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. 223 — 1 February 2016

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

Editors: Jacco van Loon, Ambra Nanni and Albert Zijlstra

Figure 1: The planetary nebulæ: (*Top Left:*) Ear Nebula, (*Top Right:*) Abell 79, (*Bottom Left:*) M 2-9 or "Minkowski's Butterfly", (*Bottom Right:*) Abell 70. All images are composites of Hα, [O III] and RVB, and [S II] in the case of Abell 79 and M 2-9, taken with the 129-cm Ritchey–Chrétien telescope on Mt. Skinakas, Crete. Credit: Capella Observatory and Stefan Binnewies, Josef Pöpsel, Makis Palaiologou, and Ralf Kreuels (Abell 79).

Editorial

Dear Colleagues,

It is our pleasure to present you the 223rd issue of the AGB Newsletter – one of the most voluminous editions ever.

There are two fantastic opportunities for postdoctoral researcher positions at the Universidad Católica del Norte in Chile. Check also the 4 meeting announcements. And pictures of your recent work remain welcome for the frontpage!

Last month's *Food for Thought* asked: "What happens to the Kuiper Belt and Oort Cloud when the Sun becomes an AGB star?" Noam Soker kindly pointed us to his recent paper: arxiv.org/abs/1601.00328 whilst Dimitri Veras from the University of Warwick (UK) also works on this problem and invites people to discuss it with him; he wrote: "Mass loss from the both the Solar RGB and the Solar AGB star will change the orbits of asteroids, comets and planets.If the bodies are far enough away from the Sun, then they are susceptible to escape.The Solar system's post-main-sequence boundary lies between 1000 au and 10000 au, as shown by adsabs.harvard.edu/abs/2012MNRAS.421.2969V Therefore, Oort Cloud comets are susceptible to escape due to mass loss. But the question of just how many will escape is complicated due to Galactic tides and stellar flybys: adsabs.harvard.edu/abs/2014MNRAS.437.1127V We have attempted to estimate the fraction which escapes, and quantify that as a function of time in Figure 3 of: adsabs.harvard.edu/abs/2014MNRAS.445.4175V The Kuiper belt will remain bound to the Sun, but its evolution will be complicated by a variety of forces (radiation and mutual collisions). These effects are detailed here for Kuiper belts around A stars: adsabs.harvard.edu/abs/2010MNRAS.409.1631B Certainly a dedicated study for the post-main-sequence evolution of the Solar system's Kuiper belt would be welcome!"

The next issue is planned to be distributed around the 1st of March.

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

Food for Thought

This month's thought-provoking statement is:

Has the Earth ever been immersed within a nearby planetary nebula?

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

The radio continuum spectrum of Mira A and Mira B up to submillimeter wavelengths

Pere Planesas[1], *Javier Alcolea*[1] *and Rafael Bachiller*[1]

[1]Observatorio Astronómico Nacional (OAN–IGN), Spain

We present new measurements of the flux densities at submillimeter wavelengths based on ALMA band 7 (338 GHz, λ0.89 mm) and band 9 (679 GHz, λ0.44 mm) observations to better constrain the origin of the continuum emission of the Mira AB binary system and to check its orbit. We have measured the Mira A and Mira B continuum in ALMA band 7, with a resolution of $\sim 0\farcs31$, and for the first time in ALMA band 9, with a resolution of $\sim 0\farcs18$. We have resolved the binary system at both bands, and derived the continuum spectral index of the stars and their relative position. We also analyzed ALMA Science Verification data obtained in bands 6 and 3. Measurements at centimeter wavelengths obtained by other authors have been included in our study of the spectral energy distribution of the Mira components. The Mira A continuum emission has a spectral index of 1.98 ± 0.04 extending from submillimeter down to centimeter wavelengths. The spectral index of the Mira B continuum emission is 1.93 ± 0.06 at wavelengths ranging from submillimeter to ~ 3.1 mm, and a shallower spectral index of 1.22 ± 0.09 at longer wavelengths. The high precision relative positions of the A and B components are shown to significantly depart from the current (preliminary) orbit by ~ 14 milliarsec. The Mira A continuum emission up to submillimeter wavelengths is consistent with that of a radio photosphere surrounding the evolved star for which models predict a spectral index close to 2. The Mira B continuum emission cannot be described with a single ionized component. An extremely compact and dense region around the star can produce the nearly thermal continuum measured in the range λ0.4–3.1 mm, and an inhomogeneous, less dense, and slightly larger ionized envelope could be responsible for the emission at longer wavelengths. Our results illustrate the potential of ALMA for high precision astrometry of binary systems. We have found a significant discrepancy between the ALMA measurements and the predicted orbit positions.

Accepted for publication in A&A
Available from arXiv:1512.08638
and from http://www.aanda.org/component/article?access=doi&doi=10.1051/0004-6361/201527833

Exploring the crowded central region of 10 Galactic globular clusters using EMCCDs. Variable star searches and new discoveries

R. Figuera Jaimes[1,2], *D.M. Bramich*[3], *J. Skottfelt*[4,5], *N. Kains*[6], *U.G. Jørgensen*[5], *K. Horne*[1], *M. Dominik*[1] *and The MiNDSTEp Consortium*

[1]SUPA, School of Physics and Astronomy, University of St. Andrews, North Haugh, St. Andrews, KY16 9SS, United Kingdom

[2]European Southern Observatory, Karl-Schwarzschild-Straße 2, 85748 Garching bei München, Germany

[3]Qatar Environment and Energy Research Institute (QEERI), HBKU, Qatar Foundation, Doha, Qatar

[4]Centre for Electronic Imaging, Dept. of Physical Sciences, The Open University, Milton Keynes MK7 6AA, UK

[5]Niels Bohr Institute and Centre for Star and Planet Formation, University of Copenhagen, Øster Voldgade 5, 1350 Copenhagen K, Denmark

[6]Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, United States of America

We obtained time-series photometry of the very crowded central regions of Galactic globular clusters with better angular resolution than previously achieved with conventional CCDs on ground-based telescopes to complete, or improve, the census of the variable star population in those stellar systems.
Images were taken using the Danish 1.54-m Telescope at the ESO observatory at La Silla in Chile. The telescope was equipped with an electron-multiplying CCD and the short-exposure-time images obtained (10 images per second) were stacked using the shift-and-add technique to produce the normal-exposure-time images (minutes). Photometry

was performed via difference image analysis. Automatic detection of variable stars in the field was attempted.
The light curves of 12541 stars in the cores of 10 globular clusters were statistically analysed in order to automatically extract the variable stars. We obtained light curves for 31 previously known variable stars (3 L, 2 SR, 20 RR Lyræ, 1 SX Phe, 3 cataclysmic variables, 1 EW and 1 NC) and we discovered 30 new variables (16 L, 7 SR, 4 RR Lyræ, 1 SX Phe and 2 NC).

Accepted for publication in A&A
Available from arXiv:1512.07913

Lithium in open cluster red giants hosting substellar companions

Joleen K. Carlberg[1], *Verne V. Smith*[2], *Katia Cunha*[3] *and Kenneth G. Carpenter*[1]

[1]NASA Goddard Space Flight Center, USA
[2]National Optical Astronomy Observatory, USA
[3]Observatório Nacional, Brazil

We have measured stellar parameters, [Fe/H], lithium abundances, rotation, and $^{12}C/^{13}C$ in a small sample of red giants in three open clusters that are each home to a red giant star that hosts a substellar companion (NGC 2423 3, NGC 4349 127, and BD +12°1917 in M 67). Our goal is to explore whether the presence of substellar companions influences the Li content. Both $^{12}C/^{13}C$ and stellar rotation are measured as additional tracers of stellar mixing. One of the companion hosts, NGC 2423 3, is found to be Li-rich with $A(\mathrm{Li})_{\mathrm{NLTE}} = 1.56$ dex, and this abundance is significantly higher than the A(Li) of the two comparison stars in NGC 2423. All three substellar companion hosts have the highest A(Li) and $^{12}C/^{13}C$ when compared to the control red giants in their respective clusters; however, except for NGC 2423 3, at least one control star has similarly high abundances within the uncertainties. Higher A(Li) could suggest that the formation or presence of planets plays a role in the degree of internal mixing on or before the red giant branch. However, a multitude of factors affect A(Li) during the red giant phase, and when the abundances of our sample are compared to abundances of red giants in other open clusters available in the literature, we find that they all fall well within a much larger distribution of A(Li) and $^{12}C/^{13}C$. Thus, even the high Li in NGC 2423 3 cannot be concretely tied to the presence of the substellar companion.

Accepted for publication in ApJ
Available from arXiv:1512.08558

Period spacings in red giants I. Disentangling rotation and revealing core structure discontinuities

B. Mosser[1], *M. Vrard*[1], *K. Belkacem*[1], *S. Deheuvels*[2,3] *and M.J. Goupil*[1]

[1]LESIA, Observatoire de Paris, PSL Research University, CNRS, Université Pierre et Marie Curie, Université Paris Diderot, 92195 Meudon, France
[2]Université de Toulouse; UPS–OMP; IRAP; Toulouse, France
[3]CNRS; IRAP; 14, avenue Edouard Belin, F-31400 Toulouse, France

Context: Asteroseismology allows us to probe the physical conditions inside the core of red giant stars. This process relies on the properties of the global oscillations with a mixed character that are highly sensitive to the physical properties of the core. However, overlapping rotational splittings and mixed-mode spacings result in complex structures in the mixed-mode pattern, which severely complicates its identification and the measurement of the asymptotic period spacing.
Aims: This work aims at disentangling the rotational splittings from the mixed-mode spacings in order to open the way to a fully automated analysis of large data sets.
Methods: An analytical development of the mixed-mode asymptotic expansion is used to derive the period spacing between two consecutive mixed modes. The échelle diagrams constructed with the appropriately stretched periods are

used to exhibit the structure of the gravity modes and of the rotational splittings.
Results: We propose a new view of the mixed-mode oscillation pattern based on corrected periods, called stretched periods, that mimic the evenly spaced gravity-mode pattern. This provides a direct understanding of all oscillation components, even in the case of rapid rotation. In this way, the measurement of the asymptotic period spacing and the signature of the structural glitches on mixed modes can be performed easily.
Conclusions: This work makes it possible to derive all seismic global parameters in an automated way, including the identification of the different rotational multiplets and the measurement of the rotational splitting, even when this splitting is significantly larger than the period spacing. Revealing buoyancy glitches provides a detailed view of the radiative core.

