We also used optical and infrared photometry available for the object. Emission-line diagnostic ratios are characteristic of a dusty type symbiotic star and reveal a two-component nebula (low- and high-density). The spectral energy distribution is well fitted with a two-component blackbody spectrum with the respective temperatures of 1150 K and 600 K. The total luminosity of 3000 $L_{\odot}$ is consistent with the expected luminosity of a typical Mira star, embedded in an optically thick dust shell. We conclude that [JD2002] 11 is the ninth symbiotic star in total and only the second dusty type symbiotic star discovered in the Small Magellanic Cloud.

Published in Acta Astronomica, Vol. 65 (2015), p.139

The excitation mechanism of H_2 in bipolar planetary nebulæ

R.A. Marquez-Lugo[1], *M.A. Guerrero*[1], *G. Ramos-Larios*[2] *and L.F. Miranda*[1]

[1]Instituto de Astrofísica de Andalucía IAA, CSIC, Glorieta de la Astronomía s/n, E-18008 Granada, Spain

[2]Instituto de Astronomía y Meteorología, CUCEI, Universidad de Guadalajara, Av. Vallarta No. 2602, Col. Arcos Vallarta, 44130 Guadalajara, Jalisco, México

We present near-IR K-band intermediate-dispersion spatially-resolved spectroscopic observations of a limited sample of bipolar planetary nebulæ (PNe). The spectra have been used to determine the excitation mechanism of the H_2 molecule using standard line ratios diagnostics. The H_2 molecule is predominantly shock-excited in bipolar PNe with broad equatorial rings, whereas bipolar PNe with narrow equatorial waists present either UV excitation at their cores (e.g., Hb 12) or shock-excitation at their bipolar lobes (e.g., M1-92). The shock-excitation among bipolar PNe with ring is found to be correlated with emission in the H_2 1–0 S(1) line brighter than Brγ. We have extended this investigation to other PNe with available near-IR spectroscopic observations. This confirms that bipolar PNe with equatorial rings are in average brighter in H_2 than in Brγ and show dominant shock excitation.

Accepted for publication in Monthly Notices of the Royal Astronomical Society
Available from arXiv:1508.01740

Chemical abundance study of two strongly s-process enriched post-AGB stars in the LMC: J051213.81−693537.1 and J051848.86−700246.9

K. De Smedt[1], *H. Van Winckel*[1], *D. Kamath*[1] *and P.R. Wood*[2]

[1]Instituut voor Sterrenkunde, K.U. Leuven, Celestijnenlaan 200D, B-3001 Leuven, Belgium

[2]Research School of Astronomy and Astrophysics, Mount Stromlo Observatory, Weston Creek ACT 2611, Australia

Context: This paper is part of a larger project in which we systematically study the chemical abundances of extragalactic post-asymptotic giant branch (post-AGB) stars. The aim of our programme is to derive chemical abundances of stars covering a large range in luminosity and metallicity with the ultimate goal of testing, constraining and improving our knowledge of the poorly understood AGB phase, especially the third dredge-up mixing processes and associated s-process nucleosynthesis.
Aims: Post-AGB photospheres are dominated by atomic lines and indicate the effects of internal chemical enrichment processes over the entire stellar lifetime. In this paper, we study two carefully selected post-AGB stars: J051213.81−693537.1 and J051848.86−700246.9 in the Large Magellanic Cloud (LMC). Both objects show signs of s-process enhancement. The combination of favourable atmospheric parameters for detailed abundance studies and their known distances (and hence luminosities and initial masses) make these objects ideal probes of the AGB third dredge-up and s-process nucleosynthesis in that they provide observational constraints for theoretical AGB models.
Methods: We use high-resolution optical UVES spectra to determine accurate stellar parameters and subsequently perform detailed elemental abundance studies of post-AGB stars. Additionally, we use available photometric data covering optical and IR bands to construct spectral energy distributions for reddening and luminosity determinations. We then estimate initial masses from theoretical post-AGB tracks.
Results: We obtained accurate atmospheric parameters for J051213.81−693537.1 ($T_{\rm eff} = 5875 \pm 125$ K, $\log g = 1.00 \pm 0.25$ dex, [Fe/H] $= -0.56 \pm 0.16$ dex) and J051848.86−700246.9 ($T_{\rm eff} = 6000 \pm 125$ K, $\log g = 0.50 \pm 0.25$ dex, [Fe/H] $= -1.06 \pm 0.17$ dex). Both stars show extreme s-process enrichment associated with relatively low C/O ratios of 1.26 ± 0.40 and 1.29 ± 0.30 for J051213−693537.1 and J051848−700246.9, respectively. We could only derive upper limits of the lead (Pb) abundance. These upper limits show a possible very slight Pb overabundance with respect to heavy s-elements for J051213−693537.1, while J051848−700246.9 shows an upper limit of the Pb abundance similar to [hs/Fe]. A comparison with theoretical post-AGB evolutionary tracks in the HR-diagram reveals that both stars have low initial masses between 1.0 and 1.5 $M_\odot$.
Conclusions: This study adds to the results obtained so far on a very limited number of s-process enriched stars in the Magellanic Clouds. With the addition of the two stars in this study, we find an increasing discrepancy between observed and predicted Pb abundances towards lower metallicities of the studied s-process rich post-AGB stars in the Magellanic Clouds. The more metal-rich J051213−693537.1 fits the theoretical Pb abundance predictions well, while the five other objects with [Fe/H] < 1, including J051848−700246.9, have much lower Pb overabundances than predicted. In all objects found so far, including the objects in this study, the C/O ratio is very moderate because of the enhancement of O as well as C. We find that all s-process rich stars in the LMC and SMC studied so far, cluster in the same region of the HR-diagram and are associated with low-mass stars with a low metallicity on average. We corroborate the published lack of correlation between the metallicity and the neutron irradiation, while the neutron exposure ([hs/ls]) is strongly correlated with the third dredge-up efficiency ([s/Fe]). These correlations seem to hold in our Galaxy as well as in the Magellanic Clouds.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:1508.01091

