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Editors: Jacco van Loon, Ambra Nanni and Albert Zijlstra

Editorial

Dear Colleagues,

It is a pleasure to present you the 236th issue of the AGB Newsletter. Apart from many new interesting results published in journals there are three reviews very worthy of reading.

Have a look at the announcements for a meeting on the physics of evolved stars in Nice, France, and the Guillermo Haro School in México.

If you would like your research advertised, why not send us a picture (image, spectrum, diagram...) and we'll consider it for the front cover of the newsletter.

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

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

Food for Thought

This month's thought-provoking statement is:

How does the upper mass limit for Hot Bottom Burning depend on metallicity?

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

Refereed Journal Papers

Sc and neutron-capture abundances in Galactic low- and high-α field halo stars

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We determine relative abundance ratios for the neutron-capture elements Zr, La, Ce, Nd, and Eu for a sample of 27 Galactic dwarf stars with $-1.5 <$ [Fe/H] < -0.8. We also measure the iron-peak element Sc. These stars separate into three populations (low- and high-α halo and thick-disc stars) based on the [α/Fe] abundance ratio and their kinematics as discovered by Nissen & Schuster. We find differences between the low- and high-α groups in the abundance ratios of [Sc/Fe], [Zr/Fe], [La/Zr], [Y/Eu], and [Ba/Eu] when including Y and Ba from Nissen & Schuster. For all ratios except [La/Zr], the low-α stars have a lower abundance compared to the high-α stars. The low-α stars display the same abundance patterns of high [Ba/Y] and low [Y/Eu] as observed in present-day dwarf spheroidal galaxies, although with smaller abundance differences, when compared to the high-α stars. These distinct chemical patterns have been attributed to differences in the star formation rate between the two populations and the contribution of low-metallicity, low-mass asymptotic giant branch (AGB) stars to the low-α population. By comparing the low-α population with AGB stellar models, we place constraints on the mass range of the AGB stars.

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Available from https://arxiv.org/abs/1701.02423

A fast spinning magnetic white dwarf in the double-degenerate, super-Chandrasekhar system NLTT 12758

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We present an analysis of the close double degenerate NLTT 12758, which is comprised of a magnetic white dwarf with a field of about 3.1 MG and an apparently non-magnetic white dwarf. We measured an orbital period of 1.154 days and found that the magnetic white dwarf is spinning around its axis with a period of 23 minutes. An analysis of the atmospheric parameters has revealed that the cooling ages of the two white dwarfs are comparable, suggesting that they formed within a short period of time from each other. Our modelling indicates that the non-magnetic white dwarf is more massive ($M = 0.83$ M$_\odot$) than its magnetic companion ($M = 0.69$ M$_\odot$) and that the total mass of the system is higher than the Chandrasekhar mass. Although the stars will not come into contact over a Hubble time, when they do come into contact, dynamically unstable mass transfer will take place leading to either an accretion induced collapse into a rapidly spinning neutron star or a Type Ia supernova.

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Low temperature MIR to submillimeter mass absorption coefficient of interstellar dust analogues I: Mg-rich glassy silicates

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The submillimeter spectral domain has been extensively explored by the *Herschel* and *Planck* satellites and is now reachable from the ground with ALMA. A wealth of data, revealing cold dust thermal emission, is available for astronomical environments ranging from interstellar clouds, cold clumps, circumstellar envelops, and protoplanetary disks. The interpretation of these observations relies on the understanding and modeling of cold dust emission and on the knowledge of the dust optical properties.

The aim of this work is to provide astronomers with a set of spectroscopic data of realistic interstellar dust analogues that can be used to interpret the observations. It pursues the experimental effort aimed at characterizing the spectroscopic properties of interstellar dust analogues at low temperature in the mid infrared (MIR) to millimeter spectral domain. Compared to previous studies, it extends the range of studied dust analogues in terms of composition and of structure of the material.

Glassy silicates of mean composition (1-x)MgO–xSiO$_2$ with x = 0.35 (close to forsterite, Mg_2SiO_4), 0.50 (close to enstatite, $MgSiO_3$) and 0.40 (close to $Mg_{1.5}SiO_{3.5}$ or $MgSiO_3$:Mg_2SiO_4 = 50 : 50) were synthesized. The mass absorption coefficient (MAC) of the samples was measured in the spectral domain 30–1000 μm for grain temperature in the range 300–10 K and at room temperature in the 5–40 μm domain.

We find that the MAC of all samples varies with the grains temperature and that its spectral shape cannot be approximated by a single power law in $\lambda^{-\beta}$. In the FIR/submm, and above 30 K, the MAC value at a given wavelength increases with the temperature as thermally activated absorption processes appear. The studied materials exhibit different and complex behaviors at long wavelengths ($\lambda \geq 200$ to 700 μm depending on the samples).These behaviors are attributed to the amorphous nature of dust and to the amount and nature of the defects within this amorphous structure. We do not observe MAC variations in the 10–30 K range. Above 20 μm, the measured MAC are much higher than the MAC calculated from interstellar silicate dust models indicating that the analogues measured in this study are more emissive than the silicates in cosmic dust models.

The underestimated value of the MAC deduced from cosmic dust models in the FIR/submm has important astrophysical implications because masses are overestimated by the models. Moreover, constraints on elemental abundance of heavy elements in cosmic dust models are relaxed.

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Torsional Alfvén resonances as an efficient damping mechanism for non-radial oscillations in red giant stars

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Stars are self-gravitating fluids in which pressure, buoyancy, rotation and magnetic fields provide the restoring forces for global modes of oscillation. Pressure and buoyancy energetically dominate, while rotation and magnetism are generally assumed to be weak perturbations and often ignored. However, observations of anomalously weak dipole mode amplitudes in red giant stars suggest that a substantial fraction of these are subject to an additional source of damping localised to their core region, with indirect evidence pointing to the role of a deeply buried magnetic field. It

is also known that in many instances the gravity-mode character of affected modes is preserved, but so far no effective damping mechanism has been proposed that accommodates this aspect. Here we present such a mechanism, which damps the oscillations of stars harbouring magnetised cores via resonant interactions with standing Alfvén modes of high harmonic index. The damping rates produced by this mechanism are quantitatively on par with those associated with turbulent convection, and in the range required to explain observations, for realistic stellar models and magnetic field strengths. Our results suggest that magnetic fields can provide an efficient means of damping stellar oscillations without needing to disrupt the internal structure of the modes, and lay the groundwork for an extension of the theory of global stellar oscillations that incorporates these effects.