Published in A&A
Available from arXiv:1509.06193

Using intermediate-luminosity optical transients (ILOTs) to reveal extended exo-solar Kuiper belt objects

Ealeal Bear[1] *and Noam Soker*[2]

[1]Technion , Israel

We suggest that in the rare case of an Intermediate-Luminosity Optical Transient (ILOTs) event, evaporation of exo-solar Kuiper belt objects (ExoKBOs) at distances of $d \sim 500$–10000 au from the ILOT can be detected. If the ILOT lasts for 1 month to a few years, enough dust might be ejected from the ExoKBOs for the IR emission to be detected. Because of the large distance of the ExoKBOs, tens of years will pass before the ILOT wind disperses the dust. We suggest that after an ILOT outburst there is a period of months to several years during which IR excess emission might hint at the existence of a Kuiper belt analog (ExoK-Belt).

Submitted to astro-ph
Available from arXiv:1601.00328

Deciphering the bipolar planetary nebula Abell 14 with 3D ionization and morphological studies

S. Akras[1]*, N. Clyne*[1,2]*, P. Boumis*[3]*, H. Monteiro*[4]*, D.R . Gonçalves*[1]*, M.P. Redman*[2] *and S. William*[3]

[1]Observatório do Valongo, Universidade Federal do Rio de Janeiro, Brazil

[2]Centre for Astronomy, School of Physics, National University of Ireland Galway,Galway, Ireland

[3]IAASARS, National Observatory of Athens, Greece

[4]Instituto de Física e Química, Universidade Federal de Itajubá, Brasil

Abell 14 is a poorly studied object despite being considered a born again planetary nebula. We performed a detailed study of its 3D morphology and ionization structure using the SHAPE and MOCASSIN codes. We found that Abell 14 is a highly evolved, bipolar nebula with a kinematical age of $\sim 19,400$ yr for a distance of 4 kpc. The high He abundance, and N/O ratio indicate a progenitor of 5 $M_{\odot}$ that has experienced the third dredge-up and hot bottom burning phases. The stellar parameters of the central source reveal a star at a highly evolved stage near to the white dwarf cooling track, being inconsistent with the born again scenario. The nebula shows unexpectedly strong [N I] λ5200 and [O I] λ6300 emission lines indicating possible shock interactions. Abell 14 appears to be a member of a small group of highly evolved, extreme Type-I PNe. The members of this group lie at the lower-left corner of the PNe regime on the [N II]/Hα vs. [S II]/Hα diagnostic diagram, where shock-excited regions/objects are also placed. The low luminosity of their central stars, in conjunction with the large physical size of the nebulæ, result in a very low photo-ionization rate, which can make any contribution of shock interaction easily perceptible, even for small velocities.

Accepted for publication in Monthly Notices of the Royal Astronomical Society
Available from arXiv:1601.02170

Near-infrared spectro-interferometry of Mira variables and comparisons to 1D dynamic model atmospheres and 3D convection simulations

M. Wittkowski[1], A. Chiavassa[2], B. Freytag[3], M. Scholz[4,5], S. Höfner[3], I. Karovicova[4] and P.A. Whitelock[6,7]

[1]ESO, Karl-Schwarzschild-Str. 2, 85748 Garching bei München, Germany

[2]Laboratoire Lagrange, UMR 7293, Université de Nice Sophia-Antipolis, CNRS, Observatoire de la Côte d'Azur, BP. 4229, 0 6304 Nice Cedex 4, France

[3]Department of Physics and Astronomy at Uppsala University, Regementsvägen 1, Box 516, SE-75120 Uppsala, Sweden

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

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

[6]South African Astronomical Observatory, P.O. Box 9, 7935 Observatory, South Africa

[7]Astronomy, Cosmology and Gravity Centre, Astronomy Department, University of Cape Town, 7701 Rondebosch, South Africa

We obtained a total of 20 near-infrared K-band spectro-interferometric snapshot observations of the Mira variables o Cet, R Leo, R Aqr, X Hya, W Vel, and R Cnc with a spectral resolution of about 1500. We compared observed flux and visibility spectra with predictions by CODEX 1D dynamic model atmospheres and with azimuthally averaged intensities based on CO5BOLD 3D dynamic model atmospheres including convection. Our visibility data confirm the presence of spatially extended molecular atmospheres located above the continuum radii with large-scale inhomogeneities or clumps that contribute a few percent of the total flux. The detailed structure of the inhomogeneities or clumps show a variability on time scales of 3 months and above. Both modeling attempts provided satisfactory fits to our data. In particular, they are both consistent with the observed decrease in the visibility function at molecular bands of water vapor and CO, indicating a spatially extended molecular atmosphere. Observational variability phases are mostly consistent with those of the best-fit CODEX models, except for near-maximum phases, where data are better described by near-minimum models. Rosseland angular diameters derived from the model fits are broadly consistent between those based on the 1D and the 3D models and with earlier observations. We derived fundamental parameters including absolute radii, effective temperatures, and luminosities for our sources. Our results provide a first observational support for theoretical results that shocks induced by convection and pulsation in the 3D CO5BOLD models of AGB stars are roughly spherically expanding and of similar nature to those of self-excited pulsations in 1D CODEX models. Unlike for red supergiants, the pulsation- and shock-induced dynamics can levitate the molecular atmospheres of Mira variables to extensions that are consistent with observations.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1601.02368
and from http://www.aanda.org/component/article?access=doi&doi=10.1051/0004-6361/201527614

On potassium and other abundance anomalies of red giants in NGC 2419

Christian Iliadis[1], Amanda Karakas[2], Nicolas Prantzos[3], John Lattanzio[4] and Carolyn Doherty[4]

[1]University of North Carolina, USA

[2]Australian National University, Australia

[3]Institut d'Astrophysique de Paris, France

[4]Monash University, Australia

Globular clusters are of paramount importance for testing theories of stellar evolution and early galaxy formation. Strong evidence for multiple populations of stars in globular clusters derives from observed abundance anomalies. A puzzling example is the recently detected Mg–K anticorrelation in NGC 2419. We perform Monte Carlo nuclear reaction network calculations to constrain the temperature–density conditions that gave rise to the elemental abundances observed in this elusive cluster. We find a correlation between stellar temperature and density values that provide a satisfactory match between simulated and observed abundances in NGC 2419 for all relevant elements (Mg, Si, K, Ca, Sc, Ti, and V). Except at the highest densities ($\rho \gtrsim 10^8$ g cm^{-3}), the acceptable conditions range from ≈ 100 MK at $\approx 10^8$ g cm^{-3} to ≈ 200 MK at $\approx 10^{-4}$ g cm^{-3}. This result accounts for uncertainties in nuclear reaction rates and variations in the assumed initial composition. We review hydrogen burning sites and find that low-mass stars, AGB

stars, massive stars, or super-massive stars cannot account for the observed abundance anomalies in NGC 2419. Super-AGB stars could be viable candidates for the polluter stars if stellar model parameters can be fine-tuned to produce higher temperatures. Novæ, either involving CO or ONe white dwarfs, could be interesting polluter candidates, but a current lack of low-metallicity nova models precludes firmer conclusions. We also discuss if additional constraints for the first-generation polluters can be obtained by future measurements of oxygen, or by evolving models of second-generation low-mass stars with a non-canonical initial composition.

Accepted for publication in The Astrophysical Journal
Available from arXiv:1601.01359

Lithium-rich giants in globular clusters

Evan N. Kirby[1], *Puragra Guhathakurta*[2], *Andrew J. Zhang*[3,4], *Jerry Hong*[5], *Michelle Guo*[4,6], *Rachel Guo*[6], *Judith G. Cohen*[1] *and Katia Cunha*[7,8]

[1]California Institute of Technology, 1200 E. California Blvd., MC 249-17, Pasadena, CA 91125, USA
[2]UCO/Lick Observatory and Department of Astronomy and Astrophysics, University of California, 1156 High St., Santa Cruz, CA 95064, USA
[3]The Harker School, 500 Saratoga Ave., San Jose, CA 95129, USA
[4]Stanford University, 450 Serra Mall, Stanford, CA 94305, USA
[5]Palo Alto High School, 50 Embarcadero Rd., Palo Alto, CA, 94301, USA
[6]Irvington High School, 41800 Blacow Rd., Fremont, CA 94538, USA
[7]Observatorio Nacional, São Cristovao, Rio de Janeiro, Brazil
[8]University of Arizona, Tucson, AZ 85719, USA

Although red giants deplete lithium on their surfaces, some giants are Li-rich. Intermediate-mass asymptotic giant branch (AGB) stars can generate Li through the Cameron–Fowler conveyor, but the existence of Li-rich, low-mass red giant branch (RGB) stars is puzzling. Globular clusters are the best sites to examine this phenomenon because it is straightforward to determine membership in the cluster and to identify the evolutionary state of each star. In 72 hours of Keck/DEIMOS exposures in 25 clusters, we found four Li-rich RGB and two Li-rich AGB stars. There were 1696 RGB and 125 AGB stars with measurements or upper limits consistent with normal abundances of Li. Hence, the frequency of Li-richness in globular clusters is $(0.2 \pm 0.1)\%$ for the RGB, $(1.6 \pm 1.1)\%$ for the AGB, and $(0.3 \pm 0.1)\%$ for all giants. Because the Li-rich RGB stars are on the lower RGB, Li self-generation mechanisms proposed to occur at the luminosity function bump or He core flash cannot explain these four lower RGB stars. We propose the following origin for Li enrichment: (1) All luminous giants experience a brief phase of Li enrichment at the He core flash. (2) All post-RGB stars with binary companions on the lower RGB will engage in mass transfer. This scenario predicts that 0.1% of lower RGB stars will appear Li-rich due to mass transfer from a recently Li-enhanced companion. This frequency is at the lower end of our confidence interval.