Can star cluster environment affect dust input from massive AGB stars?

Svitlana Zhukovska[1,2], *Mykola Petrov*[3] *and Thomas Henning*[2]

[1]Max Planck Institute for Astrophysics, Karl-Schwarzschild-Str. 1, D-86748 Garching, Germany

[2]Max Planck Institute for Astronomy, Königstuhl 17, D-69117 Heidelberg, Germany

[3]Institute for Astrophysics, University of Vienna, Türkenschanzstraße 17, A-1180 Vienna

We examine the fraction of massive asymptotic giant branch (AGB) stars remaining bound in their parent star

clusters and the effect of irradiation of these stars by intracluster ultraviolet (UV) field. We employ a set of N-body models of dynamical evolution of star clusters rotating in a galactic potential at the solar galactocentric radius. The cluster models are combined with stellar evolution formulæ, a library of stellar spectra, and simple models for SiO photodissociation in circumstellar environment (CSE). The initial stellar masses of clusters are varied from 50 $M_\odot$ to 10^5 $M_\odot$. Results derived for individual clusters are combined using a mass distribution function for young star clusters. We find that about 30% of massive AGB stars initially born in clusters become members of the field population, while the rest evolves in star clusters. They are irradiated by strong intracluster UV radiation resulting in the decrease of the photodissociation radius of SiO molecules, in many stars down to the dust formation zone. In absence of dust shielding, the UV photons penetrate in the CSE deeper than 10 $R_\star$ in 64% and deeper than 2 $R_\star$ in 42% of all massive AGB stars. If this suppresses following dust formation, the current injection rate of silicate dust from AGB stars in the local Galaxy decreases from 2.2×10^{-4} $M_\odot$ pc^{-2} Gyr^{-1} to 1.8×10^{-4} $M_\odot$ pc^{-2} Gyr^{-1} at most. A lower revised value of 40% for the expected fraction of presolar silicate grains from massive AGB stars is still high to explain the non-detection of these grains in meteorites.

Accepted for publication in The Astrophysical Journal
Available from arXiv:1508.01035

Thermal runaway during the evolution of ONeMg cores towards accretion-induced collapse

Josiah Schwab[1,2], Eliot Quataert[1,2] and Lars Bildsten[3,4]

[1]Physics Department, University of California, Berkeley, CA 94720, USA
[2]Astronomy Department and Theoretical Astrophysics Center, University of California, Berkeley, CA 94720, USA
[3]Department of Physics, University of California, Santa Barbara, CA 93106, USA
[4]Kavli Institute for Theoretical Physics, Santa Barbara, CA 93106, USA

We study the evolution of degenerate electron cores primarily composed of the carbon burning products oxygen, neon, and magnesium (hereafter ONeMg cores) that are undergoing compression. Electron capture reactions on $A = 20$ and $A = 24$ isotopes reduce the electron fraction and heat the core. We develop and use a new capability of the Modules for Experiments in Stellar Astrophysics (MESA) stellar evolution code that provides a highly accurate implementation of these key reactions. These new accurate rates and the ability of MESA to perform extremely small spatial zoning demonstrates a thermal runaway in the core triggered by the temperature and density sensitivity of the ^{20}Ne electron capture reactions. Both analytics and numerics show that this thermal runaway does not trigger core convection, but rather leads to a centrally concentrated ($r <$ km) thermal runaway that will subsequently launch an oxygen deflagration wave from the center of the star. We use MESA to perform a parameter study that quantifies the influence of the magnesium mass fraction, the central temperature, the compression rate, and uncertainties in the electron capture reaction rates on the ONeMg core evolution. This allows us to establish a lower limit on the central density at which the oxygen deflagration wave initiates of $\rho_c > 8.5 \times 10^9$ g cm^{-3}. Based on previous work and order-of-magnitude calculations, we expect objects which ignite oxygen at or above these densities to collapse and form a neutron star. Calculations such as these are an important step in producing more realistic progenitor models for studies of the signature of accretion-induced collapse.

