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Editors: Jacco van Loon, Ambra Nanni and Albert Zijlstra

Editorial

Dear Colleagues,

It is our pleasure to present you the 209th issue of the AGB Newsletter.

We congratulate Ashkibiz Danehkar on his Ph.D. thesis and we wish him all the best in his future career.

Last month’s Food for Thought provoked a couple of reactions. Marian Martínez González’s favourite (celestial) object is the planetary nebula Abell 39 because, as she puts it: "It is just simply beautiful. It has this kind of plain, magnificent beauty that attracts my attention, the same as an Yves Klein art work." We cannot disagree with that. On the other hand, Sakib Rasool found it hard to choose: "It is impossible to have a favourite PN as all of them possess a unique character and sense of identity that [together] form a beautiful community of Galactic stardeath." We can hardly disagree with that either.

The next issue is planned to be distributed around the 3rd of January, 2015. With the Season’s Greetings and a Peaceful start of the New Year,

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

Food for Thought

This month’s thought-provoking statement is:

Do AGB stars enrich or pollute the galaxies they inhabit?

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)
On the numerical treatment and dependence of thermohaline mixing in red giants

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In recent years much interest has been shown in the process of thermohaline mixing in red giants. In low and intermediate mass stars this mechanism first activates at the position of the bump in the luminosity function, and has been identified as a likely candidate for driving the slow mixing inferred to occur in these stars. One particularly important consequence of this process, which is driven by a molecular weight inversion, is the destruction of lithium. We show that the degree of lithium destruction, or in some cases production, is extremely sensitive to the numerical details of the stellar models. Within the standard 1D diffusion approximation to thermohaline mixing, we find that different evolution codes, with their default numerical schemes, can produce lithium abundances that differ from one another by many orders of magnitude. This disagreement is worse for faster mixing. We perform experiments with four independent stellar evolution codes, and derive conditions for the spatial and temporal resolution required for a converged numerical solution. The results are extremely sensitive to the timesteps used. We find that predicted lithium abundances published in the literature until now should be treated with caution.

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Internal proper-motions in the Eskimo Nebula

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We present measurements of internal proper motions at more than five hundred positions of NGC 2392, the Eskimo Nebula, based on images acquired with WFPC2 on board the Hubble Space Telescope at two epochs separated by 7.695 years. Comparison of the two observations shows clearly the expansion of the nebula. We measured the amplitude and direction of the motion of local structures in the nebula by determining their relative shift during that interval. In order to assess the potential uncertainties in the determination of proper motions in this object, and in general, the measurements were performed using two different methods, used previously in the literature. We compare the results from the two methods, and to perform the scientific analysis of the results we choose one, the cross-correlation method, as the more reliable. We go on to perform a "criss-cross" mapping analysis on the proper motion vectors which helps in the interpretation of the velocity pattern. Combining our results on the proper motions with radial velocity measurements obtained from high resolution spectroscopic observations, and employing an existing 3D model, we estimate the distance to the nebula as 1300 pc.

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Discovery of time variation of the intensity of molecular lines in IRC +10°216 in the submillimeter and far infrared domains

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We report on the discovery of strong intensity variations in the high rotational lines of abundant molecular species towards the archetypical circumstellar envelope of IRC +10°216. The observations have been carried out with the HIFI instrument on board Herschel and with the IRAM 30-m telescope. They cover several observing periods spreading over 3 years. The line intensity variations for molecules produced in the external layers of the envelope most probably result from time variations in the infrared pumping rates. We analyze the main implications this discovery has on the interpretation of molecular line emission in the envelopes of Mira-type stars. Radiative transfer calculations have to take into account both the time variability of infrared pumping and the possible variation of the dust and gas temperatures with stellar phase in order to reproduce the observation of molecular lines at different epochs. The effect of gas temperature variations with stellar phase could be particularly important for lines produced in the innermost regions of the envelope. Each layer of the circumstellar envelope sees the stellar light radiation with a different lag time (phase). Our results show that this effect must be included in the models. The sub-mm and FIR lines of AGB stars cannot anymore be considered as safe intensity calibrators.

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Near-infrared spectroscopy of candidate red supergiant stars in clusters

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Clear identifications of Galactic young stellar clusters farther than a few kpc from the Sun are rare, despite the large number of candidate clusters. We aim to improve the selection of candidate clusters rich in massive stars with a multiwavelength analysis of photometric Galactic data that range from optical to mid-infrared wavelengths. We present a photometric and spectroscopic analysis of five candidate stellar clusters, which were selected as over-densities with bright stars (K_s < 7 mag) in GLIMPSE and 2MASS images. A total of 48 infrared spectra were obtained. The combination of photometry and spectroscopy yielded six new red supergiant stars with masses from 10 M_☉ to 15 M_☉. Two red supergiants are located at Galactic coordinates (l, b) = (16°7, −0°63) and at a distance of about ~ 3.9 kpc;
four other red supergiants are members of a cluster at Galactic coordinates \((l, b) = (49\degree3, +072\degree)\) and at a distance of \(\sim 7.0\) kpc. Spectroscopic analysis of the brightest stars of detected overdensities and studies of interstellar extinction along their line of sights are fundamental to distinguish regions of low extinction from actual stellar clusters. The census of young star clusters containing red supergiants is incomplete; in the existing all-sky near-infrared surveys, they can be identified as overdensities of bright stars with infrared color–magnitude diagrams characterized by gaps.

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**A Spitzer Space Telescope survey of extreme Asymptotic Giant Branch stars in M32**

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We investigate the population of cool, evolved stars in the Local Group dwarf elliptical galaxy M 32, using Infrared Array Camera observations from the *Spitzer* Space Telescope. We construct deep mid-infrared colour–magnitude diagrams for the resolved stellar populations within 3'5 of M 32's centre, and identify those stars that exhibit infrared excess. Our data is dominated by a population of luminous, dust-creating stars on the asymptotic giant branch (AGB) and extend to approximately 3 mag below the AGB tip. We detect for the first time a sizeable population of ‘extreme’ AGB stars, highly enshrouded by circumstellar dust and likely completely obscured at optical wavelengths. The total dust-injection rate from the extreme AGB candidates is measured to be \(7.5 \times 10^{-7}\) M\(_\odot\) yr\(^{-1}\), corresponding to a gas mass-loss rate of \(1.5 \times 10^{-4}\) M\(_\odot\) yr\(^{-1}\). These extreme stars may be indicative of an extended star-formation epoch between 0.2 and 5 Gyr ago.

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**Sulfur-bearing species in molecular clouds**

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We study several molecules that could help in the solution of the missing sulfur problem in dense clouds and circumstellar regions, as well as in the clarification of the sulfur chemistry in comets. These sulfur molecules are: the trimer (CH\(_3\)S)\(_3\) and the tetramer (CH\(_3\)S)\(_4\) of thioformaldehyde, pentathian S\(_5\)CH\(_2\), hexathiepan S\(_6\)CH\(_2\), thiurane C\(_2\)H\(_4\)S, trisulfane HSSSH, and thionocetone (CH\(_3\))\(_2\)CS. Infrared spectra of these species are calculated using density functional theory methods. The majority of calculated bands belong to the mid-infrared, with some of them occurring in the near and far-infrared region. We suggest that some of unidentified spectral features measured by Infrared Space Observatory in several active galactic nuclei and starburst galaxies could be caused by 1,3,5-trithiane ((CH\(_2\)S)\(_3\)), 1,3,5,7-tetraethiokane ((CH\(_2\)S)\(_4\)), and thiurane (C\(_2\)H\(_4\)S). The objects whose unidentified infrared features we compare with calculated bands are: NGC 253, M82, NGC 1068, Circinus, Arp 220, 30 Doradus, Orion KL, and Sgr B2.

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Pulsations of red supergiant pair-instability supernova progenitors leading to extreme mass loss

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Recent stellar evolution models show consistently that very massive metal-free stars evolve into red supergiants shortly before they explode. We argue that the envelopes of these stars, which will form pair-instability supernovae, become pulsationally unstable and that this will lead to extreme mass-loss rates despite the tiny metal content of the envelopes. We investigate the pulsational properties of such models and derive pulsationally induced mass-loss rates, which take the damping effects of the mass loss on the pulsations self-consistently into account. We find that the pulsations may induce mass-loss rates of \( \sim 10^{-4} - 10^{-2} \, M_{\odot} \, \text{yr}^{-1} \) shortly before the explosions, which may create a dense circumstellar medium. Our results show that very massive stars with dense circumstellar media may stem from a wider initial mass range than pulsational-pair instability supernovae. The extreme mass loss will cease when so much of the hydrogen-rich envelope is lost that the star becomes more compact and stops pulsating. The helium core of these stars therefore remains unaffected, and their fate as pair-instability supernovae remains unaltered. The existence of dense circumstellar media around metal-free pair-instability supernovae can make them brighter and bluer, and they may be easier to detect at high redshifts than previously expected. We argue that the mass-loss enhancement in pair-instability supernova progenitors can naturally explain some observational properties of superluminous supernovae: the energetic explosions of stars within hydrogen-rich dense circumstellar media with little \(^{56}\text{Ni}\) production and the lack of a hydrogen-rich envelope in pair-instability supernova candidates with large \(^{56}\text{Ni}\) production.

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Mass transfer from giant donors

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The stability of mass transfer in binaries with convective giant donors remains an open question in modern astrophysics. There is a significant discrepancy between what the existing methods predict for a response to mass loss of the giant itself, as well as for the mass transfer rate during the Roche lobe overflow. Here we show that the recombination energy in the superadiabatic layer plays an important and hitherto unaccounted-for role in the donor’s response to mass loss, in particular on its luminosity and effective temperature. Our improved optically thick nozzle method to calculate the mass transfer rate via \( L_1 \) allows us to evolve binary systems for a substantial Roche lobe overflow. We propose a new, strengthened criterion for the mass transfer instability, basing it on whether the donor experiences overflow through its outer Lagrangian point. We find that with the new criterion, if the donor has a well-developed outer convective envelope, the critical initial mass ratio for which a binary would evolve stably through the conservative mass transfer varies from 1.5 to 2.2, which is about twice as large as previously believed. In underdeveloped giants with shallow convective envelopes this critical ratio may be even larger. When the convective envelope is still growing, and in particular for most cases of massive donors, the critical mass ratio gradually decreases to this value, from that of radiative donors.

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Close stellar binary systems by grazing envelope evolution

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I suggest a spiral-in process by which a stellar companion graze the envelope of a giant star while both the orbital
separation and the giant radius shrink simultaneously, and a close binary system is formed. The binary system might be viewed as evolving in a constant state of ‘just entering a common envelope (CE) phase’. In cases where this process takes place it can be an alternative to the CE evolution where the secondary star is immersed in the giant’s envelope. The grazing envelope evolution (GEE) is made possible only if the companion manages to accreted mass at a high rate and launch jets that remove the outskirts of the giant envelope, hence preventing the formation of a CE. The high accretion rate is made possible by the accretion disk that launches jets that efficiently carry the excess angular momentum and energy from the accreted mass. Mass loss through the second Lagrangian point can carry additional angular momentum and envelope mass. The GEE lasts for tens to hundreds of years. The high accretion rate with peaks lasting months to years might lead to a bright object termed intermediate luminosity optical transient [ILOT; Red Novae; Red Transients]. A bipolar nebula and/or equatorial ring are formed around the binary remnant.

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Spectral variability of the IR-source IRAS 01005+7910 optical component
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High-resolution optical spectra of the IR source IRAS01005+7910 are used to determine the spectral type of its central star, B1.5±0.3, identify the spectral features, and analyze their profile and radial-velocity variations. The systemic velocity $v_{sys} = -50.5$ km s$^{-1}$ is determined from the positions of the symmetric and stable profiles of the forbidden [Nii], [Nii], [Oii], [Sii], and [Feii] emission lines. The presence of the [Nii] and [Sii] forbidden emissions indicates the onset of the ionization of the circumstellar envelope and the fact that the star is very close to undergoing the planetary nebula stage. The broad range of radial velocity $v_r$ estimates based on the line cores, which amounts to about 34 km s$^{-1}$, is partly due to the deformations of the profiles caused by variable emissions. The variations of the $v_r$ in the line wings are smaller, about 23 km s$^{-1}$, and may be due to pulsations and/or hidden binarity of the star. The deformations of the profiles of absorption–emission lines may result from variations of their absorption components caused by the variations of the geometry and kinematics in the wind base. The Hα lines exhibit P Cyg III type wind profiles. Deviations of the wind from spherical symmetry are shown to be small. The relatively low wind velocity (27–74 km s$^{-1}$ from different observations) and the strong intensity of the red emission (it exceeds the continuum level by up to a factor of seven) are typical for hypergiants rather than the classical supergiants. IRAS01005+7910 is an example of spectral mimicry of a low-mass post-AGB star masquerading as a massive hypergiant.

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The born-again planetary nebula A78: An X-ray twin of A 30
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We present the XMM-Newton discovery of X-ray emission from the planetary nebula (PN) A 78, the second born-again PN detected in X-rays apart from A 30. These two PNe share similar spectral and morphological characteristics. They harbor diffuse soft X-ray emission associated with the interaction between the H-poor ejecta and the current fast stellar wind, and a point-like source at the position of the central star (CSPN). We present the spectral analysis of the CSPN, using for the first time a NLTE code for expanding atmospheres which takes line blanketing into account for the UV and optical spectra. The wind abundances are used for the X-ray spectral analysis of the CSPN and the
diffuse emission. The X-ray emission from the CSPN in A 78 can be modeled by a single C CVI emission line, while the X-ray emission from its diffuse component is better described by an optically thin plasma emission model with temperature $kT = 0.088$ keV ($T \approx 1.0 \times 10^6$ K). We estimate X-ray luminosities in the $0.2-2.0$ keV energy band of $L_{X,\text{CSPN}} = (1.2 \pm 0.3) \times 10^{31}$ erg s$^{-1}$ and $L_{X,\text{DIFF}} = 9.2 \pm 2.3) \times 10^{30}$ erg s$^{-1}$ for the CSPN and diffuse components, respectively.

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Searching for variable stars in the cores of five metal-rich globular clusters using EMCCD observations

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In this paper, we present the analysis of time-series observations from 2013 and 2014 of five metal-rich ([Fe/H] > $-1$) globular clusters: NGC 6388, NGC 6441, NGC 6528, NGC 6638, and NGC 6652. The data have been used to perform a census of the variable stars in the central parts of these clusters. The observations were made with the electron-multiplying CCD (EMCCD) camera at the Danish 1.54m Telescope at La Silla, Chile, and they were analysed using difference image analysis (DIA) to obtain high-precision light curves of the variable stars. It was possible to identify and classify all of the previously known or suspected variable stars in the central regions of the five clusters. Furthermore, we were able to identify and, in most cases, classify 48, 49, 7, 8, and 2 previously unknown variables in NGC 6388, NGC 6441, NGC 6528, NGC 6638, and NGC 6652, respectively. Especially interesting is the case of NGC 6441, for which the variable star population of about 150 stars has been thoroughly examined by previous studies, including a Hubble Space Telescope study. In this paper we are able to present 49 new variable stars for this cluster, of which one (possibly two) are RR Lyrae stars, two are W Virginis stars, and the rest are long-period semi-regular or irregular variables on the red giant branch. We have also detected the first double-mode RR Lyrae in the cluster.

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Variability and possible rapid evolution of the hot post-AGB stars

Hen 3-1347, Hen 3-1428, and LSS 4634

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We present the results of spectroscopic and photometric observations for three hot southern-hemisphere post-AGB objects, Hen 3-1347 − IRAS 17074−1845, Hen 3-1428 − IRAS 17311−4924, and LSS 4634 − IRAS 18023−3409. In the spectrograms taken with the 1.9-m telescope of the South African Astronomical Observatory (SAAO) in 2012, we have measured the equivalent widths of the most prominent spectral lines. Comparison of the new data with those published previously points to a change in the spectra of Hen 3-1428 and LSS 4634 in the last 20 years. Based on ASAS data, we have detected rapid photometric variability in all three stars with an amplitude up to 0.3-0.4 mag in the V
band. A similarity between the patterns of variability for the sample stars and other hot protoplanetary nebulae is pointed out. We present the results of $UBV$ observations for Hen 3-1347, according to which the star undergoes rapid irregular brightness variations with maximum amplitudes $\Delta V = 0.25$ mag, $\Delta B = 0.25$ mag, and $\Delta U = 0.30$ mag and shows color-magnitude correlations. Based on archival data, we have traced the photometric history of the stars over more than 100 years. Hen 3-1347 and LSS 4634 have exhibited a significant fading on a long time scale. The revealed brightness and spectrum variations in the stars, along with evidence for their enhanced mass, may be indicative of their rapid post-AGB evolution.

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**Evolution of the central stars of young planetary nebulae**

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The evolution of central stars of planetary nebulae was so far documented in just a few cases. However, spectra collected a few decades ago may provide a good reference for studying the evolution of central stars using the emission line fluxes of their nebulae. We investigated evolutionary changes of the $[\text{O} \text{III}]$ 5007 Å line flux in the spectra of planetary nebulae. We compared nebular fluxes collected during a decade or longer. We used literature data and newly obtained spectra. A grid of Cloudy models was computed using existing evolutionary models, and the models were compared with the observations.

An increase of the $[\text{O} \text{III}]$ 5007 Å line flux is frequently observed in young planetary nebulae hosting H-rich central stars. The increasing nebular excitation is the response to the increasing temperature and hardening radiation of the central stars. We did not observe any changes in the nebular fluxes in the planetary nebulae hosting late-type Wolf-Rayet (WR) central stars. This may indicate a slower temperature evolution (which may stem from a different evolutionary status) of late-[WR] stars. The observed evolution of H-rich central stars is consistent with the predictions of the evolutionary models provided in the literature. Late-[WR] stars possibly follow a different evolutionary path.

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**SHAPEMOL: a 3-D code for calculating CO line emission in planetary and protoplanetary nebulae. Detailed model-fitting of the complex nebula NGC 6302**

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Modern instrumentation in radioastronomy constitutes a valuable tool for studying the Universe: ALMA has reached unprecedented sensitivities and spatial resolution, while Herschel/HIFI has opened a new window (most of the sub-mm and far-infrared ranges are only accessible from space) for probing molecular warm gas ($\sim$ 50–1000 K). On the other hand, the software SHAPE has emerged in the past few years as a standard tool for determining the morphology and velocity field of different kinds of gaseous emission nebula via spatio-kinematical modelling. Standard SHAPE implements radiative transfer solving, but it is only available for atomic species and not for molecules. Being aware of the growing importance of the development of tools for simplifying the analyses of molecular data from new-era observatories, we introduce the computer code SHAPEMOL, a complement to SHAPE, with which we intend to fill the
so far under-developed molecular niche. SHAPEMOL enables user-friendly, spatio-kinematic modelling with accurate non-LTE calculations of excitation and radiative transfer in CO lines. Currently, it allows radiative transfer solving in the $^{12}$CO and $^{13}$CO $J = 1-0$ to $J = 17-16$ lines, but its implementation permits easily extending the code to different transitions and other molecular species, either by the code developers or by the user. Used along SHAPE, SHAPEMOL allows easily generating synthetic maps to test against interferometric observations, as well as synthetic line profiles to match single-dish observations. We give a full description of how SHAPEMOL works, and we discuss its limitations and the sources of uncertainty to be expected in the final synthetic profiles or maps. As an example of the power and versatility of SHAPEMOL, we build a model of the molecular envelope of the planetary nebula NGC 6302 and compare it with $^{12}$CO and $^{13}$CO $J = 2-1$ interferometric maps from SMA and high-J transitions from Herschel/HIFI. We find the molecular envelope to have a complex, broken ring-like structure with an inner, hotter region and several ‘fingers’ and high-velocity blobs, emerging outwards from the plane of the ring. We derive a mass of 0.11 $M_\odot$ for the molecular envelope.

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Mixed modes in red giants: a window on stellar evolution

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Context: The detection of oscillations with a mixed character in subgiants and red giants allows us to probe the physical conditions in their cores.

Aims: With these mixed modes, we aim at determining seismic markers of stellar evolution.

Methods: Kepler asteroseismic data were selected to map various evolutionary stages and stellar masses. Seismic evolutionary tracks were then drawn with the combination of the frequency and period spacings.

Results: We measured the asymptotic period spacing for more than 1170 stars at various evolutionary stages. This allows us to monitor stellar evolution from the main sequence to the asymptotic giant branch and draw seismic evolutionary tracks. We present clear quantified asteroseismic definitions that characterize the change in the evolutionary stages, in particular the transition from the subgiant stage to the early red giant branch, and the end of the horizontal branch.

Conclusions: The seismic information is so precise that clear conclusions can be drawn independently of evolution models. The quantitative seismic information can now be used for stellar modeling, especially for studying the energy transport in the helium-burning core or for specifying the inner properties of stars entering the red or asymptotic giant branches. Modeling will also allow us to study stars that are identified to be in the helium-subflash stage, high-mass stars either arriving or quitting the secondary clump, or stars that could be in the blue-loop stage.

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Analysis of cool DO-type white dwarfs from the Sloan Digital Sky Survey Data Release 10

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We report on the identification of 22 new cool DO-type white dwarfs (WD) detected in Data Release 10 (DR10) of the Sloan Digital Sky Survey (SDSS). Among them, we found one more member of the so-called hot-wind DO WDs,
which show ultralight excitation absorption lines. Our non-LTE model atmosphere analyses of these objects and two not previously analyzed hot-wind DO WDs, revealed effective temperatures and gravities in the ranges $T_{\text{eff}} = 45-80$ kK and $\log g = 7.50-8.75$. In eight of the spectra we found traces of $C$ (0.001-0.01, by mass). Two of these are the coolest DO WDs ever discovered that still show a considerable amount of $C$ in their atmospheres. This is in strong contradiction with diffusion calculations, and probably, similar to what is proposed for DB WDs, a weak mass-loss is present in DO WDs. One object is the most massive DO WD discovered so far with a mass of 1.07 $M_\odot$ if it is an ONe-WD or 1.09 $M_\odot$ if it is a CO-WD. We furthermore present the mass distribution of all known hot non-DA (pre-) WDs and derive the hot DA to non-DA ratio for the SDSS DR7 spectroscopic sample. The mass distribution of DO WDs beyond the wind limit strongly deviates from the mass distribution of the objects before the wind limit. We address this phenomenon by applying different evolutionary input channels. We argue that the DO WD channel may be fed by about 13% by post-extreme-horizontal branch stars and that PG 1159 stars and O(He) stars may contribute in a similar extent to the non-DA WD channel.

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ALMA observations of anisotropic dust mass loss in the inner circumstellar environment of the red supergiant VY CMa

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The processes leading to dust formation and the subsequent role it plays in driving mass loss in cool evolved stars is an area of intense study. Here we present high resolution ALMA Science Verification data of the continuum emission around the highly evolved oxygen-rich red supergiant VY CMa. These data enable us to study the dust in its inner circumstellar environment at a spatial resolution of 129 mas at 321 GHz and 59 mas at 658 GHz, thus allowing us to trace dust on spatial scales down to 11 $R_*$ (71 au). Two prominent dust components are detected and resolved. The brightest dust component, C, is located 334 mas (61 $R_*$) South East of the star and has a dust mass of at least $2.5 \times 10^{-4} M_\odot$. It has a dust emissivity spectral index of $\beta = -0.1$ at its peak, implying that it is optically thick at these frequencies with a cool core of $T_d \lesssim 100$ K. Interestingly, not a single molecule in the ALMA data has emission close to the peak of this massive dust clump. The other main dust component, VY, is located at the position of the star and contains a total dust mass of $4.0 \times 10^{-5} M_\odot$. It also contains a weaker dust feature extending over 60 $R_*$ to the North with the total dust component having a typical dust emissivity spectral index of $\beta = 0.7$. We find that at least 17% of the dust mass around VY CMa is located in clumps ejected within a more quiescent roughly spherical stellar wind, with a quiescent dust mass loss rate of $5 \times 10^{-6} M_\odot \text{yr}^{-1}$. The anisotropic morphology of the dust indicates a continuous, directed mass loss over a few decades, suggesting that this mass loss cannot be driven by large convection cells alone.

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Chemical analysis of CH stars – I: atmospheric parameters and elemental abundances

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Results from high-resolution spectral analyses of a selected sample of CH stars are presented. Detailed chemical composition studies of these objects that could reveal abundance patterns that give clues to the nucleosynthesis and evolutionary status of these objects are either missing or limited in literature. We have conducted detailed chemical composition studies for these objects based on high resolution \( R \sim 42,000 \) spectra. The spectra are taken from the ELODIE archive and cover from 3900 Å to 6800 Å in the wavelength range. We have estimated the stellar atmospheric parameters, the effective temperature \( T_{\text{eff}} \), the surface gravity \( \log g \), and metallicity \( [\text{Fe/H}] \) from LTE analysis using model atmospheres. Estimated temperatures of these objects cover a wide range from 4550 K to 6030 K, the surface gravity from 1.8 to 3.8 and metallicity from \(-0.18\) to \(-1.4\). We report updates on elemental abundances for several heavy elements and present estimates of abundance ratios of Sr, Y, Zr, Ba, La, Ce, Pr, Nd, Sm, Eu and Dy with respect to Fe. For the object HD188650 we present the first abundance analyses results based on a high resolution spectrum. Enhancements of heavy elements relative to Fe, that are characteristic of CH stars are evident from our analyses for most of the objects. A parametric model based study is performed to understand the relative contributions from the \( s \) and \( r \)-processes to the abundances of the heavy elements.