Submitted to ApJ
Available from arXiv:1601.01315

Morphology and kinematics of the gas envelope of the Mira binary W Aquilæ

D.T. Hoai[1], *P.T. Nhung*[1], *P.N. Diep*[1], *N.T. Phuong*[1], *N.T. Thao*[1], *P. Tuan-Anh*[1] *and P. Darriulat*[1]

[1]Department of Astrophysics, Vietnam National Satellite Center, VAST, 18 Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam

We analyse ALMA observations of the ^{12}CO(3–2) emission of the circumstellar envelope (CSE) of the Mira variable binary star W Aql. These provide, for the first time, spatially resolved Doppler velocity spectra of the CSE up to angular distances to the central star of $\sim 5''$ (meaning some 2000 au). The exploratory nature of the observations (only five minutes in each of two different configurations) does not allow for a detailed modelling of the properties

of the CSE but provides important qualitative information on its morphology and kinematics. Emission is found to be enhanced along an axis moving from east/west to north–east/south–west when the angular distance from the central star projected on the plane of the sky increases from zero to four arcseconds. In parallel, the Doppler velocity distribution displays asymmetry along an axis moving from east/west to north–west/south–east. The results are discussed in the context of earlier observations, in particular of the dust morphology.

Submitted to Research in Astronomy and Astrophysics
Available from arXiv:1601.01439

Modelling the circumstellar medium in RS Ophiuchi and its link to Type Ia Supernovæ

Richard Booth[1,2]*, Shazrene Mohamed*[3] *and Philipp Podsiadlowski*[2]

[1]Institute of Astronomy, University of Cambridge, UK
[2]Department of Astrophysics, University of Oxford, UK
[3]South African Astronomical Observatory, South Africa

Recent interpretations of narrow, variable absorption lines detected in some Type Ia supernovæ suggest that their progenitors are surrounded by dense, circumstellar material. Similar variations detected in the symbiotic recurrent nova system RS Oph, which undergoes thermonuclear outbursts every ~ 20 years, making it an ideal candidate to investigate the origin of these lines. To this end, we present simulations of multiple mass transfer-nova cycles in RS Oph. We find that the quiescent mass transfer produces a dense, equatorial outflow, i.e. concentrated towards the binary orbital plane, and an accretion disc forms around the white dwarf. The interaction of a spherical nova outburst with these aspherical circumstellar structures produces a bipolar outflow, similar to that seen in HST imaging of the 2006 outburst. In order to produce an ionization structure that is consistent with observations, a mass-loss rate of 5×10^{-7} $M_\odot$ yr^{-1} from the red giant is required. The simulations also produce a polar accretion flow, which may explain the broad wings of the quiescent Hα line and hard X-rays. By comparing simulated absorption line profiles to observations of the 2006 outburst, we are able to determine which components arise in the wind and which are due to the novæ. We explore the possible behaviour of absorption line profiles as they may appear should a supernova occur in a system like RS Oph. Our models show similarities to supernovæ like SN 2006X, but require a high mass-loss rate, $\dot{M} \sim 10^{-6}$ to 10^{-5} $M_\odot$ yr^{-1}, to explain the variability in SN 2006X.

Accepted for publication in MNRAS
Available from arXiv:1601.02635

Two massive white dwarfs from NGC 2323 and the initial–final mass relation for progenitors of 4 to 6.5 $M_\odot$

Jeffrey D. Cummings[1]*, Jason S. Kalirai*[2,1]*, P.-E. Tremblay*[3] *and Enrico Ramirez-Ruiz*[4]

[1]Johns Hopkins University, USA
[2]Space Telescope Science Institute, USA
[3]University of Warwick, UK
[4]University of California, Santa Cruz, USA

We have observed a sample of 10 white dwarf candidates in the rich open cluster NGC 2323 (M 50) with the Keck Low-Resolution Imaging Spectrometer. The spectroscopy shows eight to be DA white dwarfs, with six of these having high S/N appropriate for our analysis. Two of these white dwarfs are consistent with singly evolved cluster membership, and both are high mass ~ 1.07 $M_\odot$, and give equivalent progenitor masses of 4.69 $M_\odot$. To supplement these new high-mass white dwarfs and analyze the initial–final mass relation (IFMR), we have also looked at 30 white dwarfs from publicly available data that are mostly all high-mass ($\gtrsim$0.9 $M_\odot$). These original published data exhibited significant scatter, and to test if this scatter is true or simply the result of systematics, we have uniformly analyzed the

white dwarf spectra and have adopted thorough photometric techniques to derive uniform cluster parameters for their parent clusters. The resulting IFMR scatter is significantly reduced, arguing that mass-loss rates are not stochastic in nature and that within the ranges of metallicity and mass analyzed in this work mass loss is not highly sensitive to variations in metallicity. Lastly, when adopting cluster ages based on Y^2 isochrones, the slope of the high-mass IFMR remains steep and consistent with that found from intermediate-mass white dwarfs, giving a linear IFMR from progenitor masses between 3 to 6.5 $M_\odot$. In contrast, when adopting the slightly younger cluster ages based on PARSEC isochrones, the high-mass IFMR has a moderate turnover near an initial mass of 4 $M_\odot$.

Accepted for publication in Astrophysical Journal
Available from arXiv:1601.03053

The role of binaries in the enrichment of the early Galactic halo III. Carbon-enhanced metal-poor stars – CEMP-*s* stars

T.T. Hansen[1], *J. Andersen*[2,3], *B. Nordström*[2,3], *T.C. Beers*[4], *V.M. Placco*[4], *J. Yoon*[4] *and L.A. Buchhave*[5,6]

[1]Observatories of the Carnegie Institution of Washington, 813 Santa Barbara St., Pasadena, CA 91101, USA
[2]Dark Cosmology Centre, The Niels Bohr Institute, University of Copenhagen, Juliane Maries Vej 30, DK-2100 Copenhagen, Denmark
[3]Stellar Astrophysics Centre, Department of Physics and Astronomy, Århus University, DK-8000 Århus C, Denmark
[4]Department of Physics and JINA Center for the Evolution of the Elements, University of Notre Dame, Notre Dame, IN 46556, USA
[5]Harvard-Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA
[6]Centre for Star and Planet Formation, University of Copenhagen,DK-1350 Copenhagen, Denmark

Detailed spectroscopic studies of metal-poor halo stars have highlighted the important role of carbon-enhanced metal-poor (CEMP) stars in understanding the early production and ejection of carbon in the Galaxy and in identifying the progenitors of the CEMP stars among the first stars formed after the Big Bang. Recent work has also classified the CEMP stars by absolute carbon abundance, A(C), into high- and low-C bands, mostly populated by binary and single stars, respectively. Our aim is to determine the frequency and orbital parameters of binary systems among the CEMP-*s* stars, which exhibit strong enhancements of neutron-capture elements associated with the *s*-process. This allows us to test whether local mass transfer from a binary companion is necessary and sufficient to explain their dramatic carbon excesses. We have systematically monitored the radial velocities of a sample of 22 CEMP-*s* stars for several years with ∼monthly, high-resolution, low S/N échelle spectra obtained at the Nordic Optical Telescope (NOT) at La Palma, Spain. From these spectra, radial velocities with an accuracy of ≈ 100 m s^{-1} were determined by cross-correlation with optimised templates. Eighteen of the 22 stars exhibit clear orbital motion, yielding a binary frequency of $82 \pm 10\%$, while four stars appear to be single ($18 \pm 10\%$). We thus confirm that the binary frequency of CEMP-*s* stars is much higher than for normal metal-poor giants, but not 100% as previously claimed. Secure orbits are determined for eleven of the binaries and provisional orbits for six long-period systems ($P > 3,000$ days), and orbital circularisation timescales are discussed. The conventional scenario of local mass transfer from a former AGB binary companion does appear to account for the chemical composition of most CEMP-*s* stars. However, the excess of C and *s*-process elements in some single CEMP-*s* stars was apparently transferred to their natal clouds by an external (distant) source. This finding has important implications for our understanding of carbon enrichment in the early Galactic halo and some high-redshift DLA systems, and of the mass loss from extremely metal-poor AGB stars.

Accepted for publication in A&A
Available from arXiv:1601.03385

Dicke's superradiance in astrophysics. II – The OH 1612 MHz line

Fereshteh Rajabi[1] *and Martin Houde*[1,2]

[1]Department of Physics and Astronomy, The University of Western Ontario, London, ON, N6A 3K7, Canada
[2]Division of Physics, Mathematics and Astronomy, California Institute of Technology, Pasadena, CA 91125, USA

We apply the concept of superradiance introduced by Dicke in 1954 to the OH molecule 1612 MHz spectral line often

used for the detection of masers in circumstellar envelopes of evolved stars. As the detection of 1612 MHz OH masers in the outer shells of envelopes of these stars implies the existence of a population inversion and a high level of velocity coherence, and that these are two necessary requirements for superradiance, we investigate whether superradiance can also happen in these regions. Superradiance is characterized by high intensity, spatially compact, burst-like features taking place over time-scales on the order of seconds to years, depending on the size and physical conditions present in the regions harboring such sources of radiation. Our analysis suggests that superradiance provides a valid explanation for previous observations of intensity flares detected in that spectral line for the U Orionis Mira star and the IRAS 18276−1431 pre-planetary nebula.