Accepted for publication in MNRAS
Available from arXiv:1504.05194

The WISE view of RV Tauri stars

I. Gezer[1,2], H. Van Winckel[2], Z. Bozkurt[1], K. De Smedt[2], D. Kamath[2], M. Hillen[2] and R. Manick[2]

[1]Astronomy and Space Science Department, Ege University, 35100 Bornova, Izmir, Turkey
[2]Institute of Astronomy, K.U. Leuven, Celestijnenlaan, 200D 3001 Leuven, Belgium

We present a detailed study based on infrared photometry of all Galactic RV Tauri stars from the General Catalogue

of Variable Stars (GCVS). RV Tauri stars are the brightest among the population II Cepheids. They are thought to evolve away from the asymptotic giant branch (AGB) towards the white dwarf domain. IRAS detected several RV Tauri stars because of their large IR excesses and it was found that they occupy a specific region in the [12]–[25], [25]–[60] IRAS two-colour diagram. We used the all sky survey of WISE to extend these studies and compare the infrared properties of all RV Tauri stars in the GCVS with a selected sample of post-AGB objects with the goal to place the RV Tauri pulsators in the context of post-AGB evolution. Moreover, we correlated the IR properties of both the RV Tauri stars and the comparison sample with other observables like binarity and the presence of a photospheric chemical anomaly called depletion. We find that Galactic RV Tauri stars display a range of infrared properties and we differentiate between disc sources, objects with no IR excess and objects for which the spectral energy distribution (SED) is uncertain. We obtain a clear correlation between disc sources and binarity. RV Tauri stars with a variable mean magnitude are exclusively found among the disc sources. We also find evidence for disc evolution among the binaries. Furthermore our studies show that the presence of a disc seems to be a necessary but not sufficient condition for the depletion process to become efficient.

Published in MNRAS
Available from arXiv:1507.04175

Resolving asymmetries along the pulsation cycle of the Mira star X Hya

X. Haubois[1,2,3]*, M. Wittkowski*[4]*, G. Perrin*[2]*, P. Kervella*[2,5]*, A. Mérand*[1]*, E. Thiébaut*[6]*, S.T. Ridgway*[7]*, M. Ireland*[8] *and M. Scholz*[3,9]

[1]European Southern Observatory (ESO), Alonso de Cordova 3107, Casilla 19001, Vitacura, Santiago 19, Chile

[2]LESIA, Observatoire de Paris, CNRS UMR 8109, UPMC, Université Paris Diderot, PSL Research University, 5 place Jules Janssen, 92195 Meudon, France

[3]Sydney Institute for Astronomy, School of Physics, University of Sydney, Sydney, NSW 2006, Australia

[4]European Southern Observatory, Karl-Schwarzschild-Str. 2, D-85748 Garching bei München, Germany

[5]Unidad Mixta Internacional Franco–Chilena de Astronomía (UMI 3386), CNRS/INSU, France & Departamento de Astronomía, Universidad de Chile, Camino El Observatorio 1515, Las Condes, Santiago, Chile

[6]Centre de Recherche Astrophysique de Lyon, CNRS/UMR 5574, 69561 Saint Genis Laval, France

[7]Kitt Peak National Observatory, National Optical Astronomy Observatories, P.O. Box 26732, Tucson, AZ 85726-6732 U.S.A.

[8]Research School of Astronomy & Astrophysics, Australian National University, Canberra, ACT 2611, Australia

[9]Zentrum für Astronomie der Universität Heidelberg (ZAH), Institut für Theoretische Astrophysik, Albert-Überle-Str. 2, 69120 Heidelberg, Germany

The mass-loss process in Mira stars probably occurs in an asymmetric way where dust can form in inhomogeneous circumstellar molecular clumps. Following asymmetries along the pulsation cycle can give us clues about these mass-loss processes. We imaged the Mira star X Hya and its environment at different epochs to follow the evolution of the morphology in the continuum and in the molecular bands. We observed X Hya with AMBER in J/H/K at low resolution at two epochs. We modelled squared visibilities with geometrical and physical models. We also present imaging reconstruction results obtained with MiRA and based on the physical a priori images. We report on the angular scale change of X Hya between the two epochs. 1D CODEX profiles allowed us to understand and model the spectral variation of squared visibilities and constrain the stellar parameters. Reconstructed model-dependent images enabled us to reproduce closure phase signals and the azimuthal dependence of squared visibilities. They show evidence for material inhomogeneities located in the immediate environment of the star.