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Candidate Hα emission and absorption line candidates in the Galactic Bulge Survey

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We present a catalogue of candidate Hα emission and absorption line sources and blue objects in the Galactic Bulge Survey (GBS) region. We use a point source catalogue of the GBS fields (two strips of $(l \times b) = (6 \times 1)$ degrees centred at $b = 1.^{\circ}5$ above and below the Galactic centre), covering the magnitude range $16 < r' < 22.5$. We utilize $(r' - i',\ r' - \mathrm{H}\alpha)$ colour–colour diagrams to select Hα emission and absorption line candidates, and also identify blue objects (compared to field stars) using the $r' - i'$ colour index. We identify 1337 Hα emission line candidates and 336 Hα absorption line candidates. These catalogues likely contain a plethora of sources, ranging from active (binary) stars, early-type emission line objects, cataclysmic variables (CVs) and low-mass X-ray binaries (LMXBs) to background active galactic nuclei (AGN). The 389 blue objects we identify are likely systems containing a compact object, such as CVs, planetary nebulæ and LMXBs. Hot subluminous dwarfs (sdO/B stars) are also expected to be found as blue outliers. Crossmatching our outliers with the GBS X-ray catalogue yields sixteen sources, including seven (magnetic) CVs and one qLMXB candidate among the emission line candidates, and one background AGN for the absorption line candidates. One of the blue outliers is a high state AM CVn system. Spectroscopic observations combined with the multi-wavelength coverage of this area, including X-ray, ultraviolet and (time-resolved) optical and infrared observations, can be used to further constrain the nature of individual sources.

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A deep mixing solution to the aluminum and oxygen isotope puzzles in presolar grains

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We present here the application of a model for a mass circulation mechanism in between the H-burning shell and the base of the convective envelope of low mass AGB stars, aimed at studying the isotopic composition of those presolar grains showing the most extreme levels of ^{18}O depletion and high concentration of ^{26}Mg from the decay of ^{26}Al. The mixing scheme we present is based on a previously suggested magnetic- buoyancy process, already shown to account adequately for the formation of the main neutron source for slow neutron captures in AGB stars. We find that this scenario is also capable of reproducing for the first time the extreme values of the $^{17}O/^{16}O$, the $^{18}O/^{16}O$, and the $^{26}Al/^{27}Al$ isotopic ratios found in the mentioned oxide grains, including the highest amounts of ^{26}Al there measured.

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Shaping planetary nebulæ with jets in inclined triple stellar systems

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We conduct three-dimensional hydrodynamical simulations of two opposite jets launched obliquely to the orbital plane around an asymptotic giant branch (AGB) star and within its dense wind, and demonstrate the formation of a 'messy' planetary nebula (PN), namely, a PN lacking any type of symmetry (highly irregular). In building the initial conditions we assume that a tight binary system orbits the AGB star, and that the orbital plane of the tight binary system is inclined to the orbital plane of the binary system and the AGB star (the triple system plane). We further assume that the accreted mass on to the tight binary system forms an accretion disk around one of the stars, and that the plane of the disk is tilted to the orbital plane of the triple system. The highly asymmetrical and filamentary structure that we obtain support the notion that messy PNe might be shaped by triple stellar systems.

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Catching a grown-up starfish planetary nebula: I. Morpho-kinematical study of PC 22

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We present the first part of an investigation on the planetary nebula (PN) PC 22 which focuses on the use of deep imaging and high resolution échelle spectroscopy to perform a detailed morpho-kinematical analysis. PC 22 is revealed to be a multipolar PN emitting predominantly in [O III] and displaying multiple non-symmetric outflows. Its central region is found to be also particularly inhomogeneous with a series of low ionization structures (knots) located on the path of the outflows. The morpho-kinematical model obtained with SHAPE indicates that i) the de-projected velocities of the outflows are rather large, > 100 km s^{-1}, while the central region has expansion velocities in the range ~ 25 to ~ 45 km s^{-1} following the "Wilson effect", ii) the majority of the measured structures share similar inclination, $\sim 100°$, i.e. they are coplanar, and iii) all outflows and lobes are coeval (within the uncertainties). All these results make us to suggest that PC 22 is an evolved starfish PN. We propose that the mechanism responsible for the morphology of PC 22 consists of a wind–shell interaction, where the fast post-AGB wind flows through a filamentary AGB shell with some large voids.

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A small fullerene (C_{24}) may be the carrier of the 11.2 μm unidentified infrared band

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We analyze the 11.2 μm unidentified infrared band (UIR) spectrum from NGC 7027 and identify a small fullerene (C_{24}) as a plausible carrier. The blurring effects of lifetime and vibrational anharmonicity broadening obscure the narrower, intrinsic spectral profiles of the UIR band carriers. We use a spectral deconvolution algorithm to remove the blurring, in order to retrieve the intrinsic profile of the UIR band. The shape of the intrinsic profile, a sharp blue peak and an extended red tail, suggests that the UIR band originates from a molecular vibration–rotation band with a blue band head. The fractional area of the band-head feature indicates a spheroidal molecule, implying a non-polar molecule and precluding rotational emission. Its rotational temperature should be well approximated by that measured for non-polar molecular hydrogen, ~ 825 K for NGC 7027. Using this temperature, and the inferred spherical symmetry, we perform a spectral fit to the intrinsic profile that results in a rotational constant implying C_{24} as the carrier. We show that the spectroscopic parameters derived for NGC 7027 are consistent with the 11.2 μm UIR bands observed for other objects. We present density functional theory (DFT) calculations for the frequencies and infrared intensities of C_{24}. The DFT results are used to predict a spectral energy distribution (SED) originating from absorption of a 5 eV photon, and characterized by an effective vibrational temperature of 930 K. The C_{24} SED is consistent with the entire UIR spectrum and is the dominant contributor to the 11.2 and 12.7 μm bands.

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Testing atomic collision theory with the two-photon continuum of astrophysical nebulæ

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Accurate rates for energy-degenerate l-changing collisions are needed to determine cosmological abundances and recombination. There are now several competing theories for the treatment of this process, and it is not possible to test these experimentally. We show that the H I two-photon continuum produced by astrophysical nebulæ is strongly affected by l-changing collisions. We perform an analysis of the different underlying atomic processes and simulate the recombination and two-photon spectrum of a nebula containing H and He. We provide an extended set of effective recombination coefficients and updated l-changing 2s–2p transition rates using several competing theories. In principle, accurate astronomical observations could determine which theory is correct.

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Masses of the planetary nebula central stars in the Galactic globular cluster system from HST imaging and spectroscopy

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The globular cluster (GC) system of our Galaxy contains four planetary nebulæ (PNe): K 648 (or Ps 1) in M 15, IRAS 18333−2357 in M 22, JaFu 1 in Pal 6, and JaFu 2 in NGC 6441. Because single-star evolution at the low stellar mass of present-epoch GCs was considered incapable of producing visible PNe, their origin presented a puzzle.

We imaged the PN JaFu 1 with the *Hubble* Space Telescope (HST) to obtain photometry of its central star (CS) and high resolution morphological information. We imaged IRAS 18333−2357 with better depth and resolution, and we analyzed its archival HST spectra to constrain its CS temperature and luminosity. All PNe in Galactic GCs now have quality HST data, allowing us to improve CS mass estimates. We find reasonably consistent masses between 0.53 and 0.58 $M_\odot$ for all four objects, though estimates vary when adopting different stellar evolutionary calculations. The CS mass of IRAS 18333−2357, though, depends strongly on its temperature, which remains elusive due to reddening uncertainties.

For all four objects, we consider their CS and nebula masses, their morphologies, and other incongruities to assess the likelihood that these objects formed from binary stars. Although generally limited by uncertainties ($\sim 0.02\ M_\odot$) in post-AGB tracks and core mass vs. luminosity relations, the high mass CS in K 648 indicates a binary origin. The CS of JaFu 1 exhibits compact bright [O III] and Hα emission, like EGB 6, suggesting a binary companion or disk. Evidence is weaker for a binary origin of JaFu 2.

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Carbon stars in the X-Shooter Spectral Library: II. Comparison with models

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In a previous paper, we assembled a collection of medium-resolution spectra of 35 carbon stars, covering optical and near-infrared wavelengths from 400 to 2400 nm. The sample includes stars from the Milky Way and the Magellanic Clouds, with a variety of $(J-K_\mathrm{s})$ colors and pulsation properties. In the present paper, we compare these observations to a new set of high-resolution synthetic spectra, based on hydrostatic model atmospheres.

We find that the broad-band colors and the molecular-band strengths measured by spectrophotometric indices match

those of the models when $(J - K_s)$ is bluer than about 1.6, while the redder stars require either additional reddening or dust emission or both. Using a grid of models to fit the full observed spectra, we estimate the most likely atmospheric parameters $T_{\rm eff}$, $\log(g)$, [Fe/H] and C/O. These parameters derived independently in the optical and near-infrared are generally consistent when $(J - K_s) < 1.6$. The temperatures found based on either wavelength range are typically within ±100 K of each other, and $\log(g)$ and [Fe/H] are consistent with the values expected for this sample.
The reddest stars ($(J - K_s) > 1.6$) are divided into two families, characterized by the presence or absence of an absorption feature at 1.53 μm, generally associated with HCN and C_2H_2. Stars from the first family begin to be more affected by circumstellar extinction. The parameters found using optical or near-infrared wavelengths are still compatible with each other, but the error bars become larger. In stars showing the 1.53 μm feature, which are all large-amplitude variables, the effects of pulsation are strong and the spectra are poorly matched with hydrostatic models. For these, atmospheric parameters could not be derived reliably, and dynamical models are needed for proper interpretation.

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Diffusion of oxygen isotopes in thermally evolving planetesimals and size ranges of presolar silicate grains

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Presolar grains are small particles found in meteorites through their isotopic compositions which are considerably different from those of materials in the Solar System. If some isotopes in presolar grains diffused out beyond their grain sizes when they were embedded in parent bodies of meteorites, their isotopic compositions could be washed out, and hence the grains cannot be identified as presolar grains any more. We explore this possibility for the first time by self-consistently simulating the thermal evolution of planetesimals and the diffusion length of ^{18}O in presolar silicate grains. Our results show that presolar silicate grains smaller than ~ 0.03 μm cannot keep their original isotopic compositions even if the host planetesimals experienced maximum temperature as low as 600 °C. Since this temperature corresponds to the one experienced by petrologic type 3 chondrites, the isotopic diffusion can constrain the size of presolar silicate grains discovered in such chondrites to be larger than ~ 0.03 μm. We also find that the diffusion lengths of ^{18}O reach ~ 0.3–2 μm in planetesimals that were heated up to 700–800 °C. This indicates that, if the original size of presolar grains spans a range from ~ 0.001 μm to ~ 0.3 μm like that in the interstellar medium, the isotopic records of the presolar grains may be almost completely lost in such highly thermalized parent bodies. We propose that isotopic diffusion could be a key process to control the size distribution and abundance of presolar grains in some types of chondrites.

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The VLTI/MIDI view on the inner mass loss of evolved stars from the *Herschel* MESS sample

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Context: The mass-loss process from evolved stars is a key ingredient for our understanding of many fields of astrophysics, including stellar evolution and the chemical enrichment of the interstellar medium (ISM) via stellar yields. Nevertheless, many questions are still unsolved, one of which is the geometry of the mass-loss process.
Aims: Taking advantage of the results from the *Herschel* Mass loss of Evolved StarS (MESS) programme, we initiated a coordinated effort to characterise the geometry of mass loss from evolved red giants at various spatial scales.
Methods: For this purpose we used the MID-infrared interferometric Instrument (MIDI) to resolve the inner envelope of 14 asymptotic giant branch stars (AGBs) in the MESS sample. In this contribution we present an overview of the interferometric data collected within the frame of our Large Programme, and we also add archive data for completeness. We studied the geometry of the inner atmosphere by comparing the observations with predictions from different geometric models.
Results: Asymmetries are detected for the following five stars: R Leo, RT Vir, π^1 Gruis, o Ori, and R Crt. All the objects are O-rich or S-type, suggesting that asymmetries in the N band are more common among stars with such chemistry. We speculate that this fact is related to the characteristics of the dust grains. Except for one star, no interferometric variability is detected, i.e. the changes in size of the shells of non-mira stars correspond to changes of the visibility of less than 10%. The observed spectral variability confirms previous findings from the literature. The detection of dust in our sample follows the location of the AGBs in the IRAS colour–colour diagram: more dust is detected around oxygen-rich stars in region II and in the carbon stars in region VII. The SiC dust feature does not appear in the visibility spectrum of the U Ant and S Sct, which are two carbon stars with detached shells. This finding has implications for the theory of SiC dust formation.

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SOFIA–EXES mid-IR observations of [Fe II] emission from the extended atmosphere of Betelgeuse

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We present a NASA–DLR SOFIA–Échelon Cross Echelle Spectrograph (EXES) and NASA Infrared Telescope Facility–Texas Échelon Cross Échelle Spectrograph (TEXES) mid-IR $R \simeq 50\,000$ spectral study of forbidden Fe II transitions in the early-type M supergiants, Betelgeuse (α Ori: M2 Iab) and Antares (α Sco: M1 Iab + B3 V). With EXES, we spectrally resolve the ground term [Fe II] 25.99 μm (a $^6\mathrm{D}_{J=7/2-9/2}$: $E_{\rm up} = 554$ K) emission from Betelgeuse. We find a small centroid blueshift of 1.9 ± 0.4 km s^{-1} that is a significant fraction (20%) of the current epoch wind speed, with a FWHM of 14.3 ± 0.1 km s^{-1}. The TEXES observations of [Fe II] 17.94 μm (a $^4\mathrm{F}_{J=7/2-9/2}$: $E_{\rm up} = 3\,496$ K) show a broader FWHM of 19.1 ± 0.2 km s^{-1}, consistent with previous observations, and a small redshift of 1.6 ± 0.6 km s^{-1} with respect to the adopted stellar center-of-mass velocity of $v_{\rm CoM} = 20.9 \pm 0.3$ km s^{-1}. To produce [Fe II] 25.99 μm blueshifts of 20% wind speed requires that the emission arises closer to the star than existing thermal models for α Ori's circumstellar envelope predict. This implies a more rapid wind cooling to below 500 K within 10 R_* ($\phi = 44$ mas, $d = 200$ pc) of the star, where the wind has also reached a significant fraction of the maximum wind speed. The line width is consistent with the turbulence in the outflow being close to the hydrogen sound speed. EXES observations of [Fe II] 22.90 μm (a $^4\mathrm{D}_{J=5/2-7/2}$: $E_{\rm up} = 12\,073$ K) reveal no emission from either star. These findings confirm the dominance of cool plasma in the mixed region where hot chromospheric plasma emits copiously in the UV, and they also constrain the wind heating produced by the poorly understood mechanisms that drive stellar outflows from these low variability and weak-dust signature stars.

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Experimental and theoretical oscillator strengths of Mg I for accurate abundance analysis

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Context: With the aid of stellar abundance analysis, it is possible to study the galactic formation and evolution. Magnesium is an important element to trace the α-element evolution in our Galaxy. For chemical abundance analysis, such as magnesium abundance, accurate and complete atomic data are essential. Inaccurate atomic data lead to uncertain abundances and prevent discrimination between different evolution models.
Aims: We study the spectrum of neutral magnesium from laboratory measurements and theoretical calculations. Our aim is to improve the oscillator strengths (f-values) of Mg I lines and to create a complete set of accurate atomic data, particularly for the near-IR region.
Methods: We derived oscillator strengths by combining the experimental branching fractions with radiative lifetimes reported in the literature and computed in this work. A hollow cathode discharge lamp was used to produce free atoms in the plasma and a Fourier transform spectrometer recorded the intensity-calibrated high-resolution spectra. In addition, we performed theoretical calculations using the multiconfiguration Hartree–Fock program ATSP2K.
Results: This project provides a set of experimental and theoretical oscillator strengths. We derived 34 experimental oscillator strengths. Except from the Mg I optical triplet lines (3p $^3\mathrm{P}^o_{0,1,2}$–4s $^3\mathrm{S}_1$), these oscillator strengths are

measured for the first time. The theoretical oscillator strengths are in very good agreement with the experimental data and complement the missing transitions of the experimental data up to $n = 7$ from even and odd parity terms. We present an evaluated set of oscillator strengths, gf, with uncertainties as small as 5%. The new values of the Mg I optical triplet line (3p $^3\mathrm{P}^o_{0,1,2}$–4s $^3\mathrm{S}_1$) oscillator strength values are ~ 0.08 dex larger than the previous measurements.

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Aperture synthesis imaging of the carbon AGB star R Sculptoris: Detection of a complex structure and a dominating spot on the stellar disk

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We present near-infrared interferometry of the carbon-rich asymptotic giant branch (AGB) star R Sculptoris (R Scl). We employ medium spectral resolution K-band interferometry obtained with the instrument AMBER at the Very Large Telescope Interferometer (VLTI) and H-band low spectral resolution interferometric imaging observations obtained with the VLTI instrument PIONIER. We compare our data to a recent grid of dynamic atmosphere and wind models. We compare derived fundamental parameters to stellar evolution models. The visibility data indicate a broadly circular resolved stellar disk with a complex substructure. The observed AMBER squared visibility values show drops at the positions of CO and CN bands, indicating that these lines form in extended layers above the photosphere. The AMBER visibility values are best fit by a model without a wind. The PIONIER data are consistent with the same model. We obtain a Rosseland angular diameter of 8.9 ± 0.3 mas, corresponding to a Rosseland radius of 355 ± 55 R$_\odot$, an effective temperature of 2640 ± 80 K, and a luminosity of $\log L/\mathrm{L}_\odot = 3.74 \pm 0.18$. These parameters match evolutionary tracks of initial mass 1.5 ± 0.5 M$_\odot$ and current mass 1.3 ± 0.7 M$_\odot$. The reconstructed PIONIER images exhibit a complex structure within the stellar disk including a dominant bright spot located at the western part of the stellar disk. The spot has an H-band peak intensity of 40% to 60% above the average intensity of the limb-darkening-corrected stellar disk. The contrast between the minimum and maximum intensity on the stellar disk is about 1:2.5. Our observations are broadly consistent with predictions by dynamic atmosphere and wind models, although models with wind appear to have a circumstellar envelope that is too extended compared to our observations. The detected complex structure within the stellar disk is most likely caused by giant convection cells, resulting in large-scale shock fronts, and their effects on clumpy molecule and dust formation seen against the photosphere at distances of 2–3 stellar radii.

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Mid-infrared spectroscopic observations of the dust-forming classical nova V2676 Oph

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The dust-forming nova V2676 Oph is unique in that it was the first nova to provide evidence of C_2 and CN molecules during its near-maximum phase and evidence of CO molecules during its early decline phase. Observations of this nova have revealed the slow evolution of its lightcurves and have also shown low isotopic ratios of carbon ($^{12}C/^{13}C$) and nitrogen ($^{14}N/^{15}N$) in its envelope. These behaviors indicate that the white dwarf (WD) star hosting V2676 Oph is a CO-rich WD rather than an ONe-rich WD (typically larger in mass than the former). We performed mid-infrared spectroscopic and photometric observations of V2676 Oph in 2013 and 2014 (respectively 452 and 782 days after its discovery). No significant [Ne II] emission at 12.8 μm was detected at either epoch. These provided evidence for a CO-rich WD star hosting V2676 Oph. Both carbon-rich and oxygen-rich grains were detected in addition to an unidentified infrared feature at 11.4 μm originating from polycyclic aromatic hydrocarbon molecules or hydrogenated amorphous carbon grains in the envelope of V2676 Oph.

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The kinematics of the permitted C II λ6578 line in a large sample of planetary nebulæ

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We present spectroscopic observations of the C II λ6578 permitted line for 83 lines of sight in 76 planetary nebulæ at high spectral resolution, most of them obtained with the Manchester Échelle Spectrograph on the 2.1-m telescope at the Observatorio Astronómico Nacional on the Sierra San Pedro Mártir. We study the kinematics of the C II λ6578 permitted line with respect to other permitted and collisionally-excited lines. Statistically, we find that the kinematics of the C II λ6578 line are not those expected if this line arises from the recombination of C^{2+} ions or the fluorescence of C^+ ions in ionization equilibrium in a chemically-homogeneous nebular plasma, but instead its kinematics are those appropriate for a volume more internal than expected. The planetary nebulæ in this sample have well-defined morphology and are restricted to a limited range in Hα line widths (no large values) compared to their counterparts in the Milky Way bulge, both of which could be interpreted as the result of young nebular shells, an inference that is also supported by nebular modeling. Concerning the long-standing discrepancy between chemical abundances inferred from permitted and collisionally-excited emission lines in photoionized nebulæ, our results imply that multiple plasma components occur commonly in planetary nebulæ.