Submitted to ApJ
Available from arXiv:1601.01718

Kinematic distances of Galactic planetary nebulæ

A.Y. Yang[1,2], W.W. Tian[1,2,3], H. Zhu[1,2], D.A. Leahy[3] and D. Wu[1,4,5]

[1]Key Laboratory of Optical Astronomy, National Astronomical Observatories, Chinese Academy of Sciences, Beijing 100012, China
[2]University of Chinese Academy of Science, 19A Yuquan Road, Beijing 100049, China
[3]Department of Physics & Astronomy, University of Calgary, Calgary, Alberta T2N 1N4, Canada
[4]College of Information Science and Technology, Beijing Normal University, Beijing 100875, China
[5]Beijing Key Laboratory of Digital Preservation and Virtual Reality for Cultural Heritage, Beijing 100875, China

We construct H I absorption spectra for 18 planetary nebulæ (PNe) and their background sources using the data from the International Galactic Plane Survey. We estimate the kinematic distances of these PNe, among which 15 objects' kinematic distances are obtained for the first time. The distance uncertainties of 13 PNe range from 10% to 50%, which is a significant improvement with uncertainties of a factor two or three smaller than most of previous distance measurements. We confirm that PN G 030.2−00.1 is not a PN because of its large distance found here.

Accepted for publication in ApJS
Available from arXiv:1601.03269

A search for white dwarfs in the Galactic plane: the field and the open cluster population

R. Raddi[1], S. Catalán[1], B.T. Gænsicke[1], J.J. Hermes[1], R. Napiwotzki[2], D. Koester[3], P.-E. Tremblay[1], G. Barentsen[2], H.J. Farnhill[2], M. Mohr-Smith[2], J.E. Drew[2], P.J. Groot[4], L. Guzman-Ramirez[5], Q.A. Parker[6,7,8], D. Steeghs[1] and A.A. Zijlstra[9]

[1]University of Warwick, UK
[2]University of Hertfordshire, UK
[3]University of Kiel, Germany
[4]Radbound University Nijmegen, The Netherlands
[5]European Southern Observatory, Chile
[6]University of Hong Kong, China
[7]Macquarie University, Australia
[8]Australian Astronomical Observatory, Australia
[9]University of Manchester, UK

We investigated the prospects for systematic searches of white dwarfs at low Galactic latitudes, using the VLT Survey Telescope (VST) Hα Photometric Survey of the Galactic plane and Bulge (VPHAS+). We targeted 17 white dwarf candidates along sightlines of known open clusters, aiming to identify potential cluster members. We confirmed all the 17 white dwarf candidates from blue/optical spectroscopy, and we suggest five of them to be likely cluster members.

We estimated progenitor ages and masses for the candidate cluster members, and compared our findings to those for other cluster white dwarfs. A white dwarf in NGC 3532 is the most massive known cluster member (1.13 $M_\odot$), likely with an oxygen–neon core, for which we estimate an $8.8^{+1.2}_{-4.3}$ $M_\odot$ progenitor, close to the mass-divide between white dwarf and neutron star progenitors. A cluster member in Ruprecht 131 is a magnetic white dwarf, whose progenitor mass exceeded 2–3 $M_\odot$. We stress that wider searches, and improved cluster distances and ages derived from data of the ESA–Gaia mission, will advance the understanding of the mass-loss processes for low- to intermediate-mass stars.

Accepted for publication in MNRAS
Available from arXiv:1601.02019

How plausible are the proposed formation scenarios of CEMP-r/s stars?

Carlo Abate[1], *Richard J. Stancliffe*[1] *and Zheng-Wei Liu*[1]

[1]Argelander Institut für Astronomie, Auf dem Hügel 71, D-53121 Bonn, Germany

CEMP-r/s stars are metal-poor stars with enhanced abundances of carbon and heavy elements associated with the slow and rapid neutron-capture process (s- and r-elements, respectively). It is believed that carbon and s-elements were accreted in the past from the wind of a primary star in the asymptotic giant branch (AGB) phase of evolution, a scenario that is generally accepted to explain the formation of CEMP stars that are only enhanced in s-elements (CEMP-s stars). The origin of r-element-enrichment in CEMP-r/s stars is currently debated and many formation scenarios have been put forward. We aim to determine the likelihood of the scenarios proposed to explain the formation of CEMP-r/s stars. We calculate the frequency of CEMP-r/s stars among CEMP-s stars for a variety of formation scenarios, and we compare it with that determined from an observed sample of CEMP-r/s stars collected from the literature. The theoretical frequency of CEMP-r/s stars predicted in most formation scenarios underestimates the observed ratio by at least a factor of five. If the enrichments in s- and r-elements are independent, the model ratio of CEMP-r/s to CEMP-s stars is about 22%, that is approximately consistent with the lowest estimate of the observed ratio. However, this model predicts that about one third of all carbon-normal stars have [Ba/Fe] and [Eu/Fe] higher than one, and that 40% of all CEMP stars have [Ba/Eu] ≤ 0. Stars with these properties are at least ten times rarer in our observed sample. The intermediate or i-process, which is supposedly active in some circumstances during the AGB phase, could provide an explanation of the origin of CEMP-r/s stars, similar to that of CEMP-s stars, in the context of wind mass accretion in binary systems. Further calculations of the nucleosynthesis of the i-process and of the detailed evolution of late AGB stars are needed to investigate if this scenario predicts a CEMP-r/s star frequency consistent with the observations.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:1601.00976

The kinematics of the nebular shells around low mass progenitors of PNe with low metallicity

Margarita Pereyra[1,2], *José Alberto López*[2] *and Michael G. Richer*[2]

[1]Schlumberger Foundation Fellow, School of Physics and Astronomy, University of Southampton, UK
[2]Instituto de Astronomía, Universidad Nacional Autónoma de México, México

We analyze the internal kinematics of 26 Planetary Nebulæ (PNe) with low metallicity that appear to derive from progenitor stars of the lowest masses, including the halo PN population. Based upon spatially-resolved, long-slit, échelle spectroscopy drawn from the San Pedro Mártir Kinematic Catalogue of PNe (López et al. 2012), we characterize the kinematics of these PNe measuring their global expansion velocities based upon the largest sample used to date for this purpose. We find kinematics that follow the trends observed and predicted in other studies, but also find that most of the PNe studied here tend to have expansion velocities less than 20 km s^{-1} in all of the emission lines considered. The

low expansion velocities that we observe in this sample of low metallicity planetary nebulæ with low mass progenitors are most likely a consequence of a weak central star wind driving the kinematics of the nebular shell. This study complements previous results (Pereyra et al. 2013, and references therein) that link the expansion velocities of the PN shells with the characteristics of the central star.

Accepted for publication in The Astronomical Journal
Available from arXiv:1601.04969

The evolved-star dust budget of the Small Magellanic Cloud: the critical role of a few key players

Sundar Srinivasan[1], *Martha L. Boyer*[2,3], *Francisca Kemper*[1], *Margaret Meixner*[4], *Benjamin A. Sargent*[5] *and David Riebel*[6]

[1]Institute of Astronomy & Astrophysics, Academia Sinica, 11F, Astronomy-Mathematics Building, No. 1, Roosevelt Rd., Sec 4, Taipei 10617, Taiwan (R.O.C.)

[2]CRESST and Observational Cosmology Lab, Code 665, NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

[3]Department of Astronomy, University of Maryland, College Park, MD 20742, USA

[4]Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA

[5]Center for Imaging Science and Laboratory for Multiwavelength Astrophysics, Rochester Institute of Technology, 54 Lomb Memorial Drive, Rochester, NY 14623, USA

[6]Department of Physics, United States Naval Academy, 572C Holloway Road, Annapolis, MD 21402, USA

The lifecycle of dust in the interstellar medium (ISM) is heavily influenced by outflows from asymptotic giant branch (AGB) and red supergiant (RSG) stars, a large fraction of which is contributed by a few very dusty sources. We compute the dust input to the Small Magellanic Cloud (SMC) by fitting the multi-epoch mid-infrared spectral energy distributions (SEDs) of AGB/RSG candidates with models from the Grid of RSG and AGB ModelS (GRAMS) grid, allowing us to estimate the luminosities and dust-production rates (DPRs) of the entire population. By removing contaminants, we guarantee a high-quality dataset with reliable DPRs and a complete inventory of the dustiest sources. We find a global AGB/RSG dust-injection rate of $(1.3 \pm 0.1) \times 10^{-6}$ $M_{\odot}$ yr^{-1}, in agreement with estimates derived from mid-infrared colours and excess fluxes. As in the LMC, a majority (66%) of the dust arises from the extreme AGB stars,which comprise only $\approx 7\%$ of our sample. A handful of far-infrared sources, whose 24-μm fluxes exceed their 8-μm fluxes, dominate the dust input. Their inclusion boosts the global DPR by $\approx 1.5\times$, making it necessary to determine whether they are AGB stars. Model assumptions, rather than missing data, are the major sources of uncertainty; depending on the choice of dust shell expansion speed and dust optical constants, the global DPR can be up to ≈ 10 times higher. Our results suggest a non-stellar origin for the SMC dust, barring as yet undiscovered evolved stars with very high DPRs.