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Discovery of true, likely and possible symbiotic stars in the dwarf spheroidal NGC 205

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In this paper we discuss the photometric and spectroscopic observations of newly discovered (symbiotic) systems in the dwarf spheroidal galaxy NGC 205. The Gemini Multi-Object Spectrograph on-off band \( [\text{O III}] 5007 \) Å emission imaging highlighted several \( [\text{O III}] \) line emitters, for which optical spectra were then obtained (Gonçalves et al. 2014). The detailed study of the spectra of three objects allow us to identify them as true, likely and possible symbiotic systems (SySts), the first ones discovered in this galaxy. SySt-1 is unambiguously classified as a symbiotic star, because of the presence of unique emission lines which belong only to symbiotic spectra, the well known \( \text{OV} \) I Raman scattered lines. SySt-2 is only possibly a SySt because the \( \text{Ne VII} \) Raman scattered line at 4881 Å, recently identified in a well studied Galactic symbiotic as another very conspicuous property of symbiotic, could as well be identified as \( \text{N III} \) or \( [\text{Fe III}] \). Finally, SySt-3 is likely a symbiotic binary because in the red part of the spectrum it shows the continuum of a late giant, and forbidden lines of moderate- to high-ionization, like \( [\text{Fe v}] 4180 \) Å. The main source for skepticism on the symbiotic nature of the latter systems is their location in the PN region in the \( [\text{O III}] 4363/\text{H}_\gamma \) vs. \( [\text{O III}] 5007/\text{H}_\beta \) diagnostic diagram (Gutierrez-Moreno et al. 1995). It is worth mentioning that at least another two confirmed symbiotics, one of the Local Group dwarf spheroidal IC 10 and the other of the Galaxy, are also misplaced in this diagram.

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The identification of extreme asymptotic giant branch stars and red supergiants in M33 by 24 \( \mu \)m variability

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We present the first detection of 24 \( \mu \)m variability in 24 sources in the Local Group galaxy M33. These results are based on 4 epochs of MIPS observations, which are irregularly spaced over \( \sim 750 \) days. We find that these sources are constrained exclusively to the Holmberg radius of the galaxy, which increases their chances of being members of M33. We have constructed spectral energy distributions (SEDs) ranging from the optical to the sub-mm to investigate the nature of these objects. We find that 23 of our objects are most likely heavily self-obscured, evolved stars; while the remaining source is the Giant \( \text{H} \text{ii} \) region, NGC 604. We believe that the observed variability is the intrinsic variability of the central star reprocessed through their circumstellar dust shells. Radiative transfer modeling was carried out to determine their likely chemical composition, luminosity, and dust production rate (DPR). As a sample, our modeling has determined an average luminosity of \( (3.8 \pm 0.9) \times 10^{4} \) \( \text{L}_\odot \) and a total DPR of \( (2.3 \pm 0.1) \times 10^{-5} \text{M}_\odot \text{yr}^{-1} \). Most of the sources, given the high DPRs and short wavelength obscuration, are likely "extreme" AGB (XAGB) stars. Five of the sources are found to have luminosities above the classical AGB limit \( (M_{\text{bol}} < -7.1, L > 54,000 \text{L}_\odot) \), which classifies them as probably red supergiants (RSGs). Almost all of the sources are classified as oxygen rich. As also seen in the LMC, a significant fraction of the dust in M33 is produced by a handful of XAGB and RSG stars.

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Detectable close-in planets around white dwarfs through late unpacking

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Although 25\%–50\% of white dwarfs (WDs) display evidence for remnant planetary systems, their orbital architectures and overall sizes remain unknown. Vibrant close-in (\( \sim 1 \text{R}_\odot \)) circumstellar activity is detected at WDs spanning many Gyr in age, suggestive of planets further away. Here we demonstrate how systems with 4 and 10 closely-packed planets that remain stable and ordered on the main sequence can become unpacked when the star evolves into a WD and experience pervasive inward planetary incursions throughout WD cooling. Our full-lifetime simulations run for the age of the Universe and adopt main sequence stellar masses of 1.5, 2.0 and 2.5 \( \text{M}_\odot \), which correspond to the mass range occupied by the progenitors of typical present-day WDs. These results provide (i) a natural way to generate an ever-changing dynamical architecture in post-main-sequence planetary systems, (ii) an avenue for planets to achieve temporary close-in orbits that are potentially detectable by transit photometry, and (iii) a dynamical explanation for how residual asteroids might pollute particularly old WDs.

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A detailed study of the structure of the nested planetary nebula, Hb12, the Matryoshka Nebula

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We present near-IR, integral field spectroscopic observations of the planetary nebula (PN) Hb12 using Near-infrared Integral Field Spectrograph (NIFS) on Gemini-North. Combining NIFS with the adaptive optics system Altair, we provide a detailed study of the core and inner structure of this PN. We focus on the prominent emission lines [FeII] (1.6436 µm), HeI (2.0585 µm), H₂ (2.1214 µm), and Brγ (2.16553 µm). We find that the [FeII] emission traces a tilted system of bipolar lobes, with the northern lobe being redshifted and the southern lobe blueshifted. The [FeII] emission is very faint at the core and only present close to the systemic velocity. There is no H₂ emission in the core, whereas the core is prominent in the HeI and Brγ recombination lines. The H₂ emission is concentrated in equatorial arcs of emission surrounding the core and expanding at ~ 30 km s⁻¹. These arcs are compared with Hubble Space Telescope images and shown to represent nested loops belonging to the inner sections of a much larger bipolar structure that replicates the inner one. The HeI and Brγ emission from the core clearly show a cylindrical central cavity that seems to represent the inner walls of an equatorial density enhancement or torus. The torus is 0°.2 wide (± 200 au radius at a distance of 2000 pc) and expanding at ≲ 30 km s⁻¹. The Eastern wall of the inner torus is consistently more intense than the Western wall, which could indicate the presence of an off-center star, such as is observed in the similar hourglass PN, MyCn 18. A bipolar outflow is also detected in Brγ emerging within 0°.1 from the core at ~ ±40 km s⁻¹.

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Imaging the transition between pre-planetary and planetary nebulae: Integral Field Spectroscopy of hot post-AGB stars with NIFS

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We present 2–2.4 µm integral field spectroscopy of a sample of hot post-AGB stars with early-B spectral types, using the NIFS instrument on Gemini North. These stars are just beginning to ionize their immediate environments and turn into planetary nebulae (PNe). We use molecular hydrogen emission lines together with hydrogen and helium recombination lines to explore the distribution of molecular and atomic gas and the extent of the developing ionized region. We see a range of evolutionary stages: IRAS 18062+2410 and IRAS 18379−1707 have recently developed compact and unresolved regions of photoionized H within axisymmetric molecular envelopes, with the former object increasing its Brγ flux by a factor of 5.3 in 14 years; IRAS 22023+5249 and IRAS 20462+3416 have extended Brγ nebulae and in the latter object only weak H₂ emission remains; IRAS 19336−0400 is at a more advanced stage of PN formation where H₂ is mostly dissociated and we see structure in both the H and He recombination line nebulae. IRAS 19200+3457 is the only object not to show the HeI line at 2.058 µm and is probably the least evolved object in our sample; the H₂ emission forms a ring around the star and we suggest that this object may be a rare example of a “round” pre-PN in transition to a “round” PN.

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Non-local thermodynamical equilibrium effects on the iron abundance of asymptotic giant branch stars In 47 Tucanae

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We present the iron abundance of 24 asymptotic giant branch (AGB) stars members of the globular cluster 47 Tucanae, obtained with high-resolution spectra collected with the FEROS spectrograph at the MPG/ESO 2.2m Telescope. We find that the iron abundances derived from neutral lines (with mean value [Fe i/H] = −0.94 ± 0.01, σ = 0.08 dex) are systematically lower than those derived from single ionized lines ([Fe ii/H] = −0.83 ± 0.01, σ = 0.05 dex). Only the latter are in agreement with those obtained for a sample of red giant branch (RGB) cluster stars, for which Fe i and Fe ii lines provide the same iron abundance. This finding suggests that Non Local Thermodynamical Equilibrium (NLTE) effects driven by overionization mechanisms are present in the atmosphere of AGB stars and significantly affect Fe i lines, while leaving Fe ii features unaltered. On the other hand, the very good ionization equilibrium found for RGB stars indicates that these NLTE effects may depend on the evolutionary stage. We discuss the impact of this finding both on the chemical analysis of AGB stars, and on the search for evolved blue stragglers.

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A search of diffuse bands in fullerene planetary nebulae: evidence for diffuse circumstellar bands

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Large fullerenes and fullerene-based molecules have been proposed as carriers of diffuse interstellar bands (DIBs). The recent detection of the most common fullerenes (C60 and C70) around some Planetary Nebulae (PN) now enable us to study the DIBs towards fullerene-rich space environments. We search DIBs in the optical spectra towards three fullerene-containing PNe (Te 1, M 1-20, and IC 418). Special attention is given to DIBs which are found to be unusually intense towards these fullerene sources. In particular, an unusually strong 4428Å absorption feature is a common characteristic to fullerene PNe. Similarly to Te 1, the strongest optical bands of neutral C60 are not detected towards IC 418. Our high-quality (S/N > 300) spectra for PN Te 1 together with its large radial velocity permits us to search for the presence of diffuse bands of circumstellar origin which we refer to as diffuse circumstellar bands (DCBs). We report the first tentative detection of two DCBs at 4428 and 5780Å in the fullerene-rich circumstellar environment around the PN Te 1. Laboratory and theoretical studies of fullerenes in their multifarious manifestations (carbon onions, fullerene clusters, or even complex species formed by fullerenes and other molecules like PAHs, or metals) may help solve the mystery of some of the diffuse band carriers.

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3D hydrodynamical simulations of evolved stars and observations of stellar surfaces

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Evolved stars are among the largest and brightest stars and they are ideal targets for the new generation of sensitive, high resolution instrumentation that provides spectrophotometric, interferometric, astrometric, and imaging observables. The interpretation of the complex stellar surface images requires numerical simulations of stellar convection that take into account multi-dimensional time-dependent radiation hydrodynamics with realistic input physics. We show how the evolved star simulations are obtained using the radiative hydrodynamics code GOSBOLD and how the accurate observables are computed with the post-processing radiative transfer code OPTIM 3D. The synergy between observations and theoretical work is supported by a proper and quantitative analysis using these simulations, and by strong constraints from the observational side.

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Duplicity: its part in the AGB’s downfall

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Half or more of stars more massive than our Sun are orbited by a companion star in a binary system. Many binaries have short enough orbits that the evolution of both stars is greatly altered by an exchange of mass and angular momentum between the stars. Such mass transfer is highly likely on the asymptotic giant branch (AGB) because this is when a star is both very large and has strong wind mass loss. Direct mass transfer truncates the AGB, and its associated nucleosynthesis, prematurely compared to in a single star. In wide binaries we can probe nucleosynthesis in the long-lived AGB primary star by today observing its initially lower-mass companion. The star we see now may be polluted by ejecta from the primary either through a wind or Roche-lobe overflow. We highlight recent quantitative work on nucleosynthesis in (ex-)AGB mass-transfer systems, such as carbon and barium stars, the link between binary stars and planetary nebulae, and suggest AGB stars as a possible source of the enigmatic element, lithium.

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Statistical studies of long-period variable stars in Odessa

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The studies of pulsating variable stars are traditional subjects of astronomers in Odessa. In the last half of the 20th
Constraining mass-loss & lifetimes of low mass, low metallicity AGB stars

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The evolution and lifetimes of thermally pulsating asymptotic giant branch (TP-AGB) stars suffer from significant uncertainties. We present a detailed framework for constraining model luminosity functions of TP-AGB stars using resolved stellar populations. We show an example of this method that compares various TP-AGB mass-loss prescriptions that differ in their treatments of mass loss before the onset of dust-driven winds (pre-dust). We find that models with more efficient pre-dust driven mass loss produce results consistent with observations, as opposed to more canonical mass-loss models. Efficient pre-dust driven mass-loss predicts for [Fe/H] \(-1.2\), lower mass TP-AGB stars \(M < 1 \, M_\odot\) must have lifetimes less than about 1.2 Myr.

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The HST Treasury “Advanced Spectral Library (ASTRAL)” Programs

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The “Advanced Spectral Library (ASTRAL)” project (PI – T. Ayres) consists of two Treasury Programs: the Cycle 18 “Cool Stars” (GO-12278) program and the Cycle 21 “Hot Stars” (GO-13346) program. The primary goal of these programs is to collect, for the use of the astronomical community over the coming decades, a definitive set of representative, high-resolution \((R \approx 30,000-100,000)\), high signal/noise \((S/N > 100)\) spectra, with full UV coverage \((\sim 1150-3100 \, \text{Å})\) of prototypical stars across the HR diagram, utilizing the high-performance Space Telescope Imaging
Spectrograph (STIS). The Cycle 18 program obtained spectra of 8 F-M evolved late-type stars, while the Cycle 21 program is in the process of observing 21 early-type stars, which span a broad range of spectral types between early-O and early-A. All of these data will be available from the HST archive and, in post-processed and merged form, at http://casa.colorado.edu/~ayres/ASTRAL/. These data will enable investigations of a broad range of problems – stellar, interstellar, and beyond – for many years into the future. We describe here the details of the observing programs, including the program targets and the observing strategies utilized to optimize the quality of the spectra, and present some illustrative examples of the on-going scientific analyses, including a study of the outer atmospheres and winds of the two evolved M stars in the sample and a first look at a “high definition” UV spectrum of a magnetic chemically peculiar “Ap” star.

and from http://www2.lowell.edu/workshops/coolstars18/proceedings.html

Calibrating the role of TP-AGB stars in the cosmic matter cycle

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In the last ten years three main facts about the thermally pulsing asymptotic giant branch (TP-AGB) have become evident: 1) the modelling of the TP-AGB phase is critical for the derivation of basic galaxy properties (e.g., mass and age) up to high redshift, with consequent cosmological implications; 2) current TP-AGB calibrations based on Magellanic Cloud (MC) clusters come out not to work properly for other external galaxies, yielding a likely TP-AGB overestimation; 3) the significance of the TP-AGB contribution in galaxies, hence their derived properties, are strongly debated, with conflicting claims in favour of either a heavy or a light TP-AGB. The only way out of this condition of persisting uncertainty is to perform a reliable calibration of the TP-AGB phase as a function of the star’s initial mass (hence age) over a wide range of metallicity, from very low to super-solar values. In this context, I will review recent advancements and ongoing efforts towards a physically sound TP-AGB calibration that, moving beyond the classical use of the MC clusters, combines increasingly refined TP-AGB stellar models with exceptionally high-quality data for resolved TP-AGB stars in nearby galaxies. Preliminary results indicate that a sort of “TP-AGB island” emerges in the age-metallicity plane, where the contribution of these stars is especially developed, embracing preferentially solar- and MC-like metallicities, and intermediate ages (\sim few Gyr).

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Rotation of white dwarf stars

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I discuss and consider the status of observational determinations of the rotation velocities of white dwarf stars via asteroseismology and spectroscopy. While these observations have important implications on our understanding of the angular momentum evolution of stars in their late stages of evolution, more direct methods are sorely needed to disentangle ambiguities.

Oral contribution, published in "19th European White Dwarf Workshop"
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The marriage of gas and dust

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Dust–gas mixtures are the simplest example of a two fluid mixture. We show that when simulating such mixtures with particles or with particles coupled to grids a problem arises due to the need to resolve a very small length scale when the coupling is strong. Since this is occurs in the limit when the fluids are well coupled, we show how the dust–gas equations can be reformulated to describe a single fluid mixture. The equations are similar to the usual fluid equations supplemented by a diffusion equation for the dust-to-gas ratio (or alternatively the dust fraction). This solves a number of numerical problems as well as making the physics clear.

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Period–mass-loss rate relation of Miras with and without technetium

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We present the discovery that Mira variables separate in two distinct sequences in a near- to mid-IR color versus pulsation period diagram, if a distinction is made with respect to the presence of technetium (Tc) in the stars. Tc is an indicator of recent or ongoing deep mixing during a third dredge-up event. At a given period, the Tc-poor Miras are redder in $K$ − $[22]$ (i.e. have higher dust mass-loss rate) than the Tc-rich Miras. This is counter-intuitive since the Tc-rich Miras are expected to be more evolved and should have a higher mass-loss rate. In this contribution we give an update on this recently discovered conundrum.

Available from arXiv:1411.1392

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A tale of two stars: Interferometric studies of post-AGB binaries

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Binaries with circumbinary disks are commonly found among optically bright post-AGB stars. Although clearly linked to binary interaction processes, the formation, evolution and fate of these disks are still badly understood. Due to their compactness, interferometric techniques are required to resolve them. Here, we discuss our high-quality multi-wavelength interferometric data of two prototypical yet very different post-AGB binaries, AC and 89Herculis, as well
as the modeling thereof with radiative transfer models. A detailed account of the data and models of both objects is published in three separate papers elsewhere; here we focus on comparing the modeling results for the two objects. In particular we discuss the successes and limitations of the models which were developed for proto-planetary disks around young stars. We conclude that multi-wavelength high-angular-resolution observations and radiative transfer disk models are indispensable to understand these complex interacting objects and their place in the grand scheme of the (binary) evolution of low and intermediate mass stars.

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**Kinematical properties of planetary nebulae with WR-type nuclei**

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We have carried out integral field unit (IFU) spectroscopy of Hα, [NII] and [OIII] emission lines for a sample of Galactic planetary nebula (PNe) with Wolf–Rayet (WR) stars and weak emission-line stars (wells). Comparing their spatially-resolved kinematic observations with morpho-kinematic models allowed us to disentangle their three-dimensional gaseous structures. Our results indicate that these PNe have axi-symmetric morphologies, either bipolar or elliptical. In many cases the associated kinematic maps for the PNe around hot central stars also reveal the presence of so-called fast low-ionization emission regions.

**Oral contribution, published in "12th Asia-Pacific Regional IAU Meeting" (APRIM), 2014**
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**Physical and chemical properties of planetary nebulae with WR-type nuclei**

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We have carried out optical spectroscopic measurements of emission lines for a sample of Galactic planetary nebula with Wolf–Rayet (WR) stars and weak emission-line stars (wells). The plasma diagnostics and elemental abundance analysis have been done using both collisionally excited lines (CELs) and optical recombination lines (ORLs). It is found that the abundance discrepancy factors (ADF ≈ ORL/CEL) are closely correlated with the dichotomy between temperatures derived from forbidden lines and those from HeI recombination lines, implying the existence of H-deficient materials embedded in the nebula. The H/β surface brightness correlations suggest that they might be also related to the nebular evolution.

**Poster contribution, published in "12th Asia–Pacific Regional IAU Meeting" (APRIM), 2014**
*Available from arXiv:1411.2191*
Evolution of planetary nebulae with WR-type central stars

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This thesis presents a study of the kinematics, physical conditions and chemical abundances for a sample of Galactic planetary nebulae (PNe) with Wolf-Rayet (WR) and weak emission-line stars (vels), based on optical integral field unit (IFU) spectroscopy obtained with the Wide Field Spectrograph (WiFeS) on the Australian National University 2.3m telescope at Siding Spring Observatory, and complemented by spectra from the literature. PNe surrounding WR-type stars constitute a particular study class for this study. A considerable fraction of currently well-identified central stars of PNe exhibit 'hydrogen-deficient' fast expanding atmospheres characterized by a large mass-loss rate. Most of them were classified as the carbon-sequence and a few of them as the nitrogen-sequence of the WR-type stars. What is less clear are the physical mechanisms and evolutionary paths that remove the hydrogen-rich outer layer from these degenerate cores, and transform it into a fast stellar wind. The aim of this thesis is to determine kinematic structure, density distribution, thermal structure and elemental abundances for a sample of PNe with different hydrogen-deficient central stars, which might provide clues about the origin and formation of their hydrogen-deficient stellar atmospheres. The Hα and [NII] emission features were used to measure the nebular radial velocities. Based on the spatially resolved velocity distributions of these emission lines combined with archival Hubble Space Telescope imaging for compact PNe, the kinematic structures of these PNe were determined. Comparing the velocity maps observed by the IFU spectrograph with those predicted by morpho-kinematic models excluded the projection effect from the nebula's appearance and identified the morphology of most PNe, apart from the compact objects. The results indicate that these PNe have axi-symmetric morphologies, either bipolar or elliptical. In many cases, the associated kinematic maps for PNe around hot WR-type stars also show the presence of so-called fast low-ionization emission regions (FLIERs). The WiFeS observations, complemented with archival spectra from the literature, have been used to carry out plasma diagnostics and abundance analysis using both collisionally excited lines (CELs) and optical recombination lines (ORLs). ORL abundances for carbon, nitrogen and oxygen have been derived where adequate recombination lines were available. The weak temperature dependence of ORLs has also been used to determine the thermal structure. It is found that the ORL abundances are several times higher than the CEL abundances, whereas the temperatures derived from the HeI recombination lines are typically lower than those measured from the collisionally excited nebular-to-auroral forbidden line ratios. The abundance discrepancy factors (ADF) for doubly-ionized nitrogen and oxygen are within a range from 2 to 49, which are closely correlated with the dichotomy between temperatures derived from forbidden lines and those from HeI recombination lines. The results show that the ADF and temperature dichotomy are correlated with the intrinsic nebular H/β surface brightness, suggesting that the abundance discrepancy problem must be related to the nebular evolution.

Three-dimensional photoionization models of four Galactic PNe have been constructed, constrained by the WiFeS observations (Abell 48 and SnWt 2) and the double echelle MIKE spectroscopy from the literature (Hb 4 and PB 8). The WiFeS observations have been used to perform the empirical analysis of Abell 48 and SnWt 2. The spatially resolved velocity distributions were used to determine the kinematic structures of Hb 4 and Abell 48. The previously identified non-LTE model atmospheres of Abell 48 and PB 8 have been used as ionizing fluxes in their photoionization models. It is found that the enhancement of the [NII] emission in the FlierRs of Hb 4 is more attributed to the geometry and density distribution, while the ionization correction factor method and electron temperature used for the empirical analysis are mostly responsible for apparent inhomogeneity of nitrogen abundance. However, the results indicate that the chemically inhomogeneous models, containing a small fraction of metal-rich inclusions (around 5 percent), provide acceptable matches to the observed ORLs in Hb 4 and PB 8. The observed nebular spectrum of Abell 48 was best produced by using a nitrogen-sequence non-LTE model atmosphere of a low-mass progenitor star rather than a massive Pop I star. For Abell 48, the helium temperature predicted by the photoionization model is higher than those empirically derived, suggesting the presence of a fraction of cold metal-rich structures inside the nebula. It is found that a dust-dust chemistry with different grain species and discrete grain sizes likely produces the nebular Spitzer mid-infrared continuum of PB 8. The photoionization models of SnWt 2 suggest the presence of a hot hydrogen-deficient degenerate core, compatible with what is known as a PG 1159-type star, while the nebula's age is consistent with a born-again scenario.

PhD Thesis, Macquarie University, April 2014
Available from http://adsabs.harvard.edu/abs/2014PhDT...76D
Announcements

Stellar End Products: The Low Mass – High Mass Connection

ESO Garching, 6–10 July, 2015

Goals of the Workshop

In this workshop, we intend to bring together observers and theorists from the low mass and high mass stellar communities with the goals of:

- understanding the evolved star mass loss process and the injection of energy and matter (enriched in molecules and dust) into the ISM
- comparing Asymptotic Giant Branch and Red Supergiant stars – why are they observationally similar in many ways yet apparently have very different interior stellar structures and their mass loss evolves differently
- determining the roles of magnetic fields, binarity, jets and collimated mass loss, metallicity, initial mass etc. upon stellar evolution and end products – how can almost spherically symmetric stars produce broadly bipolar morphologies over such a large mass loss range?

The meeting will be spread over five days, starting on Monday afternoon and ending on Friday at lunchtime. It will consist of invited and contributed talks, posters and discussion sessions.

Conference email: steps@eso.org

Important dates:
6 April abstract submission deadline
15 April preliminary program
1 May notification of contributed talk
4 May hotel block bookings expire
6 June registration payment deadline
6 July meeting starts

See also http://www.eso.org/sci/meetings/2015/STEPS2015.html

Workshop on Milky Way Astrophysics from Wide-Field Surveys
30/03–01/04 2015, London, Burlington House at the RAS, UK

The workshop will bring together ~ 90 scientists working on various aspects of astrophysics in the Milky Way, who utilise large, multi-wavelength, wide-field surveys in their work. The science topics encompass the interstellar medium, the formation of stars, supernovae, late evolutionary stages of stars (asymptotic giant branch stars and planetary nebulae), low mass stars and brown dwarfs, stellar clusters as well as Galactic structure.

We aim to bring together people from the UK community, as well as experts from Europe and overseas, to foster the exchange of knowledge and expertise on these large valuable datasets. This will include talks on various large wide-field surveys such as e.g. PHAS, VPHAS+, GAIA, UKIDSS, VVV, UWISH2(E), UWISE, Spitzer Glimpse, DeepGlimpse, GBS, WISE, AKARI, Herschel GPS, JPS, LOFAR, etc., covering the entire astrophysical useful part of the electromagnetic spectrum. Thanks to the RAS and generous SEPnet sponsorship, there will be no registration fee.

The draft program consists of the following sessions:
1) Wide-Field Surveys; PIs or leading members of large scale surveys are strongly encouraged to present a short overview of their data and science results;

2) Star Formation and Massive Stars; incl. molecular clouds, young stars, jets and outflows, etc.;

3) Late Stages of Stellar Evolution; incl. Asymptotic Giant Branch stars, Planetary nebulae, Supernovae, white dwarfs, etc.;

4) Star Clusters and Low Mass Objects; incl. low-mass stars and brown dwarfs, stellar clusters and associations, stellar streams and local dwarf galaxies, etc.;

Organisers:
Dirk Froebrich, Janet Drew, Michael D. Smith, Phil W. Lucas, Tim Gledhill, Antonio Chrysostomou

We are looking forward to seeing you in London.

Dirk Froebrich, Janet Drew

See also http://astro.kent.ac.uk/~df/gp/index.html