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The population of planetary nebulæ near the Galactic centre: chemical abundances

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Planetary nebulæ (PNe) constitute an important tool to study the chemical evolution of the Milky Way and other galaxies, probing the nucleosynthesis processes, abundance gradients and the chemical enrichment of the interstellar medium. In particular, Galactic bulge PNe (GBPNe) have been extensively used in the literature to study the chemical properties of this Galactic structure. However, the presently available GBPNe chemical composition studies are strongly biased, since they were focused on brighter objects, predominantly located in Galactic regions of low interstellar reddening. In this work, we report physical parameters and abundances derived for a sample of 17 high extinction PNe located in the inner 2° of 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 faint objects, providing chemical compositions for PNe located in this region of the bulge and an estimation for the masses of their progenitors to explore the chemical enrichment history of the central region of the Galactic bulge. The results show that there is an enhancement in the N/O abundance ratio in the Galactic centre PNe compared with PNe located in the outer regions of the Galactic bulge. This may indicate recent episodes of star formation occurring near the Galactic centre.

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Water isotopologues in the circumstellar envelopes of M-type AGB stars

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Aims: In this study we examine rotational emission lines of two isotopologues of water: $H_2^{17}O$ and $H_2^{18}O$. By determining the abundances of these molecules, we aim to use the derived isotopologue – and hence oxygen isotope – ratios to put constraints on the masses of a sample of M-type AGB stars that have not been classified as OH/IR stars.
Methods: We use detailed radiative transfer analysis based on the accelerated lambda iteration method to model the circumstellar molecular line emission of $H_2^{17}O$ and $H_2^{18}O$ for IK Tau, R Dor, W Hya, and R Cas. The emission lines used to constrain our models come from *Herschel*/HIFI and *Herschel*/PACS observations and are all optically thick, meaning that full radiative transfer analysis is the only viable method of estimating molecular abundance ratios.
Results: We find generally low values of the $^{17}O/^{18}O$ ratio for our sample, ranging from 0.15 to 0.69. This correlates with relatively low initial masses, in the range ~ 1.0 to 1.5 $M_\odot$ for each source, based on stellar evolutionary models. We also find ortho-to-para ratios close to 3, which are expected from warm formation predictions.
Conclusions: The $^{17}O/^{18}O$ ratios found for this sample are at the lower end of the range predicted by stellar evolutionary models, indicating that the sample chosen had relatively low initial masses.

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Recurring OH flares towards o Ceti: I. location and structure of the 1990s' and 2010s' events

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We present the analysis of the onset of the new 2010s' OH flaring event detected in the OH ground-state main line at 1665 MHz towards o Ceti and compare its characteristics with those of the 1990s' flaring event. This is based on a series of complementary single-dish and interferometric observations both in OH and H_2O obtained with the Nançay Radio telescope (NRT), the Medicina and Effelsberg Telescopes, the European VLBI Network (EVN), and (e)Multi-Element Radio Linked Interferometer Network ((e)MERLIN). We compare the overall characteristics of o Ceti's flaring events with those which have been observed towards other thin-shell Miras, and explore the implication of these events with respect to the standard OH circumstellar-envelope model. The role of binarity in the specific characteristics of o Ceti's flaring events is also investigated. The flaring regions are found to be less than $\sim 400 \pm 40$ mas (i.e., $\sim 40 \pm 4$ au) either side of o Ceti, with seemingly no preferential location with respect to the direction to the companion Mira B. Contrary to the usual expectation that the OH maser zone is located outside the H_2O maser zone, the coincidence of the H_2O and OH maser velocities suggests that both emissions arise at similar distances from the star. The OH flaring characteristics of Mira are similar to those observed in various Mira variables before, supporting the earlier results that the regions where the transient OH maser emission occurs are different from the standard OH maser zone.

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Investigation of faint carbon stars from the first Byurakan spectral sky survey. III. Infra-red characteristics

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Infra-Red (IR) astronomical databases, namely, IRAS, 2MASS, WISE, and *Spitzer*, are used to analyse photometric data of 126 carbon (C) stars whose spectra are visible in the First Byurakan Survey (FBS) low-resolution (lr) spectral plates. Among these, six new objects, recently confirmed on the digitized FBS plates, are included. For three of them, moderate-resolution CCD optical spectra are also presented. In this work several IR color–color diagrams are studied. Early and late-type C stars are separated in the JHK Near-Infra-Red (NIR) color–color plots, as well as in the WISE W3–W4 versus W1–W2 diagram. Late N-type Asymptotic Giant Branch (AGB) stars are redder in W1–W2, while early-types (CH and R giants) are redder in W3–W4 as expected. Objects with $W2 - W3 > 1.0$ mag. show double-peaked spectral energy distribution (SED), indicating the existence of the circumstellar envelopes around them. 26 N-type stars have IRAS Point Source Catalog (PSC) associations. For FBS 1812+455 IRAS Low-Resolution Spectra (LRS) in the wavelength range 7.7–22.6 μm and *Spitzer* Space Telescope Spectra in the range 5–38 μm are presented clearly showing absorption features of C_2H_2 (acetylene) molecule at 7.5 and 13.7 μm, and the SiC (silicon carbide) emission at 11.3 μm. The mass-loss rates for eight Mira-type variables are derived from the K–[12] color and from the pulsation periods. The reddest object among the targets is N-type C star FBS 2213+421, which belong to the group of the cold post-AGB R Coronæ Borealis (R CrB) variables.

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Population synthesis to constrain Galactic and stellar physics. I. Determining age and mass of thin-disc red-giant stars

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Context: The cornerstone mission of the European Space Agency, Gaia, together with forthcoming complementary surveys (CoRoT, *Kepler*, K2, APOGEE and Gaia–ESO), will revolutionize our understanding of the formation and history of our Galaxy, providing accurate stellar masses, radii, ages, distances, as well as chemical properties for a very large sample of stars across different Galactic stellar populations.
Aims: Using an improved population synthesis approach and new stellar evolution models we attempt to evaluate the possibility of deriving ages and masses of clump stars from their chemical properties.
Methods: A new version of the Besançon Galaxy model (BGM) is used in which new stellar evolutionary tracks are computed from the stellar evolution code STAREVOL. These provide global, chemical and seismic properties of stars from the pre-main sequence to the early-AGB. For the first time, the BGM can explore the effects of an extra-mixing occurring in red-giant stars. In particular we focus on the effects of thermohaline instability on chemical properties as well as on the determination of stellar ages and masses using the surface [C/N] abundance ratio.
Results: The impact of extra-mixing on ^{3}He, carbon isotopic ratio, nitrogen, and [C/N] abundances along the giant branch is quantified. We underline the crucial contribution of asteroseismology to discriminate between evolutionary states of field giants belonging to the Galactic disc. The inclusion of thermohaline instability has a significant impact on ^{12}C/^{13}C, ^{3}He as well as on the [C/N] values. We clearly show the efficiency of thermohaline mixing at different metallicities and its influence on the determined stellar mass and age from the observed [C/N] ratio. We then propose simple relations to determine ages and masses from chemical abundances according to these models.
Conclusions: We emphasize the usefulness of population synthesis tools to test stellar models and transport processes inside stars. We show that transport processes occurring in red-giant stars should be taken into account in the determination of ages for future Galactic archæology studies.