Accepted for publication in MNRAS
Available from arXiv:1601.04710

Morphology and kinematics of the gas envelope of the variable AGB star π^1 Gruis

P.T. Nhung[1], *D.T. Hoai*[1], *P.N. Diep*[1], *N.T. Phuong*[1], *N.T. Thao*[1] *and P. Darriulat*[1]

[1]Department of Astrophysics, Vietnam National Satellite Center, VAST, 18 Hoang Quoc Viet, Cau Giay, Hanoi, Vietnam

Observations of the ^{12}CO(3–2) emission of the circumstellar envelope (CSE) of the variable star π^1 Gru using the compact array (ACA) of the ALMA observatory have been recently made accessible to the public. An analysis of the morphology and kinematics of the CSE is presented with a result very similar to that obtained earlier for ^{12}CO(2–1) emission by Chiu et al. (2006) using the Sub-Millimeter Array. A quantitative comparison is made using their flared

disk model. A new model is presented that provides a significantly better description of the data, using radial winds and smooth evolutions of the radio emission and wind velocity from the stellar equator to the poles.

Submitted to Research in Astronomy and Astrophysics
Available from arXiv:1601.04834

A simple scheme to implement a nonlocal turbulent convection model for the convective overshoot mixing

Q.S. Zhang[1,2]

[1]Yunnan Observatories, Chinese Academy of Sciences, Kunming 650011, China

[2]Key Laboratory for the Structure and Evolution of Celestial Objects, Chinese Academy of Sciences, Kunming, 650011, China

The classical 'ballistic' overshoot models show some contradictions and are not consistence with numerical simulations and asteroseismic studies. Asteroseismic studies imply that overshoot is a weak mixing process. Diffusion model is suitable to deal with it. The form of diffusion coefficient in a diffusion model is crucial. Because the overshoot mixing is related to the convective heat transport (i.e. entropy mixing), there should be a similarity between them. A recent overshoot mixing model shows consistence between composition mixing and entropy mixing in overshoot region. A prerequisite to apply the model is to know the dissipation rate of turbulent kinetic energy. The dissipation rate can be worked out by solving turbulent convection models (TCMs). But it is difficult to apply TCMs because of some numerical problems and the enormous time cost. In order to find a convenient way, we have used the asymptotical solution and simplified the TCM to be a single linear equation for turbulent kinetic energy. This linear model is easy to be implemented in the calculations of stellar evolution with ignorable extra time cost. We have tested the linear model in stellar evolution, and have found that the linear model can well reproduce the turbulent kinetic energy profile of full TCM, as well as the diffusion coefficient, abundance profile and the stellar evolutionary tracks. We have also studied the effects of different values of the model parameters and have found that the effect due to the modification of temperature gradient in the overshoot region is slight.

Accepted for publication in ApJ
Available from arXiv:1601.01756

KIC 9246715: The double red giant eclipsing binary with odd oscillations

Meredith L. Rawls[1], *Patrick Gaulme*[2,1], *Jean McKeever*[1], *Jason Jackiewicz*[1], *Jerome A. Orosz*[3], *Enrico Corsaro*[4,5,6], *Paul G. Beck*[4], *Benoît Mosser*[7], *David W. Latham*[8] *and Christian A. Latham*[8]

[1]Department of Astronomy, New Mexico State University, P.O. Box 30001, MSC 4500, Las Cruces, NM 88003, USA

[2]Apache Point Observatory, 2001 Apache Point Road, P.O. Box 59, Sunspot, NM 88349, USA

[3]Department of Astronomy, San Diego State University, 5500 Campanile Drive, San Diego, CA 91945, USA

[4]Laboratoire AIM, CEA/DSM–CNRS–Univ. Paris Diderot–IRFU/SAp, Centre de Saclay, F-91191 Gif-sur-Yvette Cedex, France

[5]Instituto de Astrofísica de Canarias, E-38205 La Laguna, Tenerife, Spain

[6]Universidad de La Laguna, Departamento de Astrofísica, E-38206 La Laguna, Tenerife, Spain

[7]LESIA, Observatoire de Paris, PSL Research University, CNRS, Université Pierre et Marie Curie, Université Paris Diderot, F-92195 Meudon, France

[8]Harvard–Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

We combine *Kepler* photometry with ground-based spectra to present a comprehensive dynamical model of the double red giant eclipsing binary KIC 9246715. While the two stars are very similar in mass ($M_1 = 2.171^{+0.006}_{-0.008}$ $M_\odot$, $M_2 = 2.149^{+0.006}_{-0.008}$ $M_\odot$) and radius ($R_1 = 8.37^{+0.03}_{-0.07}$ $R_\odot$, $R_2 = 8.30^{+0.04}_{-0.03}$ $R_\odot$), an asteroseismic analysis finds one main set of solar-like oscillations with unusually low-amplitude, wide modes. A second set of oscillations from the other star may

exist, but this marginal detection is extremely faint. Because the two stars are nearly twins, KIC 9246715 is a difficult target for a precise test of the asteroseismic scaling relations, which yield $M = 2.17 \pm 0.14$ $M_\odot$ and $R = 8.26 \pm 0.18$ $R_\odot$. Both stars are consistent with the inferred asteroseismic properties, but we suspect the main oscillator is Star 2 because it is less active than Star 1. We find evidence for stellar activity and modest tidal forces acting over the 171-day eccentric orbit, which are likely responsible for the essential lack of solar-like oscillations in one star and weak oscillations in the other. Mixed modes indicate the main oscillating star is on the secondary red clump (a core-He-burning star), and stellar evolution modeling supports this with a coeval history for a pair of red clump stars. This system is a useful case study and paves the way for a detailed analysis of more red giants in eclipsing binaries, an important benchmark for asteroseismology.

Accepted for publication in The Astrophysical Journal
Available from arXiv:1601.00038
and from https://authorea.com/2409

RV variable, hot post-AGB stars from the MUCHFUSS project – Classification, atmospheric parameters, formation scenarios

N. Reindl[1], S. Geier[2,3,4], T. Kupfer[5], S. Bloemen[6], V. Schaffenroth[7,3], U. Heber[3], B.N. Barlow[8] and R.H. Østensen[9]

[1]Institute for Astronomy and Astrophysics, Kepler Center for Astro and Particle Physics, Eberhard Karls University, Sand 1, 72076, Tübingen, Germany

[2]Department of Physics, University of Warwick, Coventry CV4 7AL, UK

[3]Dr. Karl Remeis-Observatory & ECAP, Astronomical Institute, Friedrich-Alexander University Erlangen–Nuremberg, Sternwartstr. 7, D 96049 Bamberg, Germany

[4]ESO, Karl-Schwarzschild-Str. 2, 85748 Garching bei München, Germany

[5]Division of Physics, Mathematics, and Astronomy, California Institute of Technology, Pasadena, CA 91125, USA

[6]Department of Astrophysics/IMAPP, Radboud University Nijmegen, P.O. Box 9010, 6500 GL Nijmegen, The Netherlands

[7]Institute for Astro- and Particle Physics, University of Innsbruck, Technikerstr. 25/8, 6020 Innsbruck, Austria

[8]Department of Physics, High Point University, 833 Montlieu Avenue, High Point, NC 27262, USA

[9]Institute of Astronomy, K.U. Leuven, Celestijnenlaan 200D, B-3001 Heverlee, Belgium

In the course of the MUCHFUSS project we have recently discovered four radial velocity (RV) variable, hot ($T_{\rm eff} \approx 80,000$–$110,000$ K) post-asymptotic giant branch (AGB) stars. Among them, we found the first known RV variable O(He) star, the only second known RV variable PG 1159 close binary candidate, as well as the first two naked (i.e. without planetary nebula (PN)) H-rich post-AGB stars of spectral type O(H) that show significant RV variations. We present a non-LTE spectral analysis of these stars along with one further O(H)-type star whose RV variations were found to be not significant. We also report the discovery of an far-infrared excess in the case of the PG 1159 star. None of the stars in our sample displays nebular emission lines, which can be explained well in terms of a very late thermal pulse evolution in the case of the PG 1159 star. The "missing" PNe around the O(H)-type stars seem strange, since we find that several central stars of PNe have much longer post-AGB times. Besides the non-ejection of a PN, the occurrence of a late thermal pulse, or the re-accretion of the PN in the previous post-AGB evolution offer possible explanations for those stars not harbouring a PN (anymore). In case of the O(He) star J0757 we speculate that it might have been previously part of a compact He transferring binary system. In this scenario, the mass transfer must have stopped after a certain time, leaving behind a low mass close companion that could be responsible for the extreme RV shift of 107.0 ± 22.0 km s^{-1} measured within only 31 min.

Accepted for publication in A&A
Available from arXiv:1601.00874
and from http://dx.doi.org/10.1051/0004-6361/201527637

A new generation of Los Alamos opacity tables

James Colgan[1]

[1]Los Alamos National Laboratory, USA

We present a new, publicly available, set of Los Alamos OPLIB opacity tables for the elements hydrogen through zinc. Our tables are computed using the Los Alamos ATOMIC opacity and plasma modeling code, and make use of atomic structure calculations that use fine-structure detail for all the elements considered. Our equation-of-state (EOS) model, known as ChemEOS, is based on the minimization of free energy in a chemical picture and appears to be a reasonable and robust approach to determining atomic state populations over a wide range of temperatures and densities. In this paper we discuss in detail the calculations that we have performed for the 30 elements considered, and present some comparisons of our monochromatic opacities with measurements and other opacity codes. We also use our new opacity tables in solar modeling calculations and compare and contrast such modeling with previous work.

Accepted for publication in Astrophysical Journal
Available from arXiv:1601.01005

Orbitally modulated photoexcited Si I emission in the eclipsing composite-spectrum binary ζ Aurigæ

G.M. Harper[1]*, R.E.M. Griffin*[2]*, P.D. Bennett*[3] *and N. O'Riain*[4]

[1]CASA, University of Colorado, Boulder, CO 80309-0389, USA
[2]Dominion Astrophysical Observatory, Victoria, BC V9E 2E7, Canada
[3]Saint Mary's University, Halifax, Nova Scotia, NS B3H 3C3, Canada
[4]School of Physics, Trinity College, Dublin 2, Ireland

We examine the little-known phenomenon of orbitally modulated Si I emission at $\lambda\,3905.523$Å and $\lambda\,4102.936$Å in composite-spectrum binaries, with specific reference to ζ Aurigæ (K4 Ib + B5 V). The emission is detected in the isolated spectrum of the B-type dwarf secondary, and while $\lambda\,4102$Å is heavily blended with Hδ, $\lambda\,3905$Å falls in the B-star's featureless continuum. The narrowness of the emission ($v_{\rm turb} \simeq 6$ km s^{-1}) demonstrates that it originates in the upper photosphere or deep chromosphere of the K star primary. We propose that photoexcitation by the hot star's UV continuum, followed by recombination and cascades, leads to resonant scattering and subsequent pumping of lower opacity transitions in the singlet and triplet systems of Si I. This process channels the UV continuum into select narrow emission lines. We have also identified weaker photoexcited emission of Fe II at $\lambda\,3938.289$Å. The strengths, positions, and widths of the $\lambda\,3905$Å emission line vary with orbital phase owing to changes in the dilution of the irradiating flux and in the geometrical aspect of the irradiated hemisphere. Utilizing the inherent spatial resolution provided by the illuminated patch, and assuming that the K star is spherical with isotropic emission, yields $v \sin i \sim 5.7$ km s^{-1}. Evidence of tidal distortion was deduced from the timing of the rapidly rising phase of the emission just after periastron. Increasing the diagnostic potential requires radiative transfer modelling of the formation and centre-to-limb variation of the emission.

Published in MNRAS, 456, 1346 (2015)

Constraints on the H_2O formation mechanism in the wind of carbon-rich AGB stars

R. Lombært[1,2], L. Decin[2,3], P. Royer[2], A. de Koter[2,3], N.L.J. Cox[2], E. González-Alfonso[4], D. Neufeld[5], J. De Ridder[2], M. Agúndez[6], J.A.D.L. Blommært[2,7], T. Khouri[1,3], M.A.T. Groenewegen[8], F. Kerschbaum[9], J. Cernicharo[6], B. Vandenbussche[2] and C. Waelkens[2]

[1]Department of Earth and Space Sciences, Chalmers University of Technology, Onsala Space Observatory, 439 92 Onsala, Sweden

[2]K.U. Leuven, Instituut voor Sterrenkunde, Celestijnenlaan 200D B-2401, 3001 Leuven, Belgium

[3]University of Amsterdam, Astronomical Institute "Anton Pannekoek", P.O. Box 94249, 1090 GE Amsterdam, The Netherlands

[4]Universidad de Alcalá de Henares, Departamento de Física y Matemáticas, Campus Universitario, 28871 Alcalá de Henares, Madrid, Spain

[5]Johns Hopkins University, Department of Physics and Astronomy, 3400 North Charles Street, Baltimore, MD 21218, USA

[6]Group of Molecular Astrophysics, Instituto de Ciencia de Materiales de Madrid, CSIC, C/Sor Juana Inés de La Cruz N3, E-28049 Cantoblanco, Madrid, Spain

[7]Vrije Universiteit Brussel, Department of Physics and Astrophysics, Pleinlaan 2, 1050 Brussels, Belgium

[8]Koninklijke Sterrenwacht van België, Ringlaan 3, 1180 Brussels, Belgium

[9]University of Vienna, Department of Astrophysics, Türkenschanzstraße 17, 1180 Wien, Austria

Context: The recent detection of warm H_2O vapor emission from the outflows of carbon-rich asymptotic giant branch (AGB) stars challenges the current understanding of circumstellar chemistry. Two mechanisms have been invoked to explain warm H_2O vapor formation. In the first, periodic shocks passing through the medium immediately above the stellar surface lead to H_2O formation. In the second, penetration of ultraviolet interstellar radiation through a clumpy circumstellar medium leads to the formation of H_2O molecules in the intermediate wind.

Aims: We aim to determine the properties of H_2O emission for a sample of 18 carbon-rich AGB stars and subsequently constrain which of the above mechanisms provides the most likely warm H_2O formation pathway.

Methods: Using far-infrared spectra taken with the PACS instrument onboard the *Herschel* telescope, we combined two methods to identify H_2O emission trends and interpreted these in terms of theoretically expected patterns in the H_2O abundance. Through the use of line-strength ratios, we analyzed the correlation between the strength of H_2O emission and the mass-loss rate of the objects, as well as the radial dependence of the H_2O abundance in the circumstellar outflow per individual source. We computed a model grid to account for radiative-transfer effects in the line strengths.

Results: We detect warm H_2O emission close to or inside the wind acceleration zone of all sample stars, irrespective of their stellar or circumstellar properties. The predicted H_2O abundances in carbon-rich environments are in the range of 10^{-6} up to 10^{-4} for Miras and semiregular-a objects, and cluster around 10^{-6} for semiregular-b objects. These predictions are up to three orders of magnitude greater than what is predicted by state-of-the-art chemical models. We find a negative correlation between the H_2O/CO line-strength ratio and gas mass-loss rate for $\dot{M}_{\rm g} > 5 \times 10^{-7}$ $M_\odot$ yr^{-1}, regardless of the upper-level energy of the relevant transitions. This implies that the H_2O formation mechanism becomes less efficient with increasing wind density. The negative correlation breaks down for the sources of lowest mass-loss rate, the semiregular-b objects.

Conclusion: Observational constraints suggest that pulsationally induced shocks play an important role in warm H_2O formation in carbon-rich AGB stars, although photodissociation by interstellar UV photons may still contribute. Both mechanisms fail in predicting the high H_2O abundances we infer in Miras and semiregular-a sources, while our results for the semiregular-b objects are inconclusive.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1601.07017

Synthetic photometry for M and K giants and stellar evolution: hydrostatic dust-free model atmospheres and chemical abundances

Bernhard Aringer[1,2], *Léo Girardi*[2], *Walter Nowotny*[3], *Paola Marigo*[1] *and Alessandro Bressan*[4,2]

[1]Dipartimento di Fisica e Astronomia Galileo Galilei, Università di Padova, Vicolo dell'Osservatorio 3, I-35122 Padova, Italy

[2]Osservatorio Astronomico di Padova – INAF, Vicolo dell'Osservatorio 5, I-35122 Padova, Italy

[3]Department of Astrophysics, University of Vienna, Türkenschanzstraße 17, A-1180 Wien, Austria

[4]SISSA, via Bonomea 265, I-34136, Trieste, Italy

Based on a grid of hydrostatic spherical COMARCS models for cool stars we have calculated observable properties of these objects, which will be mainly used in combination with stellar evolution tracks and population synthesis tools. The high resolution opacity sampling and low resolution convolved spectra as well as bolometric corrections for a large number of filter systems are made electronically available. We exploit those data to study the effect of mass, C/O ratio and nitrogen abundance on the photometry of K and M giants. Depending on effective temperature, surface gravity and the chosen wavelength ranges variations of the investigated parameters cause very weak to moderate and, in the case of C/O values close to one, even strong shifts of the colours. For the usage with stellar evolution calculations they will be treated as correction factors applied to the results of an interpolation in the main quantities. When we compare the synthetic photometry to observed relations and to data from the Galactic Bulge, we find in general a good agreement. Deviations appear for the coolest giants showing pulsations, mass loss and dust shells, which cannot be described by hydrostatic models.
Database @ http://starkey.astro.unipd.it/atm

Accepted for publication in MNRAS
Available from arXiv:1601.07025

Fast, low-ionization emission regions of the planetary nebula M 2-42

Ashkbiz Danehkar[1,2], *Quentin A. Parker*[1,3,4] *and Wolfgang Steffen*[5]

[1]Department of Physics and Astronomy, Macquarie University, Sydney, NSW 2109, Australia

[2]Harvard–Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

[3]Australian Astronomical Observatory, P.O. Box 915, North Ryde, NSW 1670, Australia

[4]Department of Physics, The University of Hong Kong, Pokfulam Road, Hong Kong, China

[5]Instituto de Astronomía, Universidad Nacional Autónoma de México, C.P.22860, Ensenada, México

Spatially-resolved observations of the planetary nebula M 2-42 (PN G 008.2−04.8) obtained with the Wide Field Spectrograph on the Australian National University 2.3 m telescope have revealed the remarkable features of bipolar collimated jets emerging from its main structure. Velocity-resolved channel maps derived from the [N II] λ6584 emission line disentangle different morphological components of the nebula. This information is used to develop a three-dimensional morpho-kinematic model, which consists of an equatorial dense torus and a pair of asymmetric bipolar outflows. The expansion velocity of about 20 km s^{-1} is measured from the spectrum integrated over the main shell. However, the deprojected velocities of the jets are found to be in the range of 80–160 km s^{-1} with respect to the nebular center. It is found that the mean density of the collimated outflows, 595 ± 125 cm^{-3}, is five times lower than that of the main shell, 3150 cm^{-3}, whereas their singly-ionized nitrogen and sulfur abundances are about three times higher than those determined from the dense shell. The results indicate that the features of the collimated jets are typical of fast, low-ionization emission regions.

Published in Astronomical Journal 151(2), 38 (2016)
Available from arXiv:1601.01702
and from http://dx.doi.org/10.3847/0004-6256/151/2/38

On the relevance of bubbles and potential flows for stellar convection

Marcelo M. Miller Bertolami[1,2], *Maxime Viallet*[1], *Vincent Prat*[1], *Wasilij Barsukow*[3] *and Achim Weiss*[1]

[1]Max-Planck-Institut für Astrophysik, Karl-Schwarzschild-Str. 1, 85748, Garching bei München, Germany

[2]Instituto de Astrofísica de La Plata, UNLP–CONICET, Paseo del Bosque s/n, 1900 La Plata, Argentina

[3]Institut fur Mathematik, Universität Wurzburg, Campus Hubland Nord, Emil-Fischer-Straße 40, 97074 Wurzburg, Germany

Recently Pasetto et al. have proposed a new method to derive a convection theory appropriate for the implementation in stellar evolution codes. Their approach is based on the simple physical picture of spherical bubbles moving within a potential flow in dynamically unstable regions, and a detailed computation of the bubble dynamics. Based on this approach the authors derive a new theory of convection which is claimed to be parameter free, non-local and time-dependent. This is a very strong claim, as such a theory is the holy grail of stellar physics. Unfortunately we have identified several distinct problems in the derivation which ultimately render their theory inapplicable to any physical regime. In addition we show that the framework of spherical bubbles in potential flows is unable to capture the essence of stellar convection, even when equations are derived correctly.

Accepted for publication in MNRAS
Available from arXiv:1601.05811

Hα as a luminosity class diagnostic for K- and M-type stars

Jeff Jennings[1] *and Emily M. Levesque*[2]

[1]CASA, Department of Astrophysical and Planetary Sciences, University of Colorado, 389-UCB, Boulder, CO 80309, USA

[2]Department of Astronomy, University of Washington, Seattle, WA 98195, USA

We have identified the Hα absorption feature as a new spectroscopic diagnostic of luminosity class in K- and M-type stars. From high-resolution spectra of 19 stars with well-determined physical properties (including effective temperatures and stellar radii), we measured equivalent widths for Hα and the Ca II triplet and examined their dependence on both luminosity class and stellar radius. Hα shows a strong relation with both luminosity class and radius that extends down to late M spectral types. This behavior in Hα has been predicted as a result of the density-dependent overpopulation of the metastable 2S level in hydrogen, an effect that should become dominant for Balmer line formation in non-LTE conditions. We conclude that this new metallicity-insensitive diagnostic of luminosity class in cool stars could serve as an effective means of discerning between populations such as Milky Way giants and supergiant members of background galaxies.

Submitted to ApJ
Available from arXiv:1601.07575

Radio emission from red-giant hot Jupiters

Yuka Fujii[1,2], *David S. Spiegel*[3,4,5], *Tony Mroczkowski*[6,7], *Jason Nordhaus*[8,9], *Neil T. Zimmerman*[10], *Aaron R. Parsons*[11], *Mehrdad Mirbabayi*[5] *and Nikku Madhusudhan*[12]

[1]Earth-Life Science Institute, Tokyo Institute of Technology, Tokyo 152-8550, Japan

[2]NASA Goddard Institute for Space Studies, New York, NY 10025, USA

[3]Analytics & Algorithms, Stitch Fix, San Francisco, CA 94103 , USA

[4]Research & Development, Sum Labs, New York, NY 10001, USA

[5]Astrophysics Department, Institute for Advanced Study, Princeton, NJ 08540, USA

[6]National Research Council Fellow

[7]Naval Research Laboratory, 4555 Overlook Ave SW, Washington, DC 20375, USA

[8]Department of Science and Mathematics, National Technical Institute for the Deaf, Rochester Institute of Technology, Rochester, NY 14623, USA

[9]Center for Computational Relativity and Gravitation, Rochester Institute of Technology, Rochester, NY 14623, USA

[10]Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA

[11]Astronomy Department, University of California Berkeley, Berkeley, CA 94720, USA

[12]Astronomy Department, University of Cambridge, Cambridge CB3 0HA, UK

When planet-hosting stars evolve off the main sequence and go through the red-giant branch, the stars become orders of

magnitudes more luminous and at the same time lose mass at much higher rates than their main-sequence counterparts. Accordingly, planetary companions around them at orbital distances of a few au, if they exist, will be heated up to the level of canonical hot Jupiters and also subjected to a dense stellar wind. Given that magnetized planets interacting with stellar winds emit radio waves, such "Red-Giant Hot Jupiters" (RGHJs) may also be candidate radio emitters. We estimate the spectral auroral radio intensity of RGHJs based on the empirical relation with the stellar wind as well as a proposed scaling for planetary magnetic fields. RGHJs might be intrinsically as bright as or brighter than canonical hot Jupiters, and about 100 times brighter than equivalent objects around main-sequence stars. We examine the capabilities of low-frequency radio observatories to detect this emission and find that the signal from a RGHJ may be detectable at distances up to a few hundred parsecs with the Square Kilometer Array.

Accepted for publication in Astrophysical Journal
Available from arXiv:1601.05428

The detection of heavy metals in the circumstellar envelopes of post-AGB stars

Valentina Klochkova[1] *and Vladimir Panchuk*[1]

[1]Special Astrophysical Observatory of the Russian Academy of Sciences, Russia

A new kind of peculiarity is found: splitting or asymmetry of strong absorption lines in the optical spectra of selected post-AGB stars with carbon envelopes and atmospheres enriched in carbon and *s*-process heavy metals. This effect is strongest for BaII ions, whose lines can be split into two or three components. Infrared and radio spectroscopy data are used to demonstrate that these individual components of split absorption lines are formed in structured circumstellar envelopes. Thus, this effect reveals efficient enrichment of the envelope in heavy metals synthesized during the star's earlier evolution. The type of the strong absorption profile (split or asymmetric, number of components) could be related to the morphology and kinematical and chemical properties of the envelope.

Accepted for publication in Astronomy Reports, vol. 60, No. 3, (2016)

Conference Papers

Linking 1D evolutionary to 3D hydrodynamical simulations of massive stars

Andréa Cristini[1]*, Casey Meakin*[2,3,4]*, Raphael Hirschi*[1,5]*, David Arnett*[2]*, Cyril Georgy*[1,6] *and Maxime Viallet*[7]

[1]Astrophysics group, Keele University, Lennard-Jones Labs, Keele, ST5 5BG, UK
[2]Department of Astronomy, University of Arizona, Tucson, AZ 85721, USA
[3]New Mexico Consortium, Los Alamos, NM 87544, USA
[4]Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 87545, USA
[5]Kavli IPMU (WPI), The University of Tokyo, Kashiwa, Chiba 277-8583, Japan
[6]Geneva Observatory, University of Geneva, 1290 Versoix, Switzerland
[7]Max-Planck-Institut für Astrophysik, Karl Schwarzschild Straße 1, Garching bei München, D-85741, Germany

Stellar evolution models of massive stars are important for many areas of astrophysics, for example nucleosynthesis yields, supernova progenitor models and understanding physics under extreme conditions. Turbulence occurs in stars primarily due to nuclear burning at different mass coordinates within the star. The understanding and correct treatment of turbulence and turbulent mixing at convective boundaries in stellar models has been studied for decades but still lacks a definitive solution. This paper presents initial results of a study on convective boundary mixing (CBM) in massive stars. The 'stiffness' of a convective boundary can be quantified using the bulk Richardson number (Ri_B), the ratio of the potential energy for restoration of the boundary to the kinetic energy of turbulent eddies. A

"stiff" boundary ($\mathrm{Ri}_B \sim 10^4$) will suppress CBM, whereas in the opposite case a "soft" boundary ($\mathrm{Ri}_B \sim 10$) will be more susceptible to CBM. One of the key results obtained so far is that lower convective boundaries (closer to the centre) of nuclear burning shells are "stiffer" than the corresponding upper boundaries, implying limited CBM at lower shell boundaries. This is in agreement with 3D hydrodynamic simulations carried out by Meakin and Arnett [The Astrophysical Journal, 667:448–475, 2007]. This result also has implications for new CBM prescriptions in massive stars as well as for nuclear burning flame front propagation in Super-Asymptotic Giant Branch stars and also the onset of novæ.

Oral contribution, published in Physica Scripta special issue on "turbulent mixing and beyond"
Available from arXiv:1601.01572

Neutron capture nucleosynthesis

Miklós Kiss[1]

[1]Berze High School Gyöngyös, Hungary

Heavy elements (beyond iron) are formed in neutron capture nucleosynthesis processes. We have proposed a simple unified model to investigate the neutron capture nucleosynthesis in arbitrary neutron density environment. We have also investigated what neutron density is required to reproduce the measured abundance of nuclei assuming equilibrium processes. We found both of these that the medium neutron density has a particularly important role at neutron capture nucleosynthesis. About these results most of the nuclei can formed at medium neutron capture density environment, e.g., in some kind of AGB stars. Besides these observations our model is capable to use educational purpose.

Oral contribution, published in "Teaching Physics Innovatively – New Learning Environments and Methods in Physics Education", 17–19 August 2015, ELTE University, Faculty of Science, Budapest, Hungary
Available from arXiv:1601.07138
and from http://parrise.elte.hu/

Review Papers

IAU Commission 36 (Theory of Stellar Atmospheres): Hexennial Report 2009–2015

Joachim Puls[1] *and Martin Asplund*[2]

[1]University Observatory, LMU Munich, Germany
[2]Research School of Astronomy & Astrophysics, ANU, Canberra, Australia

This hexennial report covers the activities of IAU Commission 36 – 'Theory of Stellar Atmospheres' – during the years 2009 to 2015, and will be the last report from this Commission, being replaced by Commission C.G5.

After outlining the composition of the Organization Committee(s), we list the scientific meetings held between 2009 and 2015 that were of relevance for our Commission members, and comment on the establishment and objectives of the new Commission C.G5 ('Stellar and Planetary Atmospheres') within the re-structuring process of the IAU.

In the main part of the report, we briefly review specific contributions and achievements within our research field during the last six years, concentrating on the theoretical aspect, and dividing between late-type and massive star atmospheres. We also provide a more general overview of primary research areas, and finish our report with a collection of useful web links.

Published in Transactions IAU, Volume XXIXA (in press)
Available from arXiv:1512.06972

Post-main-sequence planetary system evolution

Dimitri Veras[1]

[1]University of Warwick, UK

The fates of planetary systems provide unassailable insights into their formation and represent rich cross-disciplinary dynamical laboratories. Mounting observations of post-main-sequence planetary systems necessitate a complementary level of theoretical scrutiny. Here, I review the diverse dynamical processes which affect planets, asteroids, comets and pebbles as their parent stars evolve into giant branch, white dwarf and neutron stars. This reference provides a foundation for the interpretation and modelling of currently known systems and upcoming discoveries.

Published in Royal Society Open Science
Available from arXiv:1601.05419

Job Adverts

Instituto de Astronomía, Universidad Católica del Norte, Antofagasta Post doctoral fellowship (ALMA – CONICYT fund)

The Astronomy Institute at Universidad Católica del Norte, Antofagasta, Chile, invites applications for a postdoctoral position in Evolution of Planetary Nebulæ: analysis & numerical models.

The successful candidate will perform research on modelling and follow up observations of Planetary Nebulæ. He/She will work with Prof. Stefan Kimeswenger, and collaborators of the numerical modelling of CRONOS and CLOUDY in Innsbruck and Brussels. The successful candidate is expected to collect and analyse new data, actively contribute to the project, and lead part of the studies with independence. He/She will have access to the 10% of the telescope time on all facilities in Chile. In addition, the IA–UCN members have exclusive access to minor facilities. For the modelling an own Compute Cluster (> 200 cores & infiniband) of the group is available in Europe. Access to the Austrian HPC infrastructure is granted.

Applicants must have a PhD in astronomy or a closely related field at the start of the appointment. A strong background in planetary nebulæ and/or radiative hyrodynamic modelling is expected. Experience in ESO archive databases is particularly welcome.

See also https://jobregister.aas.org/job_view?JobID=53204

Post-doc position at the Universidad Católica del Norte, Chile Resolving the mass loss from cool evolved stars with the Very Large Telescope Interferometer

A post-doctoral position is open at the Instituto de Astronomía of the Universidad Católica del Norte, Antofagasta, Chile. This post-doctoral position is available for two years. The starting date can be as early as April 2016, but it can be flexible.

The successful applicant will work with Prof. Keiichi Ohnaka on high spatial resolution observations of cool evolved stars with optical/infrared interferometric techniques, primarily using ESO's Very Large Telescope Interferometer (VLTI). The post-doc will work on the analysis and interpretation of VLTI data, including radiative transfer modeling

and aperture-synthesis imaging of the atmosphere and circumstellar envelope of dying stars to clarify the long-standing problem of the mass loss.

Applicants should have a PhD in astrophysics. Experience in optical/infrared interferometry and/or research on cool evolved stars and/or radiative transfer modeling would be an asset.

The successful applicant will have access to the 10% of the telescope time on all existing facilities in Chile, such as ALMA, VLT, Gemini, and Magellan.

Interested applicants should submit a CV, publication list, description of research interests and arrange two letters of reference directly sent to Prof. Keiichi Ohnaka (k1.ohnaka@gmail.com). Applications submitted by February 29, 2016 will receive full consideration, but late applications may be considered until the position is filled. Further information, please contact Prof. Keiichi Ohnaka (k1.ohnaka@gmail.com).

Announcements

Second announcement – CLOUDY: emission lines in astrophysics, from gaseous nebulæ to quasars

CLOUDY: emission lines in astrophysics, from gaseous nebulæ to quasars
México City, August 8–12, 2016

The deadline for the pre-registration is February 15th 2016.

The purpose of this symposium is to celebrate the scientific career of Gary Ferland. A substantial fraction of his research career has been devoted to the development of the code CLOUDY and its applications to the study of the interstellar medium.

CLOUDY has been applied to a wide variety of astronomical environments including: photodissociation regions, molecular clouds, H II regions, planetary nebulæ, novæ and supernovae remnants, active galactic nuclei, and starburst galaxies.

During five days we will review those areas of astrophysics where the impact of CLOUDY has been important and we will try to glance into the future of interstellar medium research.

The proposed program is aimed at the most important issues related to the modeling of emission line interpretation under different astrophysical regimes. In particular the topics to cover would be: Modeling Gaseous Nebulæ, Atomic Data for Astrophysics, Active Galactic Nuclei Emission, Interstellar and circumstellar matter, Novæ and Supernovæ Remnants, H II Regions, Planetary Nebulæ, Intergalactic Medium, Photodissociation Regions, and Extending modelling capabilities.

VENUE
The venue will be Hotel Radisson Paraíso with a special rate for participants of this conference.

HOW TO REGISTER
We invite interested colleagues to pre-register through our webpage. The pre-registration is open until 15th of February 2016. Notice that the number of participants is limited. The SOC will decide which type of presentation you will be able to give, and will communicate the result in early March 2016.

SOC & LOC
The Scientific Organizing Committee (SOC): Bozena Czerny, Andrew Fabian, William Henney, Frances Keenan, Ajit

K. Kembhav, C. Robert O'Dell (co-chair), Manuel Peimbert (co-chair), Grażyna Stasińska, Thomas Troland, Tiangu Wang, and Martin Ward.
The Local Organizing Committee (LOC): Rafael Costero, Gloria Delgado Inglada, Christophe Morisset, Antonio Peimbert, Miriam Peña, and Silvia Torres-Peimbert.

CONTACT
www.astroscu.unam.mx/cloudy2016
cloudy2016@astro.unam.mx

POSTER
The poster of the conference is available in the webpage.

See also www.astroscu.unam.mx/cloudy2016

EWASS 2016 Special Session 3: Evolved stars at high angular resolution

As part of the EWASS 2016 meeting in Athens, Greece, on July 4–8 2016, we are arranging a Special Session on theory and observations of evolved stars at high angular resolution.

Aims
This Special Session will bring together the different wavelength regimes of high angular resolution observatories with astronomers from the low- and high-mass evolved star community. This combines observations at optical and infrared wavelengths with the VLT and VLTI with observations in the millimeter/submillimeter with arrays such as ALMA and cm-wave interferometry. We want to review the recent observational results, stimulate a discussion on how to combine the results with theory, and consider their implications for our understanding of the later stages in the evolution of stars.

Invited speakers
Arancha Castro Carrizo (IRAM)
Andrea Chiavassa (Laboratoire Lagrange – Observatoire de la Côte d'Azur)
Leen Decin (K.U. Leuven)
Pierre Kervella (CNRS UMI FCA/Observatoire de Paris)
Carmen Sánchez Contreras (Center for Astrobiology (INTA/CSIC))
Markus Wittkowski (ESO)

Contributed talks and posters
You are invited to submit abstracts for contributed talks and/or posters through the EWASS 2016 homepage. Posters will be presented in a 30min poster-burst session during the evolved stars meeting. Deadline for abstract submission is March 15, 2016.

Registration
Registration is through the EWASS 2016 homepage. Deadline for very early registration is February 15, 2016. The deadline for early registration is April 30, 2016. You can register up to the beginning of the meeting on July 4, 2016.

SOC
Matthias Mærcker (chair, Chalmers, Sweden)
Claudia Paladini (ULB, Belgium)
Elvire De Beck (Chalmers, Sweden)
Valentín Bujarrabal (OAN–IGN, Spain)
Eric Lagadec (OCA, France)
Anita Richards (JBCA, UK)

See also http://eas.unige.ch/EWASS2016/session.jsp?id=SS3

Evolved stars in ALMA Cycle 4 workshop, 16–17 March 2016

You are welcome to participate in the "Evolved stars in ALMA Cycle 4" workshop on 16–17 March 2016 in Gothenburg, Sweden.

As with previous cycles, the Nordic ARC node will host an ALMA evolved stars meeting in connection with the upcoming call for proposals, which will be released March 22, 2016. The goal of the two-day meeting is to coordinate our efforts for writing successful evolved stars proposals for the next ALMA cycle, and to encourage collaborations between the different groups.

Meeting format
The meeting is supposed to be as hands-on as possible, with much of the time spent actually writing the proposal text and preparing the aot file in the ALMA Observing Tool. We will briefly present recent ALMA news and the specifications for ALMA in Cycle 4. On the first day, there will be science presentations to highlight the latest advances with ALMA in the field of evolved stars, as well as potential Cycle 4 projects.

Registration
For more information and registration, please visit the workshop homepage.

See also http://www.nordic-alma.se/other/events/62-es-almac4

Splinter sessions on "Mass-losing AGB stars and Supergiants" at the "Cool Stars 19" conference

The 19$^{\text{th}}$ Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun will be held during June 6–10, 2016 in Uppsala, Sweden. The science program includes plenary sessions on topics relevant for AGB research, e.g., stellar interiors, stellar atmospheres & cool star abundances; stellar winds, mass loss and rotation from the pre-MS through the AGB; and cool stars in the galactic context. Among the invited speakers for the plenary sessions are Amanda Karakas and Susanne Höfner. More detailed information will be made available at the Cool Stars 19 website http://www.coolstars19.com during early February.

The AGB stars & supergiants splinter will span 2 afternoons (exact programme to be determined). It will focus on new observational and theoretical insights regarding mass loss mechanisms and structure formation on various scales, due to convection, companions, magnetic fields, or wind–wind interaction. Tentative topics for the 2 afternoons are "From waves to winds: gas dynamics in evolved stars" and "The circumstellar environment of cool giants". The organizing committee consists of Patricia Whitelock (chair, SAAO & University of Cape Town, South Africa), Susanne Höfner (co-chair, Uppsala University, Sweden), Martha Boyer (NASA, USA), Markus Wittkowski (ESO, Germany) and Albert Zijlstra (University of Manchester, UK).

A call with precise dates and abstract submission information will be posted in the next AGB Newsletter. Information regarding the splinter will also be made available at iapetus.jb.man.ac.uk/csp19_agb

See also http://www.coolstars19.com/program.html