Accepted for publication in A&A
Available from arXiv:1508.03180

Hubble Space Telescope near-ultraviolet spectroscopy of bright CEMP-*s* stars

Vinicius M. Placco[1], *Timothy C. Beers*[1], *Inese I. Ivans*[2], *Dan Filler*[2], *Julie A. Imig*[2], *Ian U. Roederer*[3], *Carlo Abate*[4], *Terese Hansen*[5], *John J. Cowan*[6], *Anna Frebel*[7], *James E. Lawler*[8], *Hendrik Schatz*[9], *Christopher Sneden*[10], *Jennifer S. Sobeck*[11], *Wako Aoki*[12], *Verne V. Smith*[13] *and Michael Bolte*[14]

[1]University of Notre Dame, USA
[2]The University of Utah, USA
[3]University of Michigan, USA
[4]Argelander Institut für Astronomie, Germany
[5]Landessternwarte Heidelberg, Germany
[6]University of Oklahoma, USA
[7]Massachusetts Institute of Technology, USA
[8]University of Wisconsin, USA
[9]Michigan State University, USA
[10]University of Texas, USA
[11]University of Virginia, USA
[12]National Astronomical Observatory of Japan, Japan
[13]National Optical Astronomy Observatory, USA
[14]University of California, USA

We present an elemental-abundance analysis, in the near-ultraviolet (NUV) spectral range, for the bright carbon-enhanced metal-poor (CEMP) stars HD 196944 (V = 8.40, [Fe/H] = −2.41) and HD 201626 (V = 8.16, [Fe/H] = −1.51), based on data acquired with the Space Telescope Imaging Spectrograph (STIS) on the *Hubble* Space Telescope. Both of these stars belong to the sub-class CEMP-*s*, and exhibit clear over-abundances of heavy elements associated with production by the slow neutron-capture process. HD 196944 has been well-studied in the optical region, but we add abundance results for six species (Ge, Nb, Mo, Lu, Pt, and Au) that are only accessible in the NUV. In addition, we provide the first determination of its orbital period, P = 1325 days. HD 201626 has only a limited number of abundance results based on previous optical work – here we add five new species from the NUV, including Pb. We compare these results with models of binary-system evolution and *s*-process element production in stars on the asymptotic giant branch, with the goal of explaining their origin and evolution. Our best-fitting models for HD 196944 ($M_{1,i}$ = 0.9 $M_\odot$, $M_{2,i}$ = 0.86 $M_\odot$, for [Fe/H] = −2.2), and HD 201626 ($M_{1,i}$ = 0.9 $M_\odot$, $M_{2,i}$ = 0.76 $M_\odot$, for [Fe/H] = −2.2; $M_{1,i}$ = 1.6 $M_\odot$, $M_{2,i}$ = 0.59 $M_\odot$, for [Fe/H] = −1.5) are consistent with the current accepted scenario for the formation of CEMP-*s* stars.

Accepted for publication in ApJ
Available from arXiv:1508.05872

A molecular line survey of a sample of AGB stars and planetary nebulæ

Christina L. Smith[1], *Albert A. Zijlstra*[1] *and Gary A. Fuller*[1]

[1]Jodrell Bank Centre for Astrophysics, University of Manchester, Oxford Road, Manchester, UK

A millimeter molecular line survey of three carbon-rich AGB stars and two oxygen-rich planetary nebulæ has been carried out over the frequency range 80.5–115.5 GHz. Sixty eight different transitions were detected in the data from 27 different molecular species. The hyperfine structure of C_2H and $C^{13}CH$ has been fitted to constrain the optical depth of their transitions. All other transitions have been constrained on the basis of their line profile shapes. Rotation temperatures and column densities have been calculated for all possible species, with adaptations to the methods applied in order to account for the hyperfine structure of various transitions. From the column densities, carbon, silicon and sulphur isotopic ratios have been determined. The results corroborate IRAS 15194−5115 as a J-type star, whilst excluding IRAS 15082−4808 and IRAS 07454−7112 as such.

Accepted for publication in MNRAS
Available from arXiv:1508.05014

Barium surface abundances of blue stragglers in the open cluster NGC 6819

Katelyn E. Milliman[1], *Robert D. Mathieu*[1] *and Simon C. Schuler*[2]

[1]University of Wisconsin-Madison, USA

[2]University of Tampa, USA

We present the barium surface abundance of 12 blue stragglers (BSs) and 18 main-sequence (MS) stars in the intermediate-age open cluster NGC 6819 (2.5 Gyr) based on spectra obtained from the Hydra Multi-object Spectrograph on the WIYN 3.5 m telescope. For the MS stars we find [Fe/H] $= +0.05 \pm 0.04$ and [Ba/Fe] $= -0.01 \pm 0.10$. The majority of the BS stars are consistent with these values. We identify five BSs with significant barium enhancement. These stars most likely formed through mass transfer from an asymptotic giant branch star that polluted the surface of the BS with the nucleosynthesis products generated during thermal pulsations. This conclusion aligns with the results from the substantial work done on the BSs in old open cluster NGC 188 that identifies mass transfer as the dominant mechanism for BS formation in that open cluster. However, four of the BSs with enhanced barium show no radial-velocity evidence for a companion. The one star that is in a binary is a double-lined system, meaning the companion is not a white dwarf and not the remnant of a prior AGB star. In this paper we attempt to develop a consistent scenario to explain the origin of these five BSs.

Published in Astronomical Journal, 150, 84 (2015)
Available from arXiv:1508.01236
and from http://iopscience.iop.org/1538-3881/150/3/84/

^{12}CO emission from EP Aqr: Another example of an axi-symmetric AGB wind?

P.T. Nhung[1,2], *D.T. Hoai*[1,2], *J.M. Winters*[3], *T. Le Bertre*[1], *P.N. Diep*[2], *N.T. Phuong*[2], *N.T. Thao*[2], *P. Tuan-Anh*[2] *and P. Darriulat*[2]

[1]LERMA, UMR 8112, CNRS & Observatoire de Paris/PSL, 61 av. de l'Observatoire, F-75014 Paris, France

[2]Department of Astrophysics, Vietnam National Satellite Center, VAST, 18 Hoang Quoc Viet, Ha Noi, Vietnam

[3]IRAM, 300 rue de la Piscine, Domaine Universitaire, F-38406 St. Martin d'Hères, France

The CO(1–0) and (2–1) emission of the circumstellar envelope of the Asymptotic Giant Branch (AGB) star EP Aqr has been observed in 2003 using the IRAM Plateau-de-Bure Interferometer and in 2004 using the IRAM 30-m telescope at Pico Veleta. The line profiles reveal the presence of two distinct components centered on the star velocity, a broad component extending up to ~ 10 km s^{-1} and a narrow component indicating an expansion velocity of only ~ 2 km s^{-1}. An early analysis of these data was performed under the assumption of isotropic winds. The present study revisits this interpretation by assuming instead a bipolar outflow nearly aligned with the line of sight. A satisfactory description of the observed flux densities is obtained with a radial expansion velocity increasing from ~ 2 km s^{-1} at the equator to ~ 10 km s^{-1} near the poles. The mass loss rate is $\sim 1.8\,10^{-7}$ M$_\odot$ yr^{-1}. The angular aperture of the bipolar outflow is $\sim 45°$ with respect to the star axis, which makes an angle of $\sim 13°$ with the line of sight. A detailed study of the CO(1–0) to CO(2–1) flux ratio reveals a significant dependence of the temperature on the star latitude, smaller and steeper at the poles than at the equator at large distances from the star ($> 2'' \equiv 1.0 \times 10^{-3}$ pc). Under the hypothesis of radial expansion of the gas and of rotation invariance about the star axis, the effective density has been evaluated in space as a function of star coordinates (longitude, latitude and distance from the star). Evidence is found for an enhancement of the effective density in the northern hemisphere of the star at angular distances in excess of $\sim 3''$ and covering the whole longitudinal range. The peak velocity of the narrow component is observed to vary slightly with position on the sky, a variation consistent with the model and understood as the effect of the inclination of the star axis with respect to the line of sight. This variation is inconsistent with the assumption of a spherical wind and strengthens our interpretation in terms of an axisymmetric outflow. While the phenomenological model presented here reproduces well the general features of the observations, not only qualitatively but also quantitatively, significant differences are also revealed, which would require a better spatial resolution to be properly described and understood.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1508.05208

Infrared spectral properties of M giants

G.C. Sloan[1,2]*, C. Goes*[1]*, R.M. Ramirez*[1,2]*, K.E. Kraemer*[3] *and C.W. Engelke*[3]

[1]Cornell Center for Astrophysics and Planetary Science, Cornell University, USA

[2]Carl Sagan Institute, Cornell University, USA

[3]Institute for Scientific Research, Boston College, USA

We observed a sample of 20 M giants with the Infrared Spectrograph on the *Spitzer* Space Telescope. Most show absorption structure at 6.6–6.8 μm which we identify as water vapor, and in some cases, the absorption extends from 6.4 μm into the SiO band at 7.5 μm. Variable stars show stronger H_2O absorption. While the strength of the SiO fundamental at 8 μm increases monotonically from spectral class K0 to K5, the dependence on spectral class weakens in the M giants. As with previously studied samples, the M giants show considerable scatter in SiO band strength within a given spectral class. All of the stars in our sample also show OH band absorption, most noticeably in the 14–17 μm region. The OH bands behave much like the SiO bands, increasing in strength in the K giants but showing much weaker dependence on spectral class in the M giants, and with considerable scatter. An examination of the photometric properties reveals that the V–K color may be a better indicator of molecular band strength than the spectral class. The transformation from Tycho colors to Johnson B–V color is double-valued, and neither B–V nor B_T–V_T color increases monotonically with spectral class in the M giants like they do with the K giants.
NOTE: See http://isc.astro.cornell.edu/∼sloan/library/standards for access to spectra.