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Absence of an X-shaped structure in the Milky Way bulge using Mira variable stars

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The stellar density distribution of the bulge is analyzed through one of its tracers. We use oxygen-rich Miras variables from the Catchpole et al. (2016) survey and OGLE-III survey as standard candles. The average age of these stars is around 9 Gyr. The population traced by Mira variables matches a boxy bulge prediction, not an X-shaped one, because only one peak is observed in the density along the analysed lines of sight, whereas the prediction of an X-shape gives two clear peaks.

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Tidal distortion of the envelope of an AGB star IRS 3 near Sgr A*

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We present radio and mm continuum observations of the Galactic center taken with the VLA and ALMA at 44 and 226 GHz, respectively. We detect radio and mm emission from IRS 3, lying $\sim 4''.5$ NW of Sgr A*, with a spectrum that is consistent with the photospheric emission from an AGB star at the Galactic center. Millimeter images reveal that the envelope of IRS 3, the brightest and most extended 3.8-μm Galactic center stellar source, consists of two semi-circular dust shells facing the direction of Sgr A*. The outer circumstellar shell at the distance of 1.6×10^4 au, appears to break up into "fingers" of dust directed toward Sgr A*. These features coincide with molecular CS (5–4) emission and a near-IR extinction cloud distributed between IRS 3 and Sgr A*. The NE-SW asymmetric shape of the IRS 3 shells seen at 3.8 μm and radio are interpreted as structures that are tidally distorted by Sgr A*. Using the kinematics of CS emission and the proper motion of IRS 3, the tidally distorted outflowing material from the envelope after 5000 years constrains the distance of IRS 3 to ~ 0.7 pc in front of or ~ 0.5 pc behind Sgr A*. This suggests that the mass loss by stars near Sgr A* can supply a reservoir of molecular material near Sgr A*. We also present dark features in radio continuum images coincident with the envelope of IRS 3. These dusty stars provide examples in which high resolution radio continuum images can identify dust enshrouded stellar sources embedded an ionized medium.

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Deep into the Water Fountains: The case of IRAS 18043−2116

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The formation of large-scale (hundreds to a few thousands of au) bipolar structures in the circumstellar envelopes (CSEs) of post-asymptotic giant branch (post-AGB) stars is poorly understood. The shape of these structures, which is traced by emission from fast molecular outflows, suggests that the dynamics at the innermost regions of these CSEs does not depend only on the energy of the radiation field of the central star. Multi-frequency observations toward a group of post-AGB sources known as Water Fountain (WF) nebulæ can help to constrain the nature of the mechanism responsible for the launching and collimation of the fast molecular outlflows traced by high-velocity features of H_2O maser emission. Deep into the Water Fountains is an observational project based on the results of programs carried out with three telescope facilities: the Karl G. Jansky Very Large Array (JVLA), the Australia Telescope Compact Array (ATCA), and the Very Large Telescope (SINFONI-VLT). Here we report the results of the observations toward the WF nebula IRAS 18043−2116: detection of radio continuum emission in the frequency range 1.5–8.0 GHz, H_2O maser spectral features and radio continuum emission detected at 22 GHz, and H_2 ro-vibrational emission lines detected at the near infrared. The high-velocity H_2O maser spectral features and the shock-excited H_2 emission could be produced in molecular layers that are swept up as a consequence of the propagation of a jet-driven wind. Using the derived H_2 column density, we estimated a molecular mass-loss rate of the order on 10^{-9} M$_\odot$ yr^{-1}. On the other hand, if the radio continuum flux is generated as a consequence of the propagation of a thermal radio jet, the mass-loss rate associated with the outflowing ionized material is on the order of 10^{-5} M$_\odot$ yr^{-1}. A rotating disk could be a plausible explanation for the mass-loss rates we estimated.

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Growth of carbon chains in IRC +10°216 mapped with ALMA

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Linear carbon chains are common in various types of astronomical molecular sources. Possible formation mechanisms involve both bottom-up and top-down routes. We have carried out a combined observational and modeling study of the formation of carbon chains in the C-star envelope IRC +10°216, where the polymerization of acetylene and hydrogen cyanide induced by ultraviolet photons can drive the formation of linear carbon chains of increasing length. We have used ALMA to map the emission of 3 mm rotational lines of the hydrocarbon radicals C_2H, C_4H, and C_6H, and the CN-containing species CN, C_3N, HC_3N, and HC_5N with an angular resolution of 1″. The spatial distribution of all these species is a hollow, 5–10″ wide, spherical shell located at a radius of 10–20″ from the star, with no appreciable emission close to the star. Our observations resolve the broad shell of carbon chains into thinner sub-shells which are 1–2″ wide and not fully concentric, indicating that the mass loss process has been discontinuous and not fully isotropic. The radial distributions of the species mapped reveal subtle differences: while the hydrocarbon radicals have very similar radial distributions, the CN-containing species show more diverse distributions, with HC_3N appearing earlier in the expansion and the radical CN extending later than the rest of the species. The observed morphology can be rationalized by a chemical model in which the growth of polyynes is mainly produced by rapid gas-phase chemical reactions of C_2H and C_4H radicals with unsaturated hydrocarbons, while cyanopolyynes are mainly formed from polyynes in gas-phase reactions with CN and C_3N radicals.

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AGB and SAGB stars: modelling dust production at solar metallicity

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We present dust yields for asymptotic giant branch (AGB) and super-asymptotic giant branch (SAGB) stars of solar metallicity. Stars with initial mass 1.5 $M_\odot \leq M_{\rm ini} \leq 3$ $M_\odot$ reach the carbon star stage during the AGB phase and produce mainly solid carbon and SiC. The size and the amount of the carbon particles formed follows a positive trend with the mass of the star; the carbon grains with the largest size ($a_{\rm C} \sim 0.2$ μm) are produced by AGB stars with $M_{\rm ini} = 2.5$–3 $M_\odot$, as these stars are those achieving the largest enrichment of carbon in the surface regions. The size of SiC grains, being sensitive to the surface silicon abundance, keeps around $a_{\rm SiC} \sim 0.1$ μm. The mass of carbonaceous dust formed is in the range 10^{-4}–5×10^{-3} $M_\odot$, whereas the amount of SiC produced is 2×10^{-4}–10^{-3} $M_\odot$. Massive AGB/SAGB stars with $M_{\rm ini} > 3$ $M_\odot$ experience HBB, that inhibits formation of carbon stars. The most relevant dust species formed in these stars are silicates and alumina dust, with grain sizes in the range 0.1 μm $< a_{\rm ol} < 0.15$ μm and $a_{\rm Al_2O_3} \sim 0.07$ μm, respectively. The mass of silicates produced spans the interval 3.4×10^{-3} $M_\odot \leq M_{\rm dust} \leq 1.1 \times 10^{-2}$ $M_\odot$ and increases with the initial mass of the star.

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Origin of meteoritic stardust unveiled by a revised proton-capture rate of ^{17}O

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Stardust grains recovered from meteorites provide high-precision snapshots of the isotopic composition of the stellar environment in which they formed. Attributing their origin to specific types of stars, however, often proves difficult. Intermediate-mass stars of 4–8 $M_{\odot}$ are expected to contribute a large fraction of meteoritic stardust. However, no grains have been found with characteristic isotopic compositions expected from such stars. This is a long-standing puzzle, which points to serious gaps in our understanding of the lifecycle of stars and dust in our Galaxy. Here we show that the increased proton-capture rate of ^{17}O reported by a recent underground experiment leads to ^{17}O/^{16}O isotopic ratios that match those observed in a population of stardust grains, for proton-burning temperatures of 60–80 million K. These temperatures are indeed achieved at the base of the convective envelope during the late evolution of intermediate-mass stars of 4–8 $M_{\odot}$, which reveals them as the most likely site of origin of the grains. This result provides the first direct evidence that these stars contributed to the dust inventory from which the Solar System formed.

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Abundances in photoionized nebulæ of the Local Group and nucleosynthesis of intermediate mass stars

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Photoionized nebulæ, comprising H II regions and planetary nebulæ, are excellent laboratories to investigate the nucleosynthesis and chemical evolution of several elements in the Galaxy and other galaxies of the Local Group. Our purpose in this investigation is threefold: (i) compare the abundances of H II regions and planetary nebulæ in each system in order to investigate the differences derived from the age and origin of these objects, (ii) compare the chemical evolution in different systems, such as the Milky Way, the Magellanic Clouds, and other galaxies of the Local Group, and (iii) investigate to what extent the nucleosynthesis contributions from the progenitor stars affect the observed abundances in planetary nebulæ, which constrains the nucleosynthesis of intermediate mass stars. We show that all objects in the samples present similar trends concerning distance-independent correlations, and some constraints can be defined on the production of He and N by the PN progenitor stars.

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Available from https://arxiv.org/abs/1702.03721
and from http://www.astro.iag.usp.br/∼maciel/research/research.html

Conference Papers

O VI 6830Å imaging polarimetry of symbiotic stars

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I present here the first results from an ongoing pilot project with the 1.6 m telescope at the OPD, Brasil, aimed at the detection of the O VI λ6830 line via linear polarization in symbiotic stars. The main goal is to demonstrate that O VI imaging polarimetry is an efficient technique for discovering new symbiotic stars. The O VI λ6830 line is found in 5 out of 9 known symbiotic stars, in which the O VI line has already been spectroscopically confirmed, with at least 3-σ detection. Three new symbiotic star candidates have also been found.

Poster contribution, published in "Accretion processes in Symbiotic Stars and Related Objects, First Chile–Korea–Gemini workshop on stellar astrophysics", La Serena, Chile, 2016
Available from https://arxiv.org/abs/1701.08898

Reclassifying symbiotic stars with 2MASS and WISE: an atlas of spectral energy distributions

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We present a new updated catalogue of Galactic and extragalactic symbiotic stars (SySts). Since the last catalogue of SySts (Belczynski et al. 2000), the number of known SySts has significantly increased. Our new catalogue contains 316 known and 82 candidates SySts. Of the confirmed Systs 252 are located in our Galaxy and 64 in nearby galaxies. This reflects an increase of $\sim 50\%$ in the population of Galactic SySts and $\sim 400\%$ in the population of extragalactic SySts. The spectral energy distributions (SEDs) of 334 (known and candidates) SySts have been constructed using the 2MASS and WISE data. These SEDs are used to provide a robust reclassification in scheme of S- (74%), D- (15%) and D′-types (2.5%). The SEDs of S- and D-type peak between 0.8 and 1.6 μm and between 1.6 and 4 μm, respectively, whereas those of D′-type exhibit a plateau profile. Moreover, we provide the first compilation of SySts that exhibit the O VI Raman-scattered line at 6830Å. Our analysis shows that 55% of the Galactic SySts exhibit that line in their spectrum, whereas this percentage is different from galaxy to galaxy.

Oral contribution, published in "Accretion processes in Symbiotic Stars and Related Objects, First Chile–Korea–Gemini workshop in stellar astrophysics", La Serena, Chile, 2016
Available from https://arxiv.org/abs/1701.08894

Mass transfer in asymptotic-giant-branch binary systems

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Binary stars can interact via mass transfer when one member (the primary) ascends onto a giant branch. The amount of gas ejected by the binary and the amount of gas accreted by the secondary over the lifetime of the primary influence

the subsequent binary phenomenology. Some of the gas ejected by the binary will remain gravitationally bound and its distribution will be closely related to the formation of planetary nebulæ. We investigate the nature of mass transfer in binary systems containing an AGB star by adding radiative transfer to the AstroBEAR AMR Hydro/MHD code.

Poster contribution, published in IAUS 323
Available from https://arxiv.org/abs/1701.08764

Impacts of nuclear-physics uncertainty in stellar temperatures on the s-process nucleosynthesis

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We evaluated the uncertainty relevant to s-process nucleosynthesis using a Monte-Carlo centred approach. We are based on a realistic and general prescription of temperature dependent uncertainty for the reactions. We considered massive stars for the weak s-process and AGB stars for the main s-process. We found that the adopted uncertainty for (n,γ) rates, tens of per cent on average, affect the production of s-process nuclei along the β-stability line, while for β-decay, for which contributions from excited states enhances the uncertainty, has the strongest impact on branching points.

Poster contribution, published in "The 14$^{\text{th}}$ International Symposium on Nuclei in the Cosmos (NIC-XIV)"
Available from https://arxiv.org/abs/1701.06978

Improving the determination of chemical abundances in planetary nebulæ

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Planetary nebulæ are the products of the evolution of low and intermediate mass stars. The chemical property studies of these objects give important information about the elemental abundances as He, O, Ne, Ar, S and their modifications associated with the evolution of the progenitor stars. The determination of accurate abundances in planetary nebulæ is important from the perspective of the stellar evolution as well as the formation and chemical evolution of galaxies. Recently, new He I emissivities and ionization correction factors (ICFs) were published in the literature. In this work, these new parameters are used in a code for the determination of chemical abundances in photoionized nebulæ. This code is used for the recompilation of the chemical abundances of planetary nebulæ from the Galactic bulge observed previously by our group and also for the determination of new chemical abundances of a sample of planetary nebulæ located near the Galactic centre. The new emissivities and ICFs slightly modified the elemental abundances of He, N, O, Ar and Ne. On the other hand, S abundances are higher than previous determinations. The new ICFs can contribute to solve partially the sulphur anomaly.

Oral contribution, published in "Chemical abundances in ionised nebulæ" held in Campos do Jordão, Brazil between 3–5 November 2016. To be published in BAAA, eds. G. Hägele, M. Cardaci & E. Pérez-Montero
Available from https://arxiv.org/abs/1612.03672

Spitzer observations of large amplitude variables in the LMC and IC 1613

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The 3.6 and 4.5 μm characteristics of AGB variables in the LMC and IC 1613 are discussed. For C-rich Mira variables there is a very clear period–luminosity–colour relation, where the [3.6]–[4.5] colour is associated with the amount of circumstellar material and correlated with the pulsation amplitude. The [4.5] period–luminosity relation for dusty stars is approximately one mag brighter than for their naked counterparts with comparable periods.

