THE AGB NEWSLETTER

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Editors: Jacco van Loon and Albert Zijlstra

Editorial

Dear Colleagues,

It is a pleasure to present you the 190th issue of the AGB Newsletter. Several works discuss the properties of grains formed in the outflows from cool red giant stars. Some other works discuss the presence of planets around red giant stars. AGB stars are also studied in their rôle as "actors", and used as "probes" of galaxy structure and evolution – stay tuned for the 2014 Vienna AGB meeting!

Magnetic fields are present wherever there is moving charge, i.e. essentially everywhere in the Universe. So why not consider spending a week in Biarritz discussing the topic with friends and colleagues? (See the announcement at the back of the Newsletter.)

In response to the Food for Thought of last month, Sakib Rasool suggests "To find the hidden history of AGB, go deep and find the imprint of the AGB mass loss in giant AGB haloes"; though we had been thinking about the history on longer timescales, many millions of years, perhaps billions, back to the main sequence even. For instance, some AGB stars will have descended from Ap stars, or maybe blue stragglers... (Reactions remain welcome!)

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

Editorially Yours,
Jacco van Loon and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

What happens to the gaseous and icy objects in the Solar system when the Sun becomes a red giant?

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

Refereed Journal Papers

Europium s-process signature at close-to-solar metallicity in stardust SiC grains from AGB stars

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Individual mainstream stardust silicon carbide (SiC) grains and a SiC-enriched bulk sample from the Murchison carbonaceous meteorite have been analyzed by the Sensitive High Resolution Ion Microprobe − Reverse Geometry (SHRIMP-RG) for Eu isotopes. The mainstream grains are believed to have condensed in the outflows of 1.5 to 3 $M_\odot$ carbon-rich asymptotic giant branch (AGB) stars with close-to-solar metallicity. The ^{151}Eu fractions [$fr(^{151}\mathrm{Eu}) = {}^{151}\mathrm{Eu}/(^{151}\mathrm{Eu} +^{153}\mathrm{Eu})$] derived from our measurements are compared with previous astronomical observations of carbon-enhanced metal-poor (CEMP) stars enriched in elements made by slow neutron captures (the s-process). Despite the difference in metallicity between the parent stars of the grains and the metal-poor stars, the $fr(^{151}\mathrm{Eu})$ values derived from our measurements agree well with $fr(^{151}\mathrm{Eu})$ values derived from astronomical observations. We have also compared the SiC data with theoretical predictions of the evolution of Eu isotopic ratios in the envelope of AGB stars. Because of the low Eu abundances in the SiC grains, the $fr(^{151}\mathrm{Eu})$ values derived from our measurements show large uncertainties, being in most cases larger than the difference between solar and predicted $fr(^{151}\mathrm{Eu})$ values. The SiC aggregate yields a $fr(^{151}\mathrm{Eu})$ value within the range observed in the single grains and provides a more precise result ($fr(^{151}\mathrm{Eu}) = 0.54 \pm 0.03$, 95 percent conf.), but is approximately 12 percent higher than current s-process predictions. The AGB models can match the SiC data if we use an improved formalism to evaluate the contribution of excited nuclear states in the calculation of the ^{151}Sm(n,g) stellar reaction rate.

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The metallicity signature of evolved stars with planets

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Context: Currently, the core accretion model has its strongest observational evidence on the chemical signature of mostly main sequence stars with planets.
Aims: We aim to test whether the well-established correlation between the metallicity of the star and the presence of giant planets found for main sequence stars still holds for the evolved and generally more massive giant and subgiant stars. Although several attempts have been made so far, the results are not conclusive since they are based on small or inhomogeneous samples.
Methods: We determine in a homogeneous way the metallicity and individual abundances of a large sample of evolved stars, with and without known planetary companions, and discuss their metallicity distribution and trends. Our methodology is based on the analysis of high-resolution échelle spectra ($R \geq 67,000$) from 2–3 meter class telescopes. It includes the calculation of the fundamental stellar parameters ($T_{\rm eff}$, $\log g$, microturbulent velocity, and metallicity) by applying iron ionisation and excitation equilibrium conditions to several isolated Fe I and Fe II lines, as well as, the