Accepted for publication in ApJ
Available from arXiv:1508.05165
and from http://isc.astro.cornell.edu/∼sloan/library/2015/mgiant

A database of circumstellar OH masers

D. Engels[1] *and F. Bunzel*[1]

[1]Hamburger Sternwarte, Gojenbergsweg 112, 21029 Hamburg, Germany

We present a new database of circumstellar OH masers at 1612, 1665, and 1667 MHz in the Milky Way galaxy. The database (version 2.4) contains 13655 observations and 2341 different stars detected in at least one transition. Detections at 1612 MHz are considered to be complete until the end of 2014 as long as they were published in refereed papers. Detections of the main lines (1665 and 1667 MHz) and non-detections in all transitions are included only if published after 1983. The database contains flux densities and velocities of the two strongest maser peaks, the expansion velocity of the shell, and the radial velocity of the star. Links are provided for about 100 stars ($< 5\%$ of all stars with OH masers) to interferometric observations and monitoring programs of the maser emission published since their beginnings in the 1970s. Access to the database is possible over the Web (www.hs.uni-hamburg.de/maserdb), allowing cone searches for individual sources and lists of sources. A general search is possible in selected regions of the sky and by defining ranges of flux densities and/or velocities. Alternative ways to access the data are via the German Virtual Observatory and the VizieR library of astronomical catalogs.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1508.06200
and from www.hs.uni-hamburg.de/maserdb

Morpho-kinematics of the planetary nebula NGC 3242: an analysis beyond its multiple-shell structure

M.A. Gómez-Muñoz[1], *M.W. Blanco Cárdenas*[1], *R. Vázquez*[1], *S. Zavala*[2,3], *P.F. Guillén*[1] *and S. Ayala*[4]

[1]Instituto de Astronomía, Universidad Nacional Autónoma de México, Apdo. Postal 877, 22800 Ensenada, B.C., México

[2]Instituto Tecnológico de Ensenada, Blvd. Tecnológico No. 150, 22780 Ensenada, B.C., México

[3]Instituto de Estudios Avanzados de Baja California, A.C., Blvd. Tte. Azueta 147, Edif. Matematikè Planta Baja, 22800 Ensenada B.C., México

[4]Facultad de Ciencias Físico-Matemáticas, Universidad Autónoma de Nuevo León, Av. Universidad s /n , 66451 San Nicolás de la Garza, N.L., México

In this paper we present the results of optical high-resolution imaging and spectroscopy of the complex planetary nebula (PN) NGC 3242. Our study is based in the analysis of the narrowband Hα λ6563Å, [O III] λ5007Å, [N II] λ6584Å, and [S II] λ6724Å images, and high-resolution spectroscopy using spectral ranges centered on the Hα λ6564Å, [N II] λ6583Å, and [O III] λ5007Å. We detected and analysed morphological components beyond the multiple shell structure of this PN, to investigate the small-scale morphological components aligned towards its major axis (such as knots and ansæ, as well as the arc-like features) and its surroundings. Thus, we investigated the morpho-kinematical properties of NGC 3242, as well as their nature and formation. Our results regarding the elliptical double-shell structure and the distance to this nebula are in concordance with previous studies. Furthermore, we have used the software SHAPE to construct a 3D model of NGC 3242, allowing us to successfully reproduce our observational data. We conclude that the prominent knots emitting in the [N II] line are fast, low-ionisation emission regions (FLIERs) related to high velocity jets and the so-called ansæ-like features rather resemble bubbles. The disruptions immersed in the halo, whose emission was detected in the the [O III] high-excitation emission line, remarkably display high velocities and were formed likely in an earlier ejection event, in comparison to the innermost LIS and bubbles. Finally, according to our model, the kinematical ages of the structures in NGC 3242 range from 390 to 5400 yr.

Accepted for publication in Monthly Notices of the Royal Astronomical Society
Available from arXiv:1508.05115

Planetary nebula progenitors that swallow binary systems

Noam Soker[1]

[1]Technion, Israel

I propose that some irregular "messy" planetary nebulæ owe their morphologies to triple-stellar evolution where tight binary systems are tidally and frictionally destroyed inside the envelope of asymptotic giant branch (AGB) stars. The tight binary system might break up with one star leaving the system. In an alternative evolution, one of the stars of the broken-up tight binary system falls toward the AGB envelope with low specific angular momentum, and drowns in the envelope. In a different type of destruction process the drag inside the AGB envelope causes the tight binary system to merge. This releases gravitational energy within the AGB envelope, leading to a very asymmetrical envelope ejection, with an irregular and "messy" planetary nebula as a descendant. The evolution of the triple-stellar system before destruction can be in a full common envelope evolution (CEE) or in a grazing envelope evolution (GEE). Both before and after destruction the system might launch pairs of opposite jets. One pronounced signature of triple-stellar evolution might be a large departure from axisymmetrical morphology of the descendant planetary nebula. I estimate that about one in six non-spherical PNe is shaped by one of these triple-stellar evolutionary routes.

Submitted to MNRAS
Available from arXiv:1508.05698

Flash-ionization of pre-existing circumstellar material around Nova Oph 2015

U. Munari[1] *and F.M. Walter*[2]

[1]INAF Astronomical Observatory of Padova, Italy

[2]Dept. of Physics and Astronomy, Stony Brook University, USA

We have obtained daily high resolution Échelle spectroscopy of Nova Oph 2015 during its initial evolution. It reveals the presence of pre-existing circumstellar material around the nova, which is best interpreted as the wind of an evolved companion. On earliest observations, the emission line profiles of Nova Oph 2015 displayed a very narrow emission component (FWHM $\sim$ 60 km s^{-1}), recombining over a time scale of 5 days and showing constant low velocity (RV$_\odot$ = $-$4.5 km s^{-1}), that we interpret as coming from the wind of the secondary recombining after the ionization from the initial UV-flash of the nova. The underlying broad component underwent a marked reduction in both FWHM and width at zero intensity (the latter declining from 4000 to 2000 km s^{-1} in ten days) while increasing by 6 times in flux, that we believe is the result of the high velocity ejecta of the nova being slowed down while trying to expand within the surrounding wind of the companion. Novæ with evolved secondaries are very rare in the Galaxy, amounting 3% of the total according to recent estimates. Among them Nova Oph 2015 is perhaps unique in having displayed a long rise to maximum brightness and a slow decline from it, an Fe II-type classification (contrary to prevailing He/N) and a probable sub-giant luminosity class for the secondary (instead of the giant (e.g., RS Oph) or supergiant (e.g., V407 Cyg) class for the others).

Submitted to MNRAS
Available from arXiv:1508.06204

Modelling the atmosphere of the carbon-rich Mira RU Vir

G. Rau[1]*, C. Paladini*[2]*, J. Hron*[1]*, B. Aringer* [3]*, M.A.T. Groenewegen*[4] *and W. Nowotny*[1]

[1]University of Vienna, Department of Astrophysics, Türkenschanzstraße 17, A-1180 Vienna, Austria. e-mail: gioia.rau@univie.ac.at

[2]Institut d'Astronomie et d'Astrophysique, Université libre de Bruxelles, Boulevard du Triomphe CP 226, B-1050 Bruxelles, Belgium

[3]Department of Physics and Astronomy G. Galilei, Vicolo dell'Osservatorio 3, 35122 Padova, Italy

[4]Royal Observatory of Belgium, Ringlaan 3, B-1180 Brussels, Belgium

Context: We study the atmosphere of the carbon-rich Mira RU Vir using the mid-infrared high spatial resolution interferometric observations from VLTI/MIDI.
Aims: The aim of this work is to analyse the atmosphere of the carbon-rich Mira RU Vir, with hydrostatic and dynamic models, in this way deepening the knowledge of the dynamic processes at work in carbon-rich Miras.
Methods: We compare spectro-photometric and interferometric measurements of this carbon-rich Mira AGB star, with the predictions of different kinds of modelling approaches (hydrostatic model atmospheres plus MOD – "More Of Dusty", self-consistent dynamic model atmospheres). A geometric model fitting tool is used for a first interpretation of the interferometric data.
Results: The results show that a joint use of different kind of observations (photometry, spectroscopy, interferometry) is essential to shed light on the structure of the atmosphere of a carbon-rich Mira. The dynamic model atmospheres fit well the ISO spectrum in the wavelength range $\lambda \in [2.9, 25.0]$ μm. Nevertheless, a discrepancy is noticeable both in the SED (visible), and in the interferometric visibilities (shape and level). A possible explanation are intra-/inter-cycle variations in the dynamic model atmospheres as well as in the observations. The presence of a companion star and/or a disk or a decrease of mass loss within the last few hundred years cannot be excluded but these explanations are considered unlikely.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1506.03978

Conference Papers

An N band interferometric survey of the disks around post-AGB binary stars

M. Hillen[1]

[1]Instituut voor Sterrenkunde, University of Leuven, Leuven, Belgium

It is now well established that FGK post-AGB stars that are surrounded by both hot and cold dust (as derived from the spectral energy distribution), are almost always part of a binary system with $100 < P_{\rm orb} < 5000$ days. The properties and long-term stability of the dust emission requires it to arise from a gas- and dust-rich, puffed-up and (semi-)stable circumbinary disk. This interpretation has been confirmed with spatially resolved observations at a range of wavelengths for various individual objects. Here I present the first results of the first mid-IR interferometric survey of this class of objects. Our sample comprises 18 sources, most of which are confirmed binaries and which cover a range in IR excess. Our analysis clearly shows the compactness of the dust structures in these systems. We perform a statistical comparison with radiative transfer disk models, showing that most objects are indeed continuous disks from the sublimation radius outwards.

Oral contribution, published in "Physics of evolved stars 2015" – a conference dedicated to the memory of Olivier Chesneau
Available from arXiv:1508.04309
and from http://poe2015.sciencesconf.org/

The roles of jets: CF, CCSN, PN, CEE, GEE, ILOT

Noam Soker[1]

[1]Technion, Israel

I review the roles of jet-inflated bubbles in determining the evolution of different astrophysical objects. I discuss astrophysical systems where jets are known to inflate bubbles (cooling flow [CF] clusters; young galaxies; intermediate luminosity optical transients [ILOTs]; bipolar planetary nebulae [PNe]), and systems that are speculated to have jet-inflated bubbles (core collapse supernovae [CCSNe]; common envelope evolution [CEE]; grazing envelope evolution [GEE]). The jets in many of these cases act through a negative jet feedback mechanism (JFM). I discuss the outcomes when the JFM fizzle, or does not work at all. According to this perspective, some very interesting and energetic events owe their existence to the failure of the JFM, including stellar black holes, gamma ray bursts, and type Ia supernovae.

Oral contribution, published in "Physics of Evolved Stars 2015" – a conference dedicated to the memory of Olivier Chesneau
Available from arXiv:1508.00699

Announcements

Cloudy workshop
2016 June 20–24
Shandong University, Weihai, China

Registration is now open for the 2016 Cloudy workshop. It will be held June 20–24, Shandong University, Weihai, China.

CLOUDY simulates the microphysics of matter exposed to ionizing radiation. It calculates the atomic physics, chemistry, radiation transport, and dynamics problems simultaneously and self consistently, building from a foundation of individual atomic and molecular processes. The result is a prediction of the conditions in the material and its observed spectrum.

The workshop will cover observation, theory, and application of CLOUDY to a wide variety of astronomical environments. This includes the theory of diffuse non-LTE matter and quantitative spectroscopy, the science of using spectra to make physical measurements. We will use CLOUDY to simulate such objects as AGB stars, Active Galactic Nuclei, Starburst galaxies, and the intergalactic medium.

The sessions will consist of a mix of textbook study, using Osterbrock & Ferland, Astrophysics of Gaseous Nebulæ and Active Galactic Nuclei, application of the spectral-simulation code CLOUDY to a variety of astrophysical problems, and projects organized by the participants. No prior experience with CLOUDY is assumed. There is no registration fee and financial support is not available.

The site http://cloud9.pa.uky.edu/∼gary/cloudy/CloudySummerSchool/ about CLOUDY and the workshop. Local details and instructions for registration are on http://cloudy2016.csp.escience.cn/dct/page/1

Shandong University (SDU) is a key comprehensive university with a long history, a variety of disciplines, strong academic strength, and distinctive characteristics. Its main body, Shandong Imperial College (Shandong Da Xue Tang) established in 1901, was the second national university in China, only after the Imperial University of Peking. Shandong University at Weihai, as one of seven campuses of SDU, was established in 1984. Weihai is the easternmost prefecture-level city of Shandong province,China. Weihai is China's well-known coastal tourist and leisure resorts and the city of natural hot springs.

See also http://cloudy2016.csp.escience.cn/dct/page/1

Fizeau exchange visitors program – call for applications

Dear colleagues!

The Fizeau exchange visitors program in optical interferometry funds (travel and accommodation) visits of researchers to an institute of his/her choice (within the European Community) to perform collaborative work and training on one of the active topics of the European Interferometry Initiative. The visits will typically last for one month, and strengthen the network of astronomers engaged in technical, scientific and training work on optical/infrared interferometry. The program is open for all levels of astronomers (Ph.D. students to tenured staff), non-EU based missions will only be funded if considered essential by the Fizeau Committee. Applicants are strongly encouraged to seek also partial support from their home or host institutions.

The deadline for applications is September 15. Fellowships can be awarded for missions starting in November.

Further informations and application forms can be found at www.european-interferometry.eu

The program is funded by OPTICON/FP7.

Please distribute this message also to potentially interested colleagues outside of your community!

Looking forward to your applications,
Josef Hron & Laszlo Mosoni
(for the European Interferometry Initiative)

See also www.european-interferometry.eu