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. 171 — 3 October 2011

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

Editors: Jacco van Loon and Albert Zijlstra

Editorial

Dear Colleagues,

It is a pleasure to present you the 171st issue of the AGB Newsletter, with no fewer than 52 (!) contributions (thanks to several conferences, mainly).

There is good news on the job market: two postdoctoral positions are being advertised, one in Sweden and another one in New York State – both beautiful places.

Don't miss the announcements at the end of the newsletter, which include a workshop on extremely high-resolution astrophysics, the FRUITY nucleosynthesis database, and an important message from IAU Commission 35 president, Corinne Charbonnel.

The next issue is planned to be distributed sometime around early November 2011, but due to conference / observing travel of one of the editors the exact timing remains highly uncertain.

Editorially Yours,
Jacco van Loon and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

What are the scientific highlights in our field over the period 2009–2011? (cf. Message at end of newsletter)

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

Refereed Journal Papers

PNe as observational constraints in chemical evolution models for NGC 6822

L. Hernández-Martínez[1,2], *L. Carigi*[1], *M. Peña*[1] *and M. Peimbert*[1]

[1]Instituto de Astronomía, Universidad Nacional Autónoma de México, México

[2]Instituto Nacional de Astrofísica, Optica y Electrónica, México

Chemical evolution models are useful for understanding the formation and evolution of stars and galaxies. Model predictions will be more robust as more observational constraints are used. We present chemical evolution models for the dwarf irregular galaxy NGC 6822 using chemical abundances of old and young Planetary Nebulae (PNe) and H II regions as observational constraints. Two sets of chemical abundances, one derived from collisionally excited lines (CELs) and one, from recombination lines (RLs), are used. We try to use our models as a tool to discriminate between both procedures for abundance determinations. In our chemical evolution code, the chemical contribution of low and intermediate mass stars is time delayed, while for the massive stars the chemical contribution follows the instantaneous recycling approximation. Our models have two main free parameters: the mass-loss rate of a well-mixed outflow and the upper mass limit, Mup, of the initial mass function (IMF). To reproduce the gaseous mass and the present-day O/H value we need to vary the outflow rate and the Mup value. We calculate two models with different $M_{\rm up}$ values that reproduce adequately the constraints. The abundances of old PNe are in agreement with our models and support the star formation history derived independently from photometric data. Both require an early well-mixed wind, lasting 5.3 Gyr, to reproduce the observed gaseous mass in the galaxy. In addition, by assuming a fraction of binaries producing SNIa of 1%, the models fit the Fe/H abundance ratio as derived from A supergiants. The first model (M4C), that assumes $M_{\rm up} = 40$ M$_\odot$, fits, within errors smaller than 2 σ, the O/H, Ne/H, S/H, Ar/H and Cl/H abundances obtained from CELs, for old and young PNe and H II regions. The second model (M1R), that adopts $M_{\rm up} = 80$ M$_\odot$, reproduces, within 2 σ errors, the O/H, C/H, Ne/H and S/H abundances adopted from RLs. Both models reproduce the increase of the O, Ne, S and Ar elements during the last 6 Gyr. We are not able to match the observed N/O ratios in either case, which suggests that the N yields of LIMS need improvement. Model M1R does not provide a good fit to the Cl/H and Ar/H ratios, because the SN yields of those elements for $m > 40$ M$_\odot$ are not adequate and need to be improved (two sets of yields were tried). From these results we are not able to conclude which set of abundances (the one from CELs or the one from RLS) represents better the real abundances in the ISM. We discuss the predicted ΔY/ΔO values, finding that the value from model M1R agrees better with data for other galaxies from the literature than the value from model M4C.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1108.5995

3D hydrodynamical simulations of a proton ingestion episode in a low-metallicity asymptotic giant branch star

Richard J. Stancliffe[1,2], *David S.P. Dearborn*[3], *John C. Lattanzio*[2], *Stuart A. Heap*[2] *and Simon W. Campbell*[2]

[1]RSAA, Mount Stromlo Observatory, Australia

[2]Monash University, Australia

[3]Lawrence Livermore National Laboratory, USA

We use the 3D stellar structure code DJEHUTY to model the ingestion of protons into the intershell convection zone of a 1 solar mass asymptotic giant branch star of metallicity $Z = 10^{-4}$. We have run two simulations: a low resolution one of around 300,000 zones, and a high resolution one consisting of 2,000,000 zones. Both simulations have been evolved for about 4 hours of stellar time. We observe the existence of fast, downward flowing plumes that are able to transport hydrogen into close proximity to the helium burning shell before burning takes place. The intershell in the 3D model is richer in protons than the 1D model by several orders of magnitude and so we obtain substantially higher hydrogen-burning luminosities – over 10^8 solar luminosities in the high resolution simulation – than are found in the

1D model. Convective velocities in these simulations are over 10 times greater than the predictions of mixing length theory, though the 3D simulations have greater energy generation due to the enhanced hydrogen burning. We find no evidence of the convective zone splitting into two, though this could be as a result of insufficient spatial resolution or because the models have not been evolved for long enough. We suggest that the 1D mixing length theory and particularly the use of a diffusion algorithm for mixing do not give an accurate picture of these events. An advective mixing scheme may give a better representation of the transport processes seen in the 3D models.

Accepted for publication in ApJ
Available from arXiv:1109.1289

Chemical Compositions of a sample of candidate post-AGB stars

S. Sumangala Rao[1], *Sunetra Giridhar*[1] *and David L. Lambert*[2]

[1]Indian Institute of Astrophysics, Bangalore, India

[2]W.J. McDonald Observatory, University of Texas, Austin, Texas, U.S.A.

We have derived elemental abundances for a sample of nine IRAS sources with colours similar to those of post-AGB stars. For IRAS 01259+6823, IRAS 05208−2035, IRAS 04535+3747 and IRAS 08187−1905 this is the first detailed abundance analysis based upon high resolution spectra. Mild indication of s-processing for IRAS 01259+6823, IRAS 05208−2035 and IRAS 08187−1905 have been found and a more comprehensive study of s-process enhanced objects IRAS 17279−1119 and IRAS 22223+4327 have been carried out.
We have also made a contemporary abundance analysis of the high galactic latitude supergiants BD +39 4926 and HD 107369. The former is heavily depleted in refractories and estimated [Zn/H] of −0.7 dex most likely gives initial metallicity of the star. For HD 107369 the abundances of α and Fe-peak elements are similar to those of halo objects and moderate deficiency of s-process elements is seen. IRAS 07140−2321 despite being a short period binary with circumstellar shell does not exhibit selective depletion of refractory elements.
We have compiled the stellar parameters and abundances for post-AGB stars with s-process enhancement, those showing significant depletion of condensable elements and those showing neither. The compilation shows that the s-process enhanced group contains very small number of binaries, and observed [α/Fe] are generally similar to thick disc values. It is likely that they represent AGB evolution of single stars. The compilation of depleted group contains larger fraction of binaries and generally supports the hypothesis of dusty discs surrounding binary post-AGB stars inferred via the shape of their SED and mid IR interferometry.
IRAS 07140−2321 and BD +39 4926 are difficult to explain with this scenario and indicate the existence of additional parameter/condition needed to explain the depletion phenomenon. However the conditions for discernible depletion, minimum temperature of 5000 K and initial metallicity larger than −1.0 dex found from our earlier work still serves as useful criteria.

Accepted for publication in Monthly Notices of the Royal Astronomical Society
Available from arXiv:1109.1676

Radiative hydrodynamics simulations of red supergiant stars. IV gray versus non-gray opacities

A. Chiavassa[1], *B. Freytag*[2,3,4], *T. Masseron*[1] *and B. Plez*[5]

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

[2]Centre de Recherche Astrophysique de Lyon, UMR 5574: CNRS, Université de Lyon, Ecole Normale Supérieure de Lyon, 46 allée d'Italie, F-69364 Lyon Cedex 07, France

[3]Department of Physics and Astronomy, Division of Astronomy and Space Physics, Uppsala University, Box 515, S-751 20 Uppsala, Sweden

[4]Istituto Nazionale di Astrofisica, Osservatorio Astronomico di Capodimonte, Via Moiariello 16, I-80131 Naples, Italy

[5]LUPM, Laboratoire Univers et Particules, Université de Montpellier II, CNRS, Place Eugéne Bataillon 34095 Montpellier Cedex 05, France

Context. Red supergiants are massive evolved stars that contribute extensively to the chemical enrichment of our Galaxy. It has been shown that convection in those stars gives rise to large granules that cause surface inhomogeneities

and shock waves in the photosphere. The understanding of their dynamics is crucial to unveil the unknown mass-loss mechanism, their chemical composition and stellar parameters.
Aims. We present a new generation of red supergiants simulations with a more sophisticated opacity treatment done with 3D radiative- hydrodynamics CO5BOLD.
Methods. In the code, the coupled equations of compressible hydrodynamics and non-local radiation transport are solved in the presence of a spherical potential. The stellar core is replaced by a special spherical inner boundary condition, where the gravitational potential is smoothed and the energy production by fusion is mimicked by a simply producing heat corresponding to the stellar luminosity. All outer boundaries are transmitting for matter and light. The post-processing radiative transfer code OPTIM3D is used to extract spectroscopic and interferometric observables.
Results. We show that the relaxation of the assumption of frequency-independent opacities shows a steeper mean thermal gradient in the optical thin region that affect strongly the atomic strengths and the spectral energy distribution. Moreover, the weaker temperature fluctuations reduce the incertitude on the radius determination with interferometry. We show that 1D models of red supergiants must include a turbulent velocity calibrated on 3D simulations to obtain the effective surface gravity that mimic the effect of turbulent pressure on the stellar atmosphere. We provide an empirical calibration of the ad-hoc micro- and macroturbulence parameters for 1D models using the 3D simulations: we find that there is not a clear distinction between the different macroturbulent profiles needed in 1D models to fit 3D synthetic lines.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1109.3619

Deep spectroscopy of the emission-line populations in NGC 185

D.R. Gonçalves[1,2]*, L. Magrini*[3]*, L. Martins*[4]*, A. Teodorescu*[5] *and C. Quireza*[1]

[1]UFRJ – Observatório do Valongo, Ladeira Pedro Antonio 43, 20080-090 Rio de Janeiro, Brazil
[2]Department of Physics and Astronomy, University College London, Gower Street, WC1E 6BT London, UK
[3]INAF – Osservatorio Astrofisico di Arcetri, Largo E. Fermi 5, I-50125 Firenze, Italy
[4]NAT Universidade Cruzeiro do Sul, Rua Galvão Bueno 868, 01506-000 São Paulo, Brazil
[5]Institute for Astronomy, University of Hawai'i, 2680 Woodlawn Drive, HI 96822 Honolulu, USA

Dwarf galaxies are crucial to understand the formation and evolution of galaxies, since they constitute the most abundant galaxy population. Abundance ratios and their variations due to star formation are key constraints to chemical evolution models. The determination of these abundances in the dwarf galaxies of the Local Universe is thus of extreme importance. However, these objects are intrinsically faint and observational constraints to their evolution can be obtained only for very nearby galaxies. NGC 185 is one of the four brightest dwarf companions of M 31, but unlike than the other three, NGC 147, NGC 205, and NGC 221 (M 32) it has an important content of gas and dust. We obtained deep spectroscopic observations of the Hα emitting population of NGC 185 using GMOS-N at Gemini. As a result, in addition to the bright planetary nebulae (PNe) previously found in the galaxy and reported in the literature, we found other, much fainter, PNe. We then re-calculated the electron temperatures and chemical abundances of the brightest ones, and derived, for the first time, their electron densities. Our characterisation of the PN population properties is interpreted in terms of the chemical evolution of NGC 185, which suggests that it has suffered a significant chemical enrichment within the last ~ 8 Gyr. We also discovered the first symbiotic star in the galaxy and enlightened the properties of a known supernova remnant located close to the centre of NGC 185.