calculation of individual abundances of different elements such as Na, Mg, Si, Ca, Ti, Cr, Co, or Ni.
Results: The metallicity distributions show that giant stars hosting planets are not preferentially metal-rich having similar abundance patterns to giant stars without known planetary companions. We have found, however, a very strong relation between the metallicity distribution and the stellar mass within this sample. We show that while the less massive giant stars with planets ($M \leq 1.5$ M$_\odot$) are not metal rich, the metallicity of the sample of massive ($M > 1.5$ M$_\odot$), young (age < 2 Gyr) giant stars with planets is higher than that of a similar sample of stars without planets. Regarding other chemical elements, giant stars with and without planets in the mass domain $M \leq 1.5$ M$_\odot$ show similar abundance patterns. However, planet and non-planet hosts with masses $M > 1.5$ M$_\odot$ show differences in the abundances of some elements, specially Na, Co, and Ni. In addition, we find the sample of subgiant stars with planets to be metal rich, showing similar metallicities to main-sequence planet hosts.
Conclusions: While the metallicity distribution of planet-hosting subgiant stars and giant stars with stellar masses $M_\star > 1.5$ M$_\odot$ fits well in the predictions of current core-accretion models, the fact that giant planet hosts in the mass domain $M_\star \leq 1.5$ M$_\odot$ do not show metal enrichment is difficult to explain. Given that these stars have similar stellar parameters to subgiants and main-sequence planet hosts, the lack of the metal-rich signature in low-mass giants could be explained by a pollution scenario in the main sequence that gets erased as the star becomes fully convective. However, there is no physical reason why it should play a role for giants with masses $M_\star \leq 1.5$ M$_\odot$ yet not be observed for giants with $M_\star > 1.5$ M$_\odot$.

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Planetary Nebula Spectrograph survey of S0 galaxy kinematics. II. Clues to the origins of S0 galaxies

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The stellar kinematics of the spheroids and discs of S0 galaxies contain clues to their formation histories. Unfortunately, it is difficult to disentangle the two components and to recover their stellar kinematics in the faint outer parts of the galaxies using conventional absorption line spectroscopy. This paper therefore presents the stellar kinematics of six S0 galaxies derived from observations of planetary nebulæ (PNe), obtained using the Planetary Nebula Spectrograph. To separate the kinematics of the two components, we use a maximum-likelihood method that combines the discrete kinematic data with a photometric component decomposition. The results of this analysis reveal that: the discs of S0 galaxies are rotationally supported; however, the amount of random motion in these discs is systematically higher than in comparable spiral galaxies; and the S0s lie around one magnitude below the Tully–Fisher relation for spiral galaxies, while their spheroids lie nearly one magnitude above the Faber–Jackson relation for ellipticals. All of these findings are consistent with a scenario in which spirals are converted into S0s through a process of mild harassment or "pestering," with their discs somewhat heated and their spheroid somewhat enhanced by the conversion process. In such a scenario, one might expect the properties of S0s to depend on environment. We do not see such an effect in this fairly small sample, although any differences would be diluted by the fact that the current location does not necessarily reflect the environment in which the transformation occurred. Similar observations of larger samples probing a broader

range of environments, coupled with more detailed modelling of the transformation process to match the wide range of parameters that we have shown can now be measured, should take us from these first steps to the definitive answer as to how S0 galaxies form.

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Three-dimensional dust radiative transfer

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Cosmic dust is present in many astrophysical objects, and recent observations across the electromagnetic spectrum have revealed that the dust distribution is often strongly three-dimensional. Dust grains are effective in absorbing and scattering UV/optical radiation, and re-emit the absorbed energy at infrared wavelengths. Understanding the intrinsic properties of these objects, including the dust itself, therefore requires 3D dust radiative transfer calculations. Unfortunately, the 3D dust radiative transfer problem is non-local and non-linear, which makes it one of the hardest challenges in computational astrophysics. Nevertheless, significant progress has been made in the last decade, with an increasing number of codes capable of dealing with the complete 3D dust radiative transfer problem. We discuss the complexity of this problem, describe the two most successful solution techniques (Ray-Tracing and Monte Carlo), and discuss the state of the art in modeling observational data using 3D dust radiative transfer codes. We end with an outlook on the bright future of this field.