Oral contribution, published in "Wide-Field Variability Surveys: A 21$^{\rm st}$ Century Perspective"
Available from https://arxiv.org/abs/1702.06797

Stellar yields and abundances: new directions from planetary nebulæ

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Planetary nebulæ retain the signature of the nucleosynthesis and mixing events that occurred during the previous AGB phase. Observational signatures complement observations of AGB and post-AGB stars and their binary companions. The abundances of the elements heavier than iron such as Kr and Xe in planetary nebulae can be used to complement abundances of Sr/Y/Zr and Ba/La/Ce in AGB stars, respectively, to determine the operation of the slow neutron-capture process (the *s* process) in AGB stars. Additionally, observations of the Rb abundance in Type I planetary nebulæ may allow us to infer the initial mass of the central star. Several noble gas components present in meteoritic stardust silicon carbide (SiC) grains are associated with implantation into the dust grains in the high-energy environment connected to the fast winds from the central stars during the planetary nebulæ phase.

Oral contribution, published in IAU Symposium No. 323 "Planetary nebulæ: Multi-wavelength probes of stellar and galactic evolution", 2016, eds. X. Liu, L. Stanghellini & A.I. Karakas
Available from https://arxiv.org/abs/1703.00280

Review Papers

Cosmic Dust VIII

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When grazing up at a night sky, we may find it filled with a wide variety of unique and interesting dusty phenomena at stars, nebulae, clouds, and planetary systems. However, no matter how long we look into such a phenomenon, it is only a blink of an eye on a timescale of the entire life of cosmic dust. To understand the whole life cycle of the dust, we need to unravel the deep mystery of dust coming out of evolved stars, traveling between different phases of the interstellar medium, dying out at protostars, reviving around young stars, and finally seeding into planetary systems. Solving this mystery is a serious challenge whereof scientists from all over the world are working continuously and sharing a common interest. This is the ultimate goal, for which observers, theorists, and experimentalists have to work hand in hand with each other and need to combine their activities and studies for the optimal success. The annual Cosmic Dust meeting provides an ideal platform for scientists tackling cosmic dust problems in a wide range of disciplines to meet each other and intensively discuss their recent results and developments in this field. This meeting started in 2006 as a session called "Cosmic Dust" of the 3$^{\text{rd}}$ AOGS (Asia–Oceania Geosciences Society) annual meeting in Singapore, but detached itself from the AOGS since 2012. We have successfully kept organizing this series of Cosmic Dust meetings in a relaxing atmosphere with an excellent choice of speakers until today owing to our extraordinary enthusiasms about the development of cosmic dust research. The Cosmic Dust meeting features the coziness, ending up with grandiose contributions by a great number of top scientists from all around the world, which made the meeting a striking success.

Published in "Cosmic Dust VIII"
Available from https://arxiv.org/abs/1701.01431
and from http://dx.doi.org/10.1016/j.pss.2016.09.002

Post-AGB nebular studies

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This review presents the latest advances in the nebular studies of post-AGB objects. Post-AGB stars are great tools to test nucleosynthesis and evolution models for stars of low and intermediate masses, and the evolution of dust in harsh environment. I will present the newly discovered class of post-RGB stars, formed via binary interaction on the RGB. Binary systems can also lead to the formation of two class of aspherical post-AGB, the Proto-Planetary Nebulæ and the naked post-AGBs (dusty RV Taus , a.k.a. Van Winckel's stars).

Published in IAU symposium 323 "Planetary Nebulæ: Multi-Wavelength Probes of Stellar and Galactic Evolution" (Invited Review)
Available from https://arxiv.org/abs/1701.04324

White dwarf stars

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White dwarf stars are the final stage of most stars, born single or in multiple systems. We discuss the identification, magnetic fields, and mass distribution for white dwarfs detected from spectra obtained by the Sloan Digital Sky Survey up to Data Release 13 in 2016,which lead to the increase in the number of spectroscopically identified white dwarf stars from 5 000 to 39 000. This number includes only white dwarf stars with $\log g > 6.5$, i.e., excluding the Extremely Low Mass white dwarfs, which are necessarily the byproduct of stellar interaction.

Published in International Journal of Modern Physics Conference Series
Available from https://arxiv.org/abs/1702.01134

Announcements

Guillermo Haro advanced school on modelling the ionized universe

The Guillermo Haro advanced school on modelling the ionized universe will be held at INAOE (Instituto Nacional de Astrofísica, Óptica y Electrónica, Tonantzintla, Puebla, México) from July 3$^{\rm rd}$ to 14$^{\rm th}$, 2017. The school will provide a comprehensive, state-of-the-art, hands-on approach to the modelling of ionized gas in different environments, from AGB stars to active galactic nuclei, to an audience of up to 40 young researchers, mainly PhD students and postdocs. The first week will consist of a CLOUDY workshop led by Gary Ferland. The second week will delve further into the topics introduced during the first week, with lectures by Gloria Delgado-Inglada (IA–UNAM), Gary Ferland (University of Kentucky), Christophe Morisset (IA–UNAM), Hagai Netzer (Tel Aviv University), Manuel Peimbert (IA–UNAM), and Mónica Rodríguez (INAOE). The website has further details and instructions for applying for the School.

See also http://www.inaoep.mx/∼progharo/gh2017/index.php

The Physics of Evolved Stars: the impact of binarity
Nice, 10–13$^{\rm th}$ of July 2017

Dear colleagues,

We are organizing the second conference on the physics of evolved stars in Nice between 10–13$^{\rm th}$ of July 2017 (the first one occurred in 2015: poe2015.sciencesconf.org). We aim at focusing it on the role of binarity, be it for low-mass evolved stars (AGB, post-AGB, novæ, cataclysmic variables..), or for high-mass stars (RSG, WR, LBV, sgB[e] stars, post-interaction products...). The goal of the conference is to gather observer and theoreticians from both the low mass stars and massive stars communities. Ample discussion time is a key feature of this conference alongside breakout discussion session to trigger ideas/collaborations to tackle the main questions in the study of evolved stars.

We invite you to save the date, submit an abstract and come to the French rivièra to share your work with specialists of stellar physics during this conference. We foresee to link all the talks to the ADS instead of publishing proceedings.

Please visit our website – poe2017.sciencesconf.org, where we will post all the relevant information (registration, program, etc.). So please stay tuned!

Important dates to keep in mind are the following:

- Abstract submissions are now accepted
- 15 Feb: registration starts
- 30 Mar: deadline for abstract submission
- 15 Apr: talk/poster selection announcement
- 1 Jun: end of normal registration/ beginning of late registration
- 15 Jun: no more registration accepted
- 10 Jul: start of the conference

See also https://poe2017.sciencesconf.org/