Accepted for publication in MNRAS
Available from arXiv:1109.3019

Stellar population models at high spectral resolution

Claudia Maraston[1] *and Gustav Stromback*[1]

[1]ICG-University of Portsmouth, UK

We present new, high-to-intermediate spectral resolution stellar population models, based on four popular libraries

of empirical stellar spectra, namely Pickles, ELODIE, STELIB and MILES. These new models are the same as our previous models, but with higher resolution and based on empirical stellar spectra, while keeping other ingredients the same including the stellar energetics, the atmospheric parameters and the treatment of the Thermally-Pulsating Asymptotic Giant Branch and the Horizontal Branch morphology. We further compute very high resolution ($R = 20,000$) models based on the theoretical stellar library MARCS which extends to the near-infrared. We therefore provide merged high resolution stellar population models, extending from ~ 1000 Å to 25,000 Å, using our previously published high resolution theoretical models which extended to the ultraviolet. We compare how these libraries perform in stellar population models and highlight spectral regions where discrepancies are found. We confirm our previous findings that the flux around the V-band is lower (in a normalised sense) in models based on empirical libraries than in those based on the BaSeL–Kurucz library, which results in a bluer B–V colour. Most noticeably the theoretical library MARCS gives results fully consistent with the empirical libraries. This same effect is also found in other models using MILES, namely Vazdekis et al. and Conroy & Gunn, even though the latter authors reach the opposite conclusion. The bluer predicted B–V colour (by 0.05 magnitudes in our models) is in better agreement with both the colours of Luminous Red Galaxies and globular cluster data. We test the models on their ability to reproduce, through full spectral fitting, the ages and metallicities of galactic globular clusters as derived from CMD fitting and find overall good agreement. We also discuss extensively the Lick indices calculated directly on the integrated MILES-based SEDs and compare them with element ratio sensitive index models. We find a good agreement between the two models, if the metallicity dependent chemical pattern of the Milky Way stars is taken into account in this comparison. As a consequence, the ages and metallicities of galactic globular clusters are not well reproduced when one uses straight the MILES-based indices, because subtle chemical effects on individual lines dominate the age derivation. The best agreement with the ages of the calibrating GCs is found with either element-ratio sensitive absorption-line models or with the full SED fitting, for which no particular weight is given to selected lines.

Accepted for publication in MNRAS
Available from arXiv:1109.0543

The chemical evolution of globular clusters – II. Metals and fluorine

P. Sánchez-Blázquez[1], *A. Marcolini*[2], *B.K. Gibson*[2], *A.I. Karakas*[3], *K. Pilkington*[2] *and F. Calura*[2]

[1]Departamento de Física Teórica, Universidad Autónoma de Madrid, E28049, Cantoblanco, Madrid, Spain

[2]Jeremiah Horrocks Institute, University of Central Lancashire, Preston, PR1 2HE, UK

[3]Research School of Astronomy & Astrophysics, Mt. Stromlo Observatory, Weston Creek, ACT 2611, Australia

In the first paper in this series, we proposed a new framework in which to model the chemical evolution of globular clusters. This model, is predicated upon the assumption that clusters form within an interstellar medium enriched locally by the ejecta of a single Type Ia supernova and varying numbers of asymptotic giant branch stars, superimposed on an ambient medium pre-enriched by low-metallicity Type II supernovae. Paper I was concerned with the application of this model to the observed abundances of several reactive elements and so-called non-metals for three classical intermediate-metallicity clusters, with the hallmark of the work being the successful recovery of many of their well-known elemental and isotopic abundance anomalies. Here, we expand upon our initial analysis by (a) applying the model to a much broader range of metallicities (from the factor of three explored in Paper I, to now, a factor of ~ 50; i.e., essentially, the full range of Galactic globular cluster abundances, and (b) incorporating a broader suite of chemical species, including a number of iron-peak isotopes, heavier α-elements, and fluorine. While allowing for an appropriate fine tuning of the model input parameters, most empirical globular cluster abundance trends are reproduced, our model would suggest the need for a higher production of calcium, silicon, and copper in low-metallicity (or so-called "prompt") Type Ia supernovae than predicted in current stellar models in order to reproduce the observed trends in NGC 6752, and a factor of two reduction in carbon production from asymptotic giant branch stars to explain the observed trends between carbon and nitrogen. Observations of heavy-element isotopes produced primarily by Type Ia supernovae, including those of titanium, iron, and nickel, could support/refute unequivocally our proposed framework, although currently the feasibility of the proposed observations is well beyond current instrumental capabilities. Hydrodynamical simulations would be necessary to study its viability from a dynamical point of view.

Accepted for publication in MNRAS
Available from arXiv:1109.1938

Calculating asteroseismic diagrams for solar-like oscillations

Timothy R. White[1,2], *Timothy R. Bedding*[1], *Dennis Stello*[1], *Jørgen Christensen-Dalsgaard*[3], *Daniel Huber*[1] *and Hans Kjeldsen*[3]

[1]Sydney Institute for Astronomy (SIfA), School of Physics, University of Sydney, NSW 2006, Australia

[2]Australian Astronomical Observatory, P.O. Box 296, Epping NSW 1710, Australia

[3]Danish AsteroSeismology Centre (DASC), Department of Physics and Astronomy, Århus University, DK-8000 Århus C, Denmark

With the success of the *Kepler* and CoRoT missions, the number of stars with detected solar-like oscillations has increased by several orders of magnitude, for the first time we are able to perform large-scale ensemble asteroseismology of these stars. In preparation for this golden age of asteroseismology we have computed expected values of various asteroseismic observables from models of varying mass and metallicity. The relationships between these asteroseismic observables, such as the separations between mode frequencies, are able to significantly constrain estimates of the ages and masses of these stars. We investigate the scaling relation between the large frequency separation, $\Delta\nu$, and mean stellar density. Furthermore we present model evolutionary tracks for several asteroseismic diagrams. We have extended the so-called C–D diagram beyond the main sequence to the subgiants and the red-giant branch. We also consider another asteroseismic diagram, the ϵ diagram, which is more sensitive to variations in stellar properties at the subgiant stages and can aid in determining the correct mode identification. The recent discovery of gravity-mode period spacings in red giants forms the basis for a third asteroseismic diagram. We compare the evolutionary model tracks in these asteroseismic diagrams with results from pre-*Kepler* studies of solar-like oscillations, and early results from *Kepler*.

Accepted for publication in The Astrophysical Journal
Available from arXiv:1109.3455

Spitzer observations of white dwarfs: the missing planetary debris around DZ stars

S. Xu[1] *and M. Jura*[1]

[1]Department of Physics & Astronomy, University of California, Los Angeles, USA

We report a *Spitzer*/IRAC search for infrared excesses around white dwarfs, including 14 newly-observed targets and 16 unpublished archived stars. We find a substantial infrared excess around two warm white dwarfs – J 220934.84+122336.5 and WD 0843+516, the latter apparently being the hottest white dwarf known to display a close-in dust disk. Extending previous studies, we find that the fraction of white dwarfs with dust disks increases as the star's temperature increases; for stars cooler than 10,000 K, even the most heavily polluted ones do not have $\sim$ 1000 K dust. There is tentative evidence that the dust disk occurrence is correlated with the volatility of the accreted material. In the Appendix, we modify a previous analysis to show that Poynting–Robertson drag might play an important role in transferring materials from a dust disk into a white dwarf's atmosphere.

Accepted for publication in ApJ
Available from arXiv:1109.4207

Evolution, nucleosynthesis and yields of low mass AGB stars at different metallicities (II): the FRUITY database

S. Cristallo[1,2], *L. Piersanti*[2], *O. Straniero*[2], *R. Gallino*[3], *I. Domínguez*[1], *C. Abia*[1], *G. Di Rico*[2], *M. Quintini*[2] *and S. Bisterzo*[3]

[1]Universidad de Granada, Spain

[2]Osservatorio Astronomico di teramo – INAF, Italy

[3]Università di Torino, Dip.to di Fisica Generale, Italy

By using updated stellar low mass stars models, we systematically investigate the nucleosynthesis processes occurring

in AGB stars. In this paper we present a database dedicated to the nucleosynthesis of AGB stars: FRUITY (FRANEC Repository of Updated Isotopic Tables & Yields). An interactive web-based interface allows users to freely download the full (from H to Bi) isotopic composition, as it changes after each third dredge-up episode and the stellar yields the models produce. A first set of AGB models, having masses in the range $1.5 < M/\mathrm{M}_{\odot} < 3.0$ and metallicities $10^{-3} < Z0.02$, is discussed. For each model, a detailed description of the physical and the chemical evolution is provided. In particular, we illustrate the details of the s-process and we evaluate the theoretical uncertainties due to the parametrization adopted to model convection and mass loss. The resulting nucleosynthesis scenario is checked by comparing the theoretical [hs/ls] and [Pb/hs] ratios to those obtained from the available abundance analysis of s-enhanced stars. On the average, the variation with the metallicity of these spectroscopic indexes is well reproduced by theoretical models, although the predicted spread at a given metallicity is substantially smaller than the observed one. Possible explanations for such a difference are briefly discussed. An independent check of the third dredge-up efficiency is provided by the C-stars luminosity function. Consequently, theoretical C-stars luminosity functions for the Galactic disk and the Magellanic Clouds have been derived. We generally find a good agreement with observations.

Accepted for publication in ApJ Supplements
Available from arXiv:1109.1176

The star formation rate density and dust attenuation evolution over 12 Gyr with the VVDS surveys

O. Cucciati[1,2], L. Tresse[1], O. Ilbert[1], O. Le Fèvre[1], B. Garilli[1,3], V. Le Brun[1], P. Cassata[4], P. Franzetti[3], D. Maccagni[1,3], M. Scodeggio[3], E. Zucca[5], G. Zamorani[5], S. Bardelli[5], M. Bolzonella[5], R.M. Bielby[6,7], H.J. McCracken[7], A. Zanichelli[8], D. Vergani[5] and A. Pollo[9,10]

[1]Laboratoire d'Astrophysique de Marseille (UMR 6110), CNRS–Université de Provence, 38 rue Frédéric Joliot-Curie, F-13388 Marseille Cedex 13, France

[2]INAF–Osservatorio Astronomico di Trieste, via Tiepolo 11, I-34143 Trieste, Italy

[3]INAF–IASF, via Bassini 15, I-20133 Milano, Italy

[4]Department of Astronomy, University of Massachusetts, Amherst, MA 01003, USA

[5]INAF–Osservatorio Astronomico di Bologna, via Ranzani 1, I-40127 Bologna, Italy

[6]Department of Physics, Durham University, South Road, Durham DH1 3LE, UK

[7]Institut d'Astrophysique de Paris (UMR 7095), CNRS-Université Pierre et Marie Curie, 98bis boulevard Arago, F-75014 Paris, France

[8]IRA–INAF, via Gobetti 101, I-40129, Bologna, Italy

[9]The Andrzej Soltan Institute for Nuclear Studies, ul. Hoza 69, 00-681 Warszawa, Poland

[10]Astronomical Observatory of the Jagiellonian University, ul. Orla 171, PL-30-244, Kraków, Poland

Aims. We investigate the global galaxy evolution over ~ 12 Gyr ($0.05 \leq z \leq 4.5$), from the far ultraviolet (FUV) luminosity function (LF), luminosity density (LD), and star formation rate density (SFRD), using the VIMOS-VLT Deep Survey (VVDS), a single deep galaxy redshift survey with a well controlled selection function.
Methods. We combine the VVDS Deep ($17.5 \leq I_{AB} \leq 24.0$) and Ultra-Deep ($23.00 \leq i'_{AB} \leq 24.75$) redshift surveys, totalizing ~ 11000 galaxies, to estimate the rest-frame FUV LF and LD, using a wide wavelength range of deep photometry ($337 < \lambda < 2310$ nm). We extract the dust attenuation of the FUV radiation, embedded in the well-constrained spectral energy distributions. We then derive the dust-corrected SFRD.
Results. We find a constant and flat faint-end slope α in the FUV LF at $z < 1.7$. At $z > 1.7$, we set α steepening with $(1 + z)$. The absolute magnitude $M^{\star}_{\mathrm{FUV}}$ steadily brightens in the entire range $0 < z < 4.5$, and at $z > 2$ it is on average brighter than in the literature, while $\phi^{\star}$ is on average smaller. The evolution of our total LD shows a peak at $z \simeq 2$, clearly present also when considering all sources of uncertainty. The SFRD history peaks as well at $z \simeq 2$. It first steadily rises by a factor of ~ 6 during 2 Gyr (from $z = 4.5$ to $z = 2$), and then decreases by a factor of ~ 12 during 10 Gyr down to $z = 0.05$. This peak is produced by the decreasing contribution at $z < 2$ of galaxies with $-21.5 \leq M_{\mathrm{FUV}} \leq -19.5$ mag. As times goes by, the total SFRD is dominated by fainter and fainter galaxies. Moreover, at $z > 2$ the SFRD is entirely shaped by the high specific SFR galaxies. The mean dust attenuation of the global galaxy population rises fast by 1 mag during 2 Gyr from $z \simeq 4.5$ to $z \sim 2$, reaches slowly its maximum at $z \simeq 1$ ($A_{\mathrm{FUV}} \simeq 2.2$ mag), and then decreases by 1.1 mag during 7 Gyr down to $z \simeq 0$.

Conclusions. We have derived the cosmic SFRD history and the total dust amount in galaxies over a continuous period of ~ 12 Gyr, using a single homogeneous spectroscopic redshift sample. The presence of a clear peak at $z \simeq 2$ and a fast rise at $z > 2$ of the SFRD is compelling for models of galaxy formation. This peak is produced by intermediate luminosity galaxies, requiring that significant gas reservoirs still exist at this epoch and are probably replenished by cold accretion and wet mergers, while feedback or quenching processes are not yet strong enough to lower the SF. The dust attenuation maximum is reached ~ 2 Gyr after the SFRD peak, implying a contribution from the intermediate-mass stars to the dust production at $z < 2$.

Submitted to A&A
Available from arXiv:1109.1005

Remodel the envelope around the 21-μm PPN IRAS 07134+1005

Chun-Hui Yang[1,2] *and Chin-Fei Lee*[1]

[1]Academia Sinica Institute of Astronomy and Astrophysics, P.O. Box 23-141, Taipei 106, Taiwan
[2]Department of Physics, National Taiwan Normal University, 88, Sec. 4, Ting-Chou Rd., Taipei 116, Taiwan

Recently, the CO $J = 3$–2 observational result of the envelope of the 21-μm PPN IRAS 07134+1005 has been reported. Assuming that the CO $J = 3$–2 line was optically thin, the mass-loss rate of the superwind in this PPN was found to be at least 2 orders of magnitude lower than the typical range. In order to obtain a more accurate mass-loss rate, we reexamine this data and construct a radiative transfer model to compare with the data. Also, in order to better resolve the superwind, we adopt a different weighting on the data to obtain maps at higher resolution. Our result shows that the CO $J = 3$–2 emission is located slightly further away from the central source than the mid-IR emission, probably because that the material is cooler in the outer part and thus better traced by the CO emission. At lower resolution, however, the CO emission appeared to be spatially coincident with the mid-IR emission. Our model has two components, an inner ellipsoidal shell-like superwind with an equatorial density enhancement and an outer spheroidal AGB wind. The thick torus in previous model could be considered as the dense equatorial part of our ellipsoidal superwind. With radiative transfer, our model reproduces more observed features than previous model and obtains an averaged superwind mass-loss rate of $\sim 1.8 \times 10^{-5}$ $M_\odot$ yr^{-1}, which is typical for a superwind. The mass-loss rate in the equatorial plane is 3×10^{-5} $M_\odot$ yr^{-1}, also the same as that derived before from modeling CO $J = 1$–0 emission.

Accepted for publication in ApJ
Available from arXiv:1109.5767

Near-infrared angular diameters of a few Asymptotic Giant Branch variables by Lunar occultations

Tapas Baug[1] *and T. Chandrasekhar*[1]

[1]Physical Research Laboratory, Ahmedabad-380009, India

We present well resolved uniform disc (UD) angular diameter measurements of two Miras (AW Aur and BS Aur) and three semi-regular variables (SRVs) (GP Tau, RS Cap and RT Cap) using the Lunar occultation technique in the near-Infrared. Observations for all sources except RS Cap were in the broad K-band (2.2 μm /0.4 μm). For RS Cap narrow CO-band filter (2.37 μm /0.1 μm) was used. UD angular diameters of the two Miras and GP Tau are the first time reported measurements. For RS Cap and RT Cap our measurements are in good agreement with the earlier reported values.

We have investigated the possible enhancements of the UD angular diameters of the Miras in our sample due to high mass-loss rate / presence circumstellar shell. For this purpose we have generated a plot of the ratio of observed and calculated UD angular diameters against (K–[12]) colour excess for 43 Miras. We find that for (K–[12]) colour excess

more than 2.5 the ratio rises sharply. AW Aur with colour excess 1.1 shows no enhancement while BS Aur with a colour excess of 2.6 shows 40% enhancement in its UD angular diameter. The results of both the Miras are consistent with IRAS LRS Characterisation. A similar exercise has been carried out using a sample of 52 SRVs but they do not show any enhancements. All SRVs in our sample are consistent with results.
We have also cross checked our measurements with predictions of angular diameters of these sources through a calibration of previously reported UD angular diameters of several oxygen rich Miras and SRVs (mainly M-type). Except RT Cap, which is a carbon star, our measured values are in agreement with the predictions.

Accepted for publication in MNRAS
Available from arXiv:1109.0388

Is CGCS 5926 a symbiotic X-ray binary?

N. Masetti[1], U. Munari[2], A.A. Henden[3], K.L. Page[4], J.P. Osborne[4] and S. Starrfield[5]

[1]INAF–IASF di Bologna, Italy
[2]INAF–Osservatorio di Padova-Asiago, Italy
[3]AAVSO, Cambridge, USA
[4]University of Leicester, United Kingdom
[5]Arizona State University, USA

We here report on multiwavelength (X-ray to optical) followup observations of carbon star CGCS 5926. These were motivated by the fact that this star is positionally coincident with a faint X-ray emitting object belonging to the ROSAT catalog of sources, thus suggesting a possible symbiotic X-ray binary (SyXB) nature for it. Our spectrophotometric optical data confirm the giant carbon star nature of the object and allow us to classify its spectral type as C(6,2). This classification places CGCS 5926 at a distance of about 5 kpc from Earth. BVR_cIc photometry of the star shows that it displays a variability of about 0.3 mag on timescales of months, with the star getting bluer when its brightness increases. Our photometric data indicate a periodicity of 151 days, which we explain as due to radial pulsations of CGCS 5926 on the basis of its global characteristics. The source is not detected at X-rays with Swift/XRT down to a 0.3–10 keV band luminosity of around 3×10^{32} erg s^{-1}. This nondetection is apparently in contrast with the ROSAT data; however we show that, even if the probability that CGCS 5926 can be a SyXB appears quite low, the present information does not completely rule out such a possibility, while it makes other interpretations even more unlikely if we assume that the ROSAT detection was real. This issue might thus be settled by future, more sensitive, observations at high energies.

Accepted for publication in A&A
Available from arXiv:1109.6019

Modeling the 2010 blast wave of the symbiotic-like nova V407 Cygni

S. Orlando[1] and J.J. Drake[2]

[1]INAF – Osservatorio Astronomico di Palermo "G.S. Vaiana", Piazza del Parlamento 1, 90134, Palermo, Italy
[2]Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

(Abridged) The symbiotic-like binary Mira and nova V407 Cyg was observed in outburst on March 2010 and monitored in several wavelength bands. Here we report on multi-dimensional hydrodynamic simulations describing the 2010 outburst of V407 Cyg, exploring the first 60 days of evolution. The model takes into account thermal conduction and radiative cooling; the pre-explosion system conditions included the companion star and a circumbinary density enhancement. The simulations showed that the blast and the ejecta distribution are both aspherical due to the inhomogeneous circumstellar medium in which they expand; in particular they are significantly collimated in polar directions (producing a bipolar shock morphology) if the circumstellar envelope is characterized by an equatorial

density enhancement. The blast is partially shielded by the Mira companion, producing a wake with dense and hot post-shock plasma on the rear side of the companion star; most of the X-ray emission produced during the evolution of the blast arises from this plasma structure. The observed X-ray lightcurve can be reproduced, assuming values of outburst energy and ejected mass similar to those of RS Oph and U Sco, if a circumbinary gas density enhancement is included in the model. In this case, the 2010 blast propagated through a circumbinary gas density enhancement with radius of the order of 40 AU and gas density $\approx 10^6$ cm^{-3} and that the mass of ejecta in the outburst was $M_{\rm ej} \approx 2 \times 10^{-7}$ M$_\odot$ with an explosion energy $E_0 \approx 2 \times 10^{44}$ erg. Alternatively, the model can produce a similar X-ray lightcurve without the need of a circumbinary gas density enhancement only if the outburst energy and ejected mass were similar to those at the upper end of ranges for classical novae, namely $M_{\rm ej} \approx 5 \times 10^{-5}$ M$_\odot$ and $E_0 \approx 5 \times 10^{46}$ erg.

Accepted for publication in MNRAS
Available from arXiv:1109.5024
and from http://www.astropa.unipa.it/∼orlando/PREPRINTS/sorlando_v407cyg.pdf

Chromosphere of K giant stars: Geometrical extent and spatial structure detection

P. Berio[1], *T. Merle*[2], *F. Thévenin*[2], *D. Bonneau*[1], *D. Mourard*[1] *and et al.*

[1]Nice Sophia–Antipolis University, CNRS UMR 6525, Observatoire de la Côte d'Azur, BP 4229, 06304 Nice Cedex 4, France
[2]Nice Sophia–Antipolis University, CNRS UMR 6202, Observatoire de la Côte d'Azur, BP 4229, 06304 Nice Cedex 4, France

Context. Interferometers provide accurate diameter measurements of stars by analyzing both the continuum and the lines formed in photospheres and chromospheres. Tests of the geometrical extent of the chromospheres are therefore possible by comparing the estimated radius in the continuum of the photosphere and the estimated radii in chromospheric lines.
Aims. We aim to constrain the geometrical extent of the chromosphere of non-binary K giant stars and detect any spatial structures in the chromosphere.
Methods. We performed observations with the CHARA interferometer and the VEGA beam combiner at optical wavelengths. We observed seven non-binary K giant stars (β and η Cet, δ Crt, ρ Boo, β Oph, 109 Her and ι Cep). We measured the ratio of the radii of the photosphere to the chromosphere using the interferometric measurements in the Hα and the Ca II infrared triplet line cores. For β Cet, spectro-interferometric observations are compared to an non-local thermal equilibrium (NLTE) semi-empirical model atmosphere including a chromosphere. The NLTE computations provide line intensities and contribution functions that indicate the relative locations where the line cores are formed and can constrain the size of the limb-darkened disk of the stars with chromospheres. We measured the angular diameter of seven K giant stars and deduced their fundamental parameters: effective temperatures, radii, luminosities, and masses. We determined the geometrical extent of the chromosphere for four giant stars (β and η Cet, δ Crt and ρ Boo).
Results. The chromosphere extents obtained range between 16% to 47% of the stellar radius. The NLTE computations confirm that the Ca II/849 nm line core is deeper in the chromosphere of β Cet than either of the Ca II/854 nm and Ca II/866 nm line cores. We present a modified version of a semi-empirical model atmosphere derived by fitting the Ca II triplet line cores of this star. In four of our targets, we also detect the signature of a differential signal showing the presence of asymmetries in the chromospheres.
Conclusions. It is the first time that geometrical extents and structure in the chromospheres of non-binary K giant stars are determined by interferometry. These observations provide strong constrains on stellar atmosphere models.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:1109.5476

A double detached shell around a post-red supergiant: IRAS 17163−3907, the Fried Egg nebula

E. Lagadec[1], *A.A. Zijlstra*[2], *R.D. Oudmaijer*[3], *T. Verhoelst*[4], *N.J.L. Cox*[4], *R. Szczerba*[5], *D. Mekarnia*[6] *and H. van Winckel*[4]

[1]ESO Garching, Germany
[2]JBCA Manchestter, UK
[3]University of Leeds, UK
[4]KU Leuven, Belgium
[5]NCAC Torun, Poland
[6]OCA Nice, France

We performed a mid-infrared imaging survey of evolved stars in order to study the dust distribution in circumstellar envelopes around these objects and to better understand the mass-loss mechanism responsible for the formation of these envelopes. During this survey, we resolved for the first time the circumstellar environment of IRAS 17163−3907 (hereinafter IRAS 17163), which is one of the brightest objects in the mid-infrared sky, but is surprisingly not well studied. Our aim is to determine the evolutionary status of IRAS 17163 and study its circumstellar environment in order to understand its mass-loss history. We obtained diffraction-limited images of IRAS 17163 in the mid-infrared using VISIR on the VLT. Optical spectra of the object allowed us to determine its spectral type and estimate its distance via the presence of diffuse interstellar bands. We show that IRAS 17163 is a Post-Red Supergiant, possibly belonging to the rare class of Yellow Hypergiants, and is very similar to the well studied object IRC +10 420. Our mid-infrared images of IRAS 17163 are the first direct images of this bright mid-infrared source. These images clearly show the presence of a double dusty detached shell around the central star, due to successive ejections of material with a timescale of the order of 400 years and a total circumstellar mass larger than 4 $M_{\odot}$. This indicates that non quiescent mass-loss occurs during this phase of stellar evolution.

Accepted for publication in A&A
Available from arXiv:1109.5947

Shock-induced polarized hydrogen emission lines in the Mira star *o* Ceti

N. Fabas[1], *A. Lèbre*[1] *and D. Gillet*[2]

[1]Laboratoire Univers et Particules de Montpellier (LUPM) – Université Montpellier II, France
[2]Observatoire de Haute-Provence (OHP), France

In the spectra of pulsating stars, especially Mira stars, the detection of intense hydrogen emission lines has been explained by a radiative shock wave, periodically propagating throughout the atmosphere. Previous observation of the Mira star *o* Ceti around a bright maximum of light led to the detection of a strong linear polarization associated to Balmer emissions, although the origin of this phenomenon is not fully explained yet. With the help of spectropolarimetry, we propose to investigate the nature of shock waves propagating throughout the stellar atmosphere and present, for *o* Ceti (the prototype of Mira stars), a full observational study of hydrogen emission lines formed in the radiative region of such a shock. Using the instrument NARVAL, we performed a spectropolarimetric monitoring of *o* Ceti during three consecutive pulsation cycles. All Stokes parameters were systematically collected, with a particular emphasis on the maxima of luminosity, i.e. when a radiative shock wave is supposed to emerge from the photosphere and propagate outward. On Balmer lines, over a large part of the luminosity cycle, we report detections in Stokes spectra which are evolving with time. These signatures appear to be strongly correlated to the presence of an intense shock wave responsible for the hydrogen emission lines. We establish that those lines are polarized by a process inherent to the mechanism responsible for the emission line formation: the shock wave itself. Two mechanisms are considered: a global one that implies a polarization induced by convective cells located around the photosphere and a local one that implies a charge separation due to the passage of the shock wave, inducing an electrical current. Combined with the existing turbulence, this may generate a magnetic field, hence polarization.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1109.6500

New results for the open cluster Bica 6 and its associated planetary nebula Abell 8

David G. Turner[1,5]*, Joanne M. Rosvick*[2]*, David D. Balam*[3]*, Arne A. Henden*[4]*, Daniel J. Majaess*[1,5] *and David J. Lane*[1,5]

[1]Saint Mary's University, Halifax, NS, Canada

[2]Thompson Rivers University, Kamloops, BC, Canada

[3]Dominion Astrophysical Observatory, Victoria, BC, Canada

[4]AAVSO, Cambridge, MA, USA

[5]Abbey Ridge Observatory, Stillwater Lake, NS, Canada

The likely membership of the planetary nebula Abell 8 (PN G 167.0−00.9) in the open cluster Bica 6 is confirmed by CCD spectra, UBV(RI)$_c$ photometry, and radial velocities for luminous cluster stars. The reddening, estimated distance, and radial velocity of the planetary nebula agree with parameters derived for Bica 6 of $E(B-V) = 0.42$, $d = 1.60 \pm 0.11$ kpc, and $v_r = 57 \pm 1$ km s^{-1}, with a cluster age of 1 Gyr, a diagnostic blue hook, and a few blue stragglers, including a peculiar B1Vnn star (HDE 277593) that may be a post-AGB star. The results identify Bica 6 as a potential calibrator of the planetary nebula distance scale. The central star of the planetary nebula has a reddening of $E(B-V) = 0.49 \pm 0.02$, with a possible circumnebular excess, and an estimated luminosity of $M_V = +7.44 \pm 0.16$. It is also an optical double in 2MASS images, with a likely progenitor according to evolutionary considerations being a late B-type dwarf of ~ 2.3 M$_\odot$.

Accepted for publication in PASP
Available from arXiv:1109.6006

The 2011 outburst of the recurrent nova T Pyx. Evidence for a face-on bipolar ejection

O. Chesneau[1]*, A. Meilland*[1]*, D.P.K. Banerjee*[2]*, J.-B. Le Bouquin*[3]*, H. McAlister*[4,5]*, F. Millour*[1]*, S.T. Ridgway*[6]*, A. Spang*[1]*, T. ten Brummelaar*[5]*, M. Wittkowski*[7]*, N.M. Ashok*[2]*, M. Benisty*[8]*, J.-P. Berger*[9]*, T. Boyajian*[4]*, Ch. Farrington*[5]*, P.J. Goldfinger*[5]*, A. Merand*[9]*, N. Nardetto*[1]*, R. Petrov*[1]*, Th. Rivinius*[9]*, G. Schaefer*[4]*, Y. Touhami*[4] *and G.Zins*[3]

[1]UMR 6525 Fizeau, Univ. Nice Sophia Antipolis, CNRS, Obs. de la Côte d'Azur, Nice, France

[2]Physical Research Laboratory, Navrangpura, Ahmedabad, Gujarat, India

[3]UJF–Grenoble 1/CNRS–INSU, Institut de Planétologie et d'Astrophysique de Grenoble (IPAG), UMR 5274, Grenoble, France

[4]Georgia State University, P.O. Box 3969, Atlanta GA 30302-3969, USA

[5]CHARA Array, Mount Wilson Observatory, 91023 Mount Wilson CA, USA

[6]National Optical Astronomy Observatories, 950 North Cherry Avenue, Tucson, AZ, 85719, USA

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

[8]Max Planck Institut für Astronomie, Königstuhl 17, 69117 Heidelberg, Germany

[9]European Southern Observatory, Casilla 19001, Santiago 19, Chile

T Pyx is the first recurrent nova ever historically studied. It was seen in outburst six times between 1890 and 1966 and then not for 45 years. We report on near-IR interferometric observations of the recent outburst of 2011. We obtained near-IR observations of T Pyx at dates ranging from $t = 2.37$ d to $t = 48.2$ d after the outburst, with the CLASSIC recombiner located at the CHARA array and with the PIONIER and AMBER recombiners located at the VLTI array. These data are supplemented with near-IR photometry and spectra obtained at Mount Abu, India. We compare expansion of the H and K band continua and the Brγ emission line, and infer information on the kinematics and morphology of the early ejecta. Slow expansion velocities were measured (≤ 300 km s^{-1}) before $t = 20$ d. From $t = 28$ d on, the AMBER and PIONIER continuum visibilities (K and H band, respectively) are best simulated with a two-component model consisting of an unresolved source plus an extended source whose expansion velocity onto the sky plane is lower than ~ 700 km s^{-1}. The expansion of the Brγ line-forming region, as inferred at $t = 28$ d and $t = 35$ d, is slightly larger, implying velocities in the range 500–800 km s^{-1}, which is still strikingly lower than the velocities of 1300–1600 km s^{-1} inferred from the Doppler width of the line. Moreover, a remarkable pattern was observed in the Brγ differential phases. A semi-quantitative model using a bipolar flow with a contrast of 2 between the pole and

equator velocities, an inclination of $i = 15°$, and a position angle $P.A. = 110°$ provides a good match to the AMBER observables. At $t = 48$ d, a PIONIER dataset confirms the two-component nature of the H band emission, consisting of an unresolved stellar source and an extended region whose appearance is circular and symmetric within error bars. These observations are most simply interpreted within the frame of a bipolar model, oriented nearly face-on. This finding has profound implications for interpreting past, current, and future observations of the expanding nebula.

Accepted for publication in A&A
Available from arXiv:1109.4534

Asteroseismology of old open clusters with *Kepler*: direct estimate of the integrated RGB mass loss in NGC 6791 and NGC 6819

A. Miglio[1], *K. Brogaard*[2], *D. Stello*[3] *and et al.*

[1]School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham B15 2TT, United Kingdom
[2]Department of Physics and Astronomy, University of Victoria, P.O. Box 3055, Victoria, BC V8W 3P6, Canada
[3]Sydney Institute for Astronomy (SIfA), School of Physics, University of Sydney, NSW 2006, Australia

Mass loss of red giant branch (RGB) stars is still poorly determined, despite its crucial role in the chemical enrichment of galaxies. Thanks to the recent detection of solar–like oscillations in G–K giants in open clusters with *Kepler*, we can now directly determine stellar masses for a statistically significant sample of stars in the old open clusters NGC 6791 and NGC 6819. The aim of this work is to constrain the integrated RGB mass loss by comparing the average mass of stars in the red clump (RC) with that of stars in the low-luminosity portion of the RGB (i.e. stars with $L \lesssim L(\mathrm{RC})$). Stellar masses were determined by combining the available seismic parameters $\Delta\nu$ and $\nu_{\max}$ with additional photometric constraints and with independent distance estimates. We measured the masses of 40 stars on the RGB and 19 in the RC of the old metal-rich cluster NGC 6791. We find that the difference between the average mass of RGB and RC stars is small, but significant ($\Delta\overline{M} = 0.09 \pm 0.03$ (random) ± 0.04 (systematic) $\mathrm{M}_{\odot}$). Interestingly, such a small $\Delta\overline{M}$ does not support scenarios of an extreme mass loss for this metal-rich cluster. If we describe the mass-loss rate with Reimers' prescription, a first comparison with isochrones suggests that the observed $\Delta\overline{M}$ is compatible with a mass-loss efficiency parameter in the range $0.1 \lesssim \eta \lesssim 0.3$. Less stringent constraints on the RGB mass-loss rate are set by the analysis of the ~ 2 Gyr-old NGC 6819, largely due to the lower mass loss expected for this cluster, and to the lack of an independent and accurate distance determination. In the near future, additional constraints from frequencies of individual pulsation modes and spectroscopic effective temperatures, will allow further stringent tests of the $\Delta\nu$ and $\nu_{\max}$ scaling relations, which provide a novel, and potentially very accurate, means of determining stellar radii and masses.

Accepted for publication in MNRAS
Available from arXiv:1109.4376

Conference Papers

Ensemble asteroseismology of red-giant stars

S. Hekker[1], *R.L. Gilliland*[2], *Sarbani Basu*[3], *J. De Ridder*[4], *W.J. Chaplin*[5] *and Y. Elsworth*[5]

[1]Astronomical Institute 'Anton Pannekoek', University of Amsterdam, Science Park 904, 1098 HX Amsterdam, The Netherlands
[2]Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA
[3]Department of Astronomy, Yale University, P.O. Box 208101, New Haven CT 06520-8101, USA
[4]Instituut voor Sterrenkunde, K.U. Leuven, Celestijnenlaan 200D, 3001 Leuven, Belgium
[5]School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK

The successful launches of the CoRoT and *Kepler* space missions have led to the detections of solar-like oscillations

in large samples of red-giant stars. The large numbers of red giants with observed oscillations make it possible to investigate the properties of the sample as a whole: ensemble asteroseismology.
In this article we summarise ensemble asteroseismology results obtained from data released by the *Kepler* Science Team (∼150 000 field stars) as presented by Hekker et al. (2011b)and for the clusters NGC 6791, NGC 6811 and NGC 6819 (Hekker et al. 2011a) and we discuss the importance of such studies.

Oral contribution, published in "61st Fujihara Seminar: Progress in solar/stellar physics with helio- and asteroseismology"
Available from arXiv:1109.0144

Investigation of three red giants observed in the CoRoT seismo field

S. Hekker[1,2], T. Morel[3], A. Mazumdar[4], F. Baudin[5], E. Poretti[6] and M. Rainer[6]

[1]Astronomical Institute 'Anton Pannekoek', University of Amsterdam, Science Park 904, 1098 HX Amsterdam, the Netherlands
[2]School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK
[3]Institut d'Astrophysique et de Géophysique, Université de Liège, Allée du 6 Août, 4000 Liège, Belgium
[4]Homi Bhabha Centre for Science Education, TIFR, V. N. Purav Marg, Mankhurd, Mumbai 400088, India
[5]Institute d'Astrophysique Spatiale, UMR 8617, Université Paris XI, Bâtiment 121, 91405 Orsay Cedex, France
[6]INAF – Osservatorio Astronomico di Brera, via E. Bianchi 46, 23807, Merate (LC), Italy

Three red giants (HD 49566 (G5III), HD 169370 (K0III) and HD 169751 (K2III)) have been observed in the CoRoT seismo field and additional ground-based spectra have been acquired. We present preliminary results of a detailed study of these stars using the observational constraints from the spectra and CoRoT data, and models from the YREC stellar evolution code.

Poster contribution, published in "The second CoRoT symposium", Marseille
Available from arXiv:1109.0148

Dynamical modeling and the interactions with the ISM

Wolfgang Steffen[1]

[1]Instituto de Astronomía, Universidad Nacional Autónoma de México, Ensenada, México

This paper is a review of some of the recent modeling efforts to improve our understanding of structure formation and evolution of planetary nebulae including their interaction with the interstellar medium. New propositions have been made for the formation mechanism of multi-polar PNe and PPNe. These mechanisms are based on the central engine with interacting binary stars or hole producing instabilities in expanding shock waves leading to illumination effects from the central star that change the appearance of the nebula. Furthermore, there has been a lot of progress in the observation and 3D modeling of the kinematics, which is key to the understanding of the dynamics. Extensive observational catalogs are coming online for the kinematics, as well as some very detailed proper motion measurements have been made. New techniques for morpho-kinematic 3D modeling help to make the interpretation of kinematic data more reliable and detailed. In addition to individual pointed observations, new surveys have lead to the discovery of many PNe that show clear signs of interaction with the interstellar medium. Systematic hydrodynamic models of the interaction have produced a general scheme for the observed structure that results from the interaction of an evolving planetary nebula with the ISM. Detailed modeling of the dust–gas dynamics during the interaction with the ISM have produced interesting predictions for future IR observations. Detailed models were worked out for the structure of the bowshock and tail of Mira that was recently discovered in the UV.

Oral contribution, published in IAU Symposium 283 "Planetary Nebulae: An Eye on the Future", eds. Manchado, Stanghellini, and Schönberner
Available from arXiv:1109.4938
and from http://www.astrosen.unam.mx/shape

Central stars of planetary nebulae: The white dwarf connection

K. Werner[1]

[1]University of Tübingen, Germany

This paper is focused on the transition phase between central stars and white dwarfs, i.e. objects in the effective temperature range 100,000 – 200,000 K. We confine our review to hydrogen-deficient stars because the common H-rich objects are subject of the paper by Ziegler et al. in these proceedings. We address the claimed iron-deficiency in PG 1159 stars and [WC] central stars. The discovery of new Ne VII and Ne VIII lines in PG 1159 stars suggests that the identification of O VII and O VIII lines that are used for spectral classification of [WCE] stars is wrong. We then present evidence for two distinct post-AGB evolutionary sequences for H-deficient stars based on abundance analyses of the He-dominated O(He) stars and the hot DO white dwarf KPD 0005+5106. Finally, we report on evidence for an H-deficient post-super AGB evolution sequence represented by the hottest known, carbon/oxygen-atmosphere white dwarf H 1504+65 and the recently discovered carbon-atmosphere "hot DQ" white dwarfs.

Oral contribution, published in IAU Symp. 283, "Planetary Nebulae: An Eye to the Future" (Invited Review)
Available from arXiv:1109.2391

Magnetic field and convection in Betelgeuse

P. Petit[1]*, M. Aurière*[1]*, R. Konstantinova-Antova*[2]*, A. Morgenthaler*[1]*, G. Perrin*[3]*, T. Roudier*[1] *and J.-F. Donati*[1]

[1]IRAP, Toulouse University & CNRS, France

[2]Institute of Astronomy, Bulgarian Academy of Science, Bulgaria

[3]Observatoire de Paris, LESIA, France

We present the outcome of a highly-sensitive search for magnetic fields on the cool supergiant Betelgeuse. A time-series of six circularly-polarized spectra was obtained using the NARVAL spectropolarimeter at Télescope Bernard Lyot (Pic du Midi Observatory), between 2010 March and April. Zeeman signatures were repeatedly detected in cross-correlation profiles, corresponding to a longitudinal component of about 1 G. The time-series unveils a smooth increase of the longitudinal field from 0.5 to 1.5 G, correlated with radial velocity fluctuations. We observe a strong asymmetry of Stokes V signatures, also varying in correlation with the radial velocity. The Stokes V line profiles are red-shifted by about 9 km s^{-1} with respect to the Stokes I profiles, suggesting that the observed magnetic elements may be concentrated in the sinking components of the convective flows.

Oral contribution, published in Lecture Notes in Physics, CNRS astronomy school : "From solar environment to stellar environment"
Available from arXiv:1109.3979

The influence of binarity on the morpho-kinematics of planetary nebulae

David Jones[1]*, Amy A. Tyndall*[2]*, Myfanwy Lloyd*[2] *and Miguel Santander-García*[3]

[1]European Southern Observatory, Chile

[2]Jodrell Bank Centre for Astrophysics, University of Manchester, UK

[3]Observatorio Astronómico Nacional, Spain

The role of central star binarity in the shaping of planetary nebulae (PNe) has been the subject of much debate, with single stars believed to be incapable of producing the most highly collimated morphologies. However, observational support for binary-induced shaping has been sadly lacking. Here, we highlight the results of a continuing programme to spatio-kinematically model the morphologies of all PNe known to contain a close binary central star. Spatio-kinematical modelling is imperative for these objects, as it circumvents the degeneracy between morphology and orientation which can adversely affect determinations of morphology based on imaging alone. Furthermore, spatio-kinematical modelling accurately determines the orientation of the nebular shell, allowing the theoretically predicted perpendicular alignment, between nebular symmetry axis and binary orbital plane, to be tested. To date, every PN subjected to this investigation has displayed the predicted alignment, indicating that binarity has played an important

role in the formation and evolution of these nebulae. The further results from this programme will be key, not only in determining whether binary interaction is responsible for shaping the studied PNe, but also in assessing the importance of binarity in the formation and evolution of all PNe in general.

Poster contribution, published in IAU Symposium No. 283, "Planetary Nebulae: An Eye to the Future"
Available from arXiv:1109.2801

Reduce, reuse, recycle: Planetary Nebulae as green Galactic citizens

K.B. Kwitter[1] *and R.B.C. Henry*[2]

[1]Williams College, USA
[2]University of Oklahoma, USA

We review gas-phase abundances in PNe and describe their dual utility as archives of original progenitor metallicity via the α elements, as well as sources of processed material from nucleosynthesis during the star's evolution, i.e., C, N, and s-process elements. We describe the analysis of PNe spectra to derive abundances and discuss the discrepancies that arise from different choices at each step. Abundance results for the Milky Way and Magellanic Clouds from various groups of investigators are presented; the observational results are compared with theoretical predictions of AGB star yields. Finally, we suggest areas where more work is needed to improve our abilities to determine abundances in PNe.

Oral contribution, published in IAU Symposium #283, "Planetary Nebulae: An Eye to the Future"
Available from arXiv:1109.2502

Abundances of disk planetary nebulae in M 31 and the radial oxygen gradient

K.B. Kwitter[1]*, E.M.M. Lehman*[1]*, B. Balick*[2] *and R.B.C. Henry*[3]

[1]Williams College, USA
[2]University of Washington, USA
[3]University of Oklahoma, USA

We have obtained spectra of 16 PNe in the disk of M 31 and determined the abundances of He, N, O, Ne, S and Ar. Here we present the median abundances and compare them with previous M 31 PN disk measurements and with PNe in the Milky Way. We also derive the radial oxygen gradient in M 31, which is shallower than that in the Milky Way, even accounting for M 31's larger disk scale length.

Poster contribution, published in IAU Symposium #283, "Planetary Nebulae: An Eye to the Future"
Available from arXiv:1109.2943

The curious conundrum regarding sulfur and oxygen abundances in planetary nebulae

R.B.C. Henry[1]*, A. Speck*[2]*, A.I. Karakas*[3] *and G.J. Ferland*[4]

[1]University of Oklahoma, USA
[2]University of Missouri, USA
[3]Mt. Stromlo Observatory, Australia
[4]University of Kentucky, USA

We carefully consider numerous explanations for the sulfur abundance anomaly in planetary nebulae. No one rationale appears to be satisfactory, and we suggest that the ultimate explanation is likely to be a heretofore unidentified feature of the nebular gas which significantly impacts the sulfur ionization correction factor.

Poster contribution, published in IAU Symposium #283, "Planetary Nebulae: An Eye to the Future"
Available from arXiv:1109.2491

A *Herschel* study of planetary nebulae

G.C. Van de Steene[1], *K.M. Exter*[2], *P.A.M. van Hoof*[1], *T.L. Lim*[3], *M.J. Barlow*[4], *M. Matsuura*[4], *T. Ueta*[5] *and MESS consortium*

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

[2]IvS, Katholieke Universiteit Leuven, Celestijnenlaan 200 D, B-3001 Leuven, Belgium

[3]Space Science and Technology Dept., Rutherford Appleton Lab., Oxfordshire OX11 0QX, UK

[4]Dept. of Physics & Astronomy, Univ. College London, Gower St., London WC1E 6BT, UK

[5]Dept. of Physics and Astronomy, Univ. of Denver, Mail Stop 6900, Denver, CO 80208, USA

We present *Herschel* PACS and SPIRE images of the dust shells around the planetary nebulae NGC 650, NGC 6853, and NGC 6720, as well as images showing the dust temperature in their shells. The latter show a rich structure, which indicates that internal extinction in the UV is important despite the highly evolved status of the nebulae.

Poster contribution, published in IAU Symposium No. 283: "Planetary Nebulae: an Eye to the Future"
Available from arXiv:1109.4219

Abundances and ADFs in PNe with WC central stars

Jorge García-Rojas [1], *Miriam Peña* [2], *Christophe Morisset*[1,2] *and Maria Teresa Ruiz*[3]

[1]Instituto de Astrofísica de Canarias, E-38200 La Laguna, Tenerife, Spain

[2]Instituto de Astronomía, Universidad Nacional Autónoma de México, Apdo. Postal 70264, Mex. D. F., 04510 México

[3]Departamento de Astronomía, Universidad de Chile, Casilla 36 D, Las Condes, Santiago, Chile

We present preliminary results obtained from the analysis of very deep echelle spectra of a dozen planetary nebulae with [WC] or weak emission lines (wels) central stars. The computed abundance discrepancy factors (ADFs) are moderate, with values lower than 4. In principle, no evidence of the H-poor metal enriched inclusions proposed by Liu et al. (2000) have been found. However, a detailed analysis of the data is in progress.

Poster contribution, published in IAU Symp. 283, "Planetary Nebulae: An Eye to the Future", eds. A. Manchado & L. Stanghellini
Available from arXiv:1109.1957

Weighing Betelgeuse: Measuring the mass of α Orionis from stellar limb-darkening

Hilding Neilson[1], *John B. Lester*[2,3] *and Xavier Haubois*[4]

[1]Argelander Institute for Astronomy, Germany

[2]University of Toronto Mississauga, Canada

[3]University of Toronto, Canada

[4]Universidade de São Paulo, Brazil

Stellar limb-darkening is an important tool for constraining the properties of a stellar atmosphere. We present a novel method for relating the fundamental stellar parameters mass and radius to limb-darkening laws using grids of spherical model stellar atmospheres. This method is applied to interferometric observations of the red supergiant Betelgeuse, where an unique measure of the stellar mass is determined.

Oral contribution, published in "The 9^{th} Pacific Rim Conference on Stellar Astrophysics", Lijiang, China, April 2011, ASPC
Available from arXiv:1109.4562

Spitzer observations of planetary nebulae

You-Hua Chu[1]

[1]Astronomy Department, University of Illinois, USA

The *Spitzer* Space Telescope has three science instruments (IRAC, MIPS, and IRS) that can take images at 3.6, 4.5, 5.8, 8.0, 24, 70, and 160 μm, spectra over 5–38 μm, and spectral energy distribution over 52–100 μm. The *Spitzer* archive contains targeted imaging observations for more than 100 PNe. *Spitzer* legacy surveys, particularly the GLIMPSE survey of the Galactic plane, contain additional serendipitous imaging observations of PNe. *Spitzer* imaging and spectroscopic observations of PNe allow us to investigate atomic/molecular line emission and dust continuum from the nebulae as well as circumstellar dust disks around the central stars. Highlights of *Spitzer* observations of PNe are reviewed in this paper.

Oral contribution, published in IAU Symposium 283, "Planetary Nebulae: An Eye to the Future", eds. Manchado, Stanghellini, and Schönberner
Available from arXiv:1109.4439

A search for Type Ia supernova progenitors: the central stars of the planetary nebulae NGC 2392 and NGC 6026

Ashkbiz Danehkar[1], *David J. Frew*[1], *Orsola De Marco*[1] *and Quentin A. Parker*[1,2]

[1]Department of Physics and Astronomy, Macquarie University, Sydney, NSW 2109, Australia
[2]Australian Astronomical Observatory, P.O. Box 296, Epping, NSW 1710, Australia

We use photoionization modeling to assess the binary nature of the central stars of NGC 2392 and NGC 6026. If they are close binaries, they are potential Type Ia supernova (SN Ia) progenitors if the total mass exceeds the Chandrasekhar limit. We show that the nucleus of NGC 2392 likely has a hot, massive ($\simeq 1$ M$_\odot$) white dwarf companion, and a total mass of ~ 1.6 M$_\odot$, making it an especially interesting system. The binary mass in NGC 6026 is less, ~ 1.1 M$_\odot$. Even though its orbital period is short, it is not considered to be a SN Ia progenitor.

Poster contribution, published in IAU Symposium 281, "Binary Paths to the Explosions of type Ia Supernovae"
Available from arXiv:1109.2181

The progenitor of a type Ia supernova with a short delay time?

Sandro Mereghetti[1], *Nicola La Palombara*[1], *Andrea Tiengo*[1,2], *Paolo Esposito*[3], *Luigi Stella*[4] *and Gianluca Israel*[4]

[1]INAF IASF-Milano, Italy
[2]IUSS Pavia, Italy
[3]INAF Osservatorio Astronomico di Cagliari, Italy
[4]INAF Osservatorio Astronomico di Roma, Italy

HD 49798/RX J0648.0−4418 is the only known X-ray binary composed of a hot subdwarf and a massive white dwarf ($M = 1.28 \pm 0.05$ M$_\odot$). This system, with an orbital period of 1.55 days, is the outcome of a common envelope evolution, most likely of a pair of stars with initial masses of about 8–10 M$_\odot$. When the hot subdwarf, currently in a He-burning phase, will expand again and fill its Roche-lobe, the enhanced mass transfer can rapidly bring the already massive white dwarf above the Chandrasekhar limit. The possible final fate, either a Type Ia supernova explosion or an accretion induced collapse, is particularly interesting in view of the high rotational velocity of this star, which has the shortest spin period (13 s) observed in a white dwarf.

Oral contribution, published in IAU Symp. 281, "Binary Paths to Type Ia Supernovae Explosions", eds. R. Di Stefano and M. Orio
Available from arXiv:1109.4573

The kinematics and binary-induced shaping of PN HaTr 4

Amy Tyndall[1], *David Jones*[2] *and Myfanwy Lloyd*[1]

[1]University of Manchester, UK

[2]European Southern Observatory, Chile

We present the first detailed spatio-kinematical analysis of the planetary nebula HaTr 4, one of a few known to contain a post-Common-Envelope central star system. Based on high spatial and spectral resolution spectroscopy of the [O III] 5006.8 Å nebular emission line, in combination with deep, narrow-band imagery, a spatio-kinematical model was developed in order to accurately determine the three-dimensional morphology and orientation of HaTr 4. The nebula is found to display an extended ovoid morphology with an equatorial enhancement consistent with a toroidal waist – a feature believed to be typical of central star binarity. The nebular inclination is found to be in good agreement with that determined for the binary plane, providing strong evidence that shaping and evolution of HaTr 4 has been influenced by its central binary system – making HaTr 4 one of only 5 planetary nebulae to have had this observationally proven.

Poster contribution, published in IAU Symposium No. 283, "Planetary Nebulae: An Eye to the Future"
Available from arXiv:1109.3098

The kinematical behavior of Galactic PNe with [WC] central star

J. S. Rechy-García[1], *M. Peña*[2] *and J. García-Rojas*[3]

[1]Fac. de Física e Inteligencia Artificial, U. Veracruzana, Xalapa, Ver., México

[2]Instituto de Astronomía, UNAM, 04510 México D.F., México

[3]Instituto de Astrofísica de Canarias, La Laguna, Tenerife, Spain

High resolution spectroscopic data of a large sample of galactic planetary nebulae with [WC] central stars ([WC]PNe) are analyzed to determine their kinematical behavior. Their heliocentric velocities have been determined with a precision better than a few km/s. Distances obtained from the literature are used to derive the peculiar velocities of the objects. Our preliminary results are: (a) The [WC]PNe are distributed in the galactic disk and they appear more concentrated than the normal PNe. (b) Separating the sample in Peimbert's types, we find that Type I PNe show in general low peculiar velocities (< 50 km s^{-1}) except for a couple of objects apparently belonging to the galactic bulge. For the other [WC]PNe, most of them belong to the Peimbert's Type II (defined as having $v_{\rm pec} \leq 60$ km s^{-1}). However there is an important fraction (28%) showing $v_{\rm pec}$ larger than 60 km s^1 therefore they are classified as Peimbert's Type III.

Poster contribution, published in IAU Symposium No. 283, 2011, eds. L. Stanghellini, A. Manchado & D. Schönberner
Available from arXiv:1109.5162

Element diffusion and accretion in metal poor stars

Sylvie Vauclair[1]

[1]IRAP, CNRS, Université Paul Sabatier, IUF, Toulouse, France

The abundances of the chemical elements observed at the surface of metal-poor stars are not directly representative of their initial values. During stellar evolution, various physical processes modify their internal composition. In the present paper, I remind the importance of atomic diffusion, and the possible effects of accretion processes which may lead to double-diffusive (thermohaline) instabilities. I discuss the consequences of these processes and compare them to current observations.

Oral contribution, published in a conference in honor of George W. Preston
Available from arXiv:1108.4985

C/O abundance ratios and dust features in Galactic planetary nebulae

G. Delgado-Inglada[1] *and M. Rodríguez*[1]

[1]Instituto Nacional de Astrofísica, Optica y Electrónica (INAOE), Apdo Postal 51 y 216, 72000 Puebla, México

The iron depletion factors found in Galactic planetary nebulae (PNe) span over two orders of magnitude, suggesting that there are differences in the grain formation and destruction processes from object to object. We explore here the relation between the iron depletions, the infrared dust features, and the C/O abundance ratios in a sample of Galactic PNe. We find that those objects with C/O < 1 show a trend of increasing depletions for higher values of C/O, whereas PNe with C/O > 1 break the trend and cover all the range of depletions. Most of the PNe with C/O < 1 show silicate features, but several PNe with C-rich features have C/O < 1, probably reflecting the uncertainties associated with the derivation of C/O. PAHs are distributed over the entire range of iron depletions and C/O values.

Poster contribution, published in "Planetary Nebulae: An Eye to the Future", IAU Symp. 283, eds. A. Manchado, L. Stanghellini & D. Schönberner
Available from arXiv:1109.1867

Chlorine and sulfur in nearby planetary nebulae and H II regions

Mónica Rodríguez[1] *and Gloria Delgado-Inglada*[1]

[1]INAOE, México

We derive the chlorine abundances in a sample of nearby planetary nebulae (PNe) and H II regions that have some of the best available spectra. We use a nearly homogeneous procedure to derive the abundance in each object and find that the Cl/H abundance ratio shows similar values in H II regions and PNe. This supports our previous interpretation that the underabundance we found for oxygen in the H II regions is due to the depletion of their oxygen atoms into organic refractory dust components. For other elements, the bias introduced by ionization correction factors in their derived abundances can be very important, as we illustrate here for sulfur using photoionization models. Even for low-ionization PNe, the derived sulfur abundances can be lower than the real ones by up to 0.3 dex, and the differences found with the abundances derived for H II regions that have similar S/H can reach 0.4 dex.

Poster contribution, published in IAU Symposium No. 283, "Planetary Nebulae: an Eye to the Future"
Available from arXiv:1109.1861

The core-degenerate scenario for type Ia supernovae

Noam Soker[1]

[1]Technion, Israel

In the core-degenerate (CD) scenario for the formation of Type Ia supernovae (SNe) the Chandrasekhar or super-Chandrasekhar mass white dwarf (WD) is formed at the termination of the common envelope phase or during the planetary nebula phase, from a merger of a WD companion with the hot core of a massive asymptotic giant branch (AGB) star. The WD is destructed and accreted onto the more massive core. In the CD scenario the rapidly rotating WD is formed shortly after the stellar formation episode, and the delay from stellar formation to explosion is basically determined by the spin-down time of the rapidly rotating merger remnant. The spin-down is due to the magneto-dipole radiation torque. Several properties of the CD scenario make it attractive compared with the double-degenerate (DD) scenario. (1) Off-center ignition of carbon during the merger process is not likely to occur. (2) No large envelope is formed. Hence avoiding too much mass loss that might bring the merger remnant below the critical mass. (3) This model explains the finding that more luminous SNe Ia occur preferentially in star forming galaxies.

Oral contribution, published in IAU Symp. 281, "Binary Paths to Type Ia Supernovae Explosions", eds. R. Di Stefano & M. Orio
Available from arXiv:1109.4652

The long-term spectroscopic misadventures of AG Dra with a nod toward V407 Cyg: Degenerates behaving badly

S.N. Shore[1], *K. Genovali*[1,2] *and G.M. Wahlgren*[3,4]

[1]Dipart. di Fisica "Enrico Fermi" Univ. di Pisa, INFN–Sezione di Pisa largo B. Pontecorvo 3, Pisa 56127, Italia; shore@df.unipi.it

[2]Dipart. di Fisica, Univ. di Roma Tor Vergata, Via della Ricerca Scientifica 1, I-00133, Roma Italia

[3]Dept. of Physics, Catholic University of America, 620 Michigan Ave., N.E., Washington, DC 20064, USA

[4]NASA Goddard Space Flight Center, Code 667, Greenbelt, MD 20771, USA

We present some results of an ongoing study of the long-term spectroscopic variations of AG Dra, a prototypical eruptive symbiotic system. We discuss the effects of the environment and orbital modulation in this system and some of the physical processes revealed by a comparison with the nova outburst of the symbiotic-like recurrent nova V407 Cyg 2010.

Oral contribution, published in the 2011 Asiago Workshop on Symbiotic Stars. Baltic Astronomy
Available from arXiv:1109.5397

An H I 21-cm line survey of evolved stars

E. Gérard[1], *T. Le Bertre*[1] *and Y. Libert*[2]

[1]Observatoire de Paris, France

[2]IRAM, France

The H I line at 21 cm is a tracer of circumstellar matter around AGB stars, and especially of the matter located at large distances (0.1–1 pc) from the central stars. It can give unique information on the kinematics and on the physical conditions in the outer parts of circumstellar shells and in the regions where stellar matter is injected into the interstellar medium. However this tracer has not been much used up to now, due to the difficulty of separating the genuine circumstellar emission from the interstellar one.
With the Nançay Radiotelescope we are carrying out a survey of the H I emission in a large sample of evolved stars. We report on recent progresses of this long term programme, with emphasis on S-type stars.

Poster contribution, published in the annual meeting (2011) of the French Astronomical Society (Société Française d'Astronomie et d'Astrophysique, SF2A)
Available from arXiv:1109.5536

The ionization state of the Halo planetary nebula NGC 2438

Silvia Dalnodar[1]

[1]Institute of Astro- and Particle Physics , Leopold Franzens Universität Innsbruck, Austria

NGC 2438 is a classical multiple shell or halo planetary nebula (PN). Its central star and the main nebula are well studied. Also it was target of various hydrodynamic simulations (Corradi et al. 2000). This initiated a discussion whether the haloes are mainly containing recombined gas (Schönberner et al. 2002), or if they are still ionized (Armsdorfer et al. 2003). An analysis of narrow-band images and long slit spectra at multiple slit positions was done to obtain a deeper look on morphological details and the properties of the outer shell and halo. For this work there was data available from ESO (direct imaging and long slit spectroscopy) and from SAAO (spectroscopic observations using a small slit - scanning over the whole nebula). Using temperature measurements from emission lines resulted in an electron temperature which clearly indicates a fully ionized stage. Additionally measurements of the electron density suggest a variation of the filling factor.

Poster contribution, published in IAU Symposium 283: "Planetary Nebulae: An Eye to the Future", eds. A. Manchado, L. Stanghellini & D. Schönberner
Available from arXiv:1109.5609

Planetary nebulae and the chemical evolution of the galactic bulge: new abundances of older objects

O. Cavichia[1], *R.D.D. Costa*[1], *M. Molla*[2] *and W.J. Maciel*[1]

[1]IAG, University of São Paulo, 05508-900, São Paulo-SP, Brazil

[2]CIEMAT, Universidad Complutense de Madrid, Spain

In view of their nature, planetary nebulae have very short lifetimes, and the chemical abundances derived so far have a natural bias favoring younger objects. In this work, we report physical parameters and abundances for a sample of old PNe located in the galactic bulge, based on low dispersion spectroscopy secured at the SOAR telescope using the *Goodman* Spectrograph. The new data allow us to extend our database including older, weaker objects that are at the faint end of the planetary nebula luminosity function (PNLF). The results show that the abundances of our sample are lower than those from our previous work. Additionally, the average abundances of the galactic bulge do not follow the observed trend of the radial abundance gradient in the disk. These results are in agreement with a chemical evolution model for the Galaxy recently developed by our group.

Poster contribution, published in IAU Symposium 283: "Planetary Nebulae: An Eye to the Future", eds. A. Manchado, L. Stanghellini & D. Schönberner
Available from arXiv:1109.5910

Connecting RS Oph to [some] type Ia supernovae

F. Patat[1]

[1]European Southern Observatory, Germany

In this review I summarize the observational attempts done so far to unveil the nature of the progenitor system/s of type Ia supernovae. In particular, I focus on the most recent developments that followed the alleged detection of circumstellar material around a few events, and on the link this possibly establishes with recurrent novae. In this framework, I then discuss the case of RS Oph, what we know of its circumstellar environment, and what this is telling us about its supposed connection to Type Ia supernova explosions.

Oral contribution, published in "Binary paths to Type Ia Supernova Explosions", IAUS 281, eds. R. Di Stefano & M. Orio
Available from arXiv:1109.5799

Job Adverts

Chalmers University of Technology / Onsala Space Observatory, Sweden Postdoc in evolved star, massive star formation and/or magnetic fields

Applications are invited for a postdoctoral position in the study of evolved stars, star formation and/or magnetic fields at the Department of Earth and Space Science, Chalmers University of technology, Sweden. The starting date of the position will be as soon as possible and preferably in January 2012.

The postdoctoral project will focus on radio, millimeter and/or sub-millimeter wavelength observations of evolved stars or star forming regions with instruments such as ALMA, EVLA, eMERLIN, APEX, the SMA and IRAM PdB. He/she will also carry out his/her own research in collaboration with affiliated group members, which includes a number of PhD students.

The successful candidate will join a research group with close ties to the Nordic ALMA Regional Center (ARC) node. He/she will also have access to advanced radiative transfer modeling tools and the possibility to develop MHD simulations. The successful applicant will work mainly at Onsala Space Observatory, where Chalmers hosts the Swedish National Facility for Radio Astronomy.

Interested applicants should have a PhD in astrophysics by the start of the appointment. Applicants should send a CV, description of research interests and a publication list. They should also include the addresses of two reference persons who can be contacted by Chalmers.

The applications deadline is 7 November 2011.
Applications should be submitted via the listed URL.

For further information contact:
Wouter Vlemmings
(wouter.vlemmings@chalmers.se)

Onsala Space Observatory
SE-439 92 Onsala
Sweden

Tel: +46 31 7725509
Fax: +46 31 7725590

See also https://site1.reachmee.com/I003/chalmers/ENG/
vacdetail.aspx?commadseqno=132&postback%20=%20vacancies.aspx

Cornell University, USA
Research Associate

The *Spitzer* Infrared Spectograph Science Team at Cornell University invites applications for a post-doctoral fellowship to collaborate with Dr. Greg Sloan on an NSF-funded research program entitled "An ALMA Reconnaissance of Distant Dying Stars." By studying the evolved stellar populations in Galactic globular clusters and nearby Local Group galaxies, this program will investigate the broader question of how evolved stars lose mass and enrich the heavy-element abundances in their host galaxies. It will also help address the unsolved problem of what drives the mass-loss process. The successful candidate will join the IRS Science Team and have access to all data products generated as part of the Team's ongoing efforts to support the IRS.

This position will provide a choice of challenges in a wide-ranging project. Components include (1) optical and near-infrared imaging to characterize the evolved stellar populations in targeted systems, (2) ALMA observations to measure the mass-loss properties of individual stars, (3) synthesizing the results with existing infrared spectroscopic databases, (4) the planning of future infrared spectroscopy, and (5) ongoing technical support of IRS data at Cornell.

We are interested in innovative individuals who are well prepared for a multi-wavelength approach to observational astronomy. The candidate should also have experience with IDL, Python, and Linux platforms, or the demonstrated ability to learn these skills. They should be able to work well on group activities and have the desire to contribute to the scientific end products. A Ph.D. in astronomy, physics, or a closely related field is required. The appointment will initially be for one year, renewable for a second. Competitive salary will depend on experience.

To apply, please send a copy of your *curriculum vitae*, research interests and the names of three individuals who are willing to write reference letters to Ms. Laurie McCall, Cornell University, 228 Space Sciences Building, Ithaca, NY 14853, USA. Applications via email to 1m19@cornell.edu are encouraged. For full consideration, applications should be received by December 15, 2011, but they will be accepted until the position is filled. The appointment will begin on July 1, 2012. Cornell University is an Equal Opportunity/Affirmative Action Employer.

Announcements

Astrophysics at Extremely High Angular Resolution: Optical and Infrared Interferometry

We'd like to announce a one day RAS Specialist Discussion meeting on

Astrophysics at Extremely High Angular Resolution:
Optical and Infrared Interferometry
Fri, 11 November, 10:30 – 15:30
The Geological Society, Burlington House, LONDON, W1J 0BG

The new century has seen a quantum leap in the field of optical and infrared long-baseline interferometry, with facilities such as the CHARA and VLTI arrays now routinely producing images with milliarcsecond resolution. As a result, over the past ten years, ground-based optical/IR interfometry has transitioned to become a mainstream, common-user, technique offering unprecedented insights into a wide range of astrophysical phenomena. These include asteroseismology, YSO accretion, photosphere dynamics, exoplanet characterization, and the structure of AGN cores.

This meeting will bring together experts and novices in the field to present their latest scientific results, and to highlight the existing and upcoming capabilities at facility class arrays such as the VLTI. We hope to attract not only attendees who are excited by the possibilities that interferometric methods can bring to their research, but also those who wish to find out more and assess the investment of their time needed to best exploit the UK's access to European and American interferometric arrays.

You can find more information, including a preliminary program on http://www.ast.leeds.ac.uk/ roud/rasmeet2012.htm

Rene Oudmaijer (Leeds) roud⟨at⟩ast.leeds.ac.uk
Ettore Pedretti (St Andrews, ESO) ep41⟨at⟩st-and.ac.uk
Chris Haniff (Cambridge) cahm⟨at⟩rao.cam.ac.uk

See also http://www.ast.leeds.ac.uk/∼roud/rasmeet2012.htm

The FRUITY Database on AGB nucleosynthesis

We announce the creation of the FRUITY (Franec Repository of Upgraded Isotopic Tables & Yields) database dedicated to AGB stars nucleosynthesis. Its electronic platform is hosted at the web pages of the Teramo Observatory (INAF): www.oa-teramo.inaf.it/fruity. FRUITY contains nucleosynthesis features of our AGB theoretical models, directly calculated with a full nuclear network (from H to Pb). Surface elements enhancements ([El/Fe]) and isotopic compositions after First dredge Up and after each Third Dredge Up episode are available. Moreover, net yields can be downloaded. The database currently contains models with masses $1.5 \leq M/\mathrm{M}_{\odot} \leq 3.0$ and metallicities $10^{-3} \leq Z \leq 0.02$ (Cristallo et al. ApJS in press, arXiv:1109.1176) and it will be expandend soon with very low metallicity models ($Z \leq 10^{-4}$) and Intermediate Mass Stars models ($M \geq 5$ M$_{\odot}$). People interested in receiving infos on FRUITY upgrades and implementations can register to the FRUITY mailing list by filling all the requested fields (name, insitution and e-mail address) in the dedicated window on the database home page.

Sergio Cristallo on behalf of the FRUITY Collaboration

Message from the President of IAU Commission 35

Dear colleagues and members of IAU Commission 35:

The IAU General Secretary, Ian Corbett, has called for contributions from the various Divisions, Commissions, Working Groups, Program Groups, for the triennial IAU Transactions XXVIIIA, Reports on Astronomy 2009–2012. This will be an important document for the preparation of IAU GA2012 in Beijing, and a permanent record for posterity.

In order to help us prepare the contribution from Commission 35 (Stellar Constitution), we ask you to identify important scientific results that appeared over the past three years in the field of stellar structure and evolution.

Please send your input on these highlights (a few sentences describing the key points together with the relevant references) at your earliest convenience, and in any case before October 11, to Corinne.Charbonnel@unige.ch and leitherer@stsci.edu.

Looking forward to receiving your contribution,

Corinne Charbonnel, President of IAU C35