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Multiple outflows in the planetary nebula NGC 6058

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We present narrow-band [O III]λ5007 and Hα images, as well as long-slit high-resolution echelle spectra of the planetary nebula NGC 6058. Our data reveal that NGC 6058 is a multipolar planetary nebula of about $\simeq 45''$ in extent and formed by four bipolar outflows that are oriented at different position angles. Assuming homologous expansion for all the structures, and a distance of 3.5 kpc, we obtain polar velocities around $\simeq 68$ km s^{-1} for three of them. The estimated kinematical ages suggest that the three oldest outflows have been ejected in intervals of ~ 1100 and ~ 400 yr during which, the ejection axis has changes its orientation by $\sim 60°$ and $\sim 40°$, respectively. Although a inner ring-like structure is suggested by the direct images, its kinematics shows that no equatorial ring or toroid exists in the nebula. On the contrary, the long-slit spectra reveal that the ring-like structure corresponds to a fourth outflow that is oriented almost perpendicular to the other three. This fourth outflow is the youngest one and appears to be

interacting with the other three, creating a protruding zone that sweeps material in a region almost perpendicular to the major axes of the oldest outflows. This structure also presents two bright arcuate regions along the same direction of the older outflows, and at opposite sides from the central star. From our model, we suggest that NGC 6058 could be an intermediate evolutionary stage between starfish planetary nebulæ and multipolar planetary nebulæ with apparent equatorial lobes.

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Effect of metallicity on the evolution of the habitable zone from the pre-main sequence to the asymptotic giant branch and the search for life

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During the course of stellar evolution, the location and width of the habitable zone changes as the luminosity and radius of the star evolves. The duration of habitability for a planet located at a given distance from a star is greatly affected by the characteristics of the host star. A quantification of these effects can be used observationally in the search for life around nearby stars. The longer the duration of habitability, the more likely it is that life has evolved. The preparation of observational techniques aimed at detecting life would benefit from the scientific requirements deduced from the evolution of the habitable zone. We present a study of the evolution of the habitable zone around stars of 1, 1.5, and 2 $M_\odot$ for metallicities ranging from a $Z = 0.0001$ to $Z = 0.070$. We also consider the evolution of the habitable zone from the pre-main sequence until the asymptotic giant branch is reached. We find that metallicity strongly affects the duration of the habitable zone for a planet as well as the distance from the host star where the duration is maximized. For a 1 $M_\odot$ star with near Solar metallicity, $Z = 0.017$, the duration of the habitable zone is > 10 Gyr at distances 1.2 to 2 au from the star, whereas the duration is > 20 Gyr for high metallicity stars ($Z = 0.070$) at distances of 0.7 to 1.8 au, and ~ 4 Gyr at distances of 1.8 to 3.3 au for low metallicity stars ($Z = 0.0001$). Corresponding results have been obtained for stars of 1.5 and 2 $M_\odot$.

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Deriving stellar effective temperatures of metal-poor stars with the excitation potential method

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It is well established that stellar effective temperatures determined from photometry and spectroscopy yield systematically different results. We describe a new, simple method to correct spectroscopically derived temperatures ("excitation temperatures") of metal-poor stars based on a literature sample with $-3.3 <$ [Fe/H] < -2.5. Excitation temparatures were determined from Fe I line abundances in high-resolution optical spectra in the wavelength range of ~ 3700 to ~ 7000 Å, although shorter wavelength ranges, up to 4750 to 6800 Å, can also be employed, and compared with photometric literature temperatures. Our adjustment scheme increases the temperatures up to several hundred degrees for cool red giants, while leaving the near-main-sequence stars mostly unchanged. Hence, it brings the excitation temperatures in good agreement with photometrically derived values. The modified temperature also influences other stellar parameters, as the Fe I–Fe II ionization balance is simultaneously used to determine the surface gravity, while also forcing no abundance trend on the absorption line strengths to obtain the microturbulent velocity. As a result of increasing the temperature, the often too low gravities and too high microturbulent velocities in red giants

become higher and lower, respectively. Our adjustment scheme thus continues to build on the advantage of deriving temperatures from spectroscopy alone, independent of reddening, while at the same time producing stellar chemical abundances that are more straightforwardly comparable to studies based on photometrically derived temperatures. Hence, our method may prove beneficial for comparing different studies in the literature as well as the many high-resolution stellar spectroscopic surveys that are or will be carried out in the next few years.

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Optical constants of refractory oxides at high temperatures: Mid-infrared properties of corundum, spinel and α-quartz, potential carriers of the 13-μm feature

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Many cosmic dust species, among them refractory oxides, form at temperatures higher than 300 K. Nevertheless, most astrophysical studies are based on the room-temperature optical constants of solids, such as corundum and spinel. A more realistic approach is needed for these materials, especially in the context of modeling late-type stars. We have derived sets of optical constants of selected, astrophysically relevant oxide dust species with high melting points. A high-temperature-high-pressure-cell and a Fourier-transform spectrometer were used to measure reflectance spectra of polished samples. For corundum (α-Al_2O_3), spinel ($MgAl_2O_4$), and α-quartz (SiO_2), temperature-dependent optical constants were measured from 300 K up to more than 900 K. Small particle spectra were calculated from these data. All three examined oxides show a significant temperature dependence of their mid-IR bands. For the case of corundum, we find that the 13-μm emission feature – seen in the IR spectra of many AGB stars – can very well be assigned to this mineral species. The best fit of the feature is achieved with oblate corundum grains at mean temperatures around 550 K. Spinel remains a viable carrier of the 13-μm feature as well, but only for $T < 300$ K and nearly spherical grain shapes. Under such circumstances, spinel grains may also account for the 31.8-μm band that is frequently seen in sources of the 13-μm feature and which has not yet been identified with certainty.

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Decoding the message from meteoritic stardust silicon carbide grains

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Micron-sized stardust grains that originated in ancient stars are recovered from meteorites and analysed using high-resolution mass spectrometry. The most widely studied type of stardust is silicon carbide (SiC). Thousands of these grains have been analysed with high precision for their Si isotopic composition. Here we show that the distribution of the Si isotopic composition of the vast majority of stardust SiC grains carry the imprints of a spread in the age–metallicity distribution of their parent stars and of a power-law increase of the relative formation efficiency of SiC dust with the metallicity. This result offers a solution for the long-standing problem of silicon in stardust SiC grains, confirms the necessity of coupling chemistry and dynamics in simulations of the chemical evolution of our Galaxy, and constrains the modelling of dust condensation in stellar winds as function of the metallicity.

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Studies of NGC 6720 with calibrated HST WFC3 emission-line filter images. III.Tangential motions using AstroDrizzle images

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We have been able to compare with astrometric precision AstroDrizzle processed images of NGC 6720 (the Ring Nebula) made using two cameras on the *Hubble* Space Telescope. The time difference of the observations was 12.925 yr. This large time-base allowed determination of tangential velocities of features within this classic planetary nebula. Individual features were measured in [N II] images as were the dark knots seen in silhouette against background nebular [O III] emission. An image magnification and matching technique was also used to test the accuracy of the usual assumption of homologous expansion. We found that homologous expansion does apply, but the rate of expansion is greater along the major axis of the nebula, which is intrinsically larger than the minor axis. We find that the dark knots expand more slowly that the nebular gas, that the distance to the nebula is 720 pc ±30%, and the dynamic age of the Ring Nebula is about 4000 yr. The dynamic age is in agreement with the position of the central star on theoretical curves for stars collapsing from the peak of the Asymptotic Giant Branch to being white dwarfs.

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On the pulsation modes of OGLE small amplitude red giant variables in the LMC

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We discuss the properties of pulsations in the OGLE Small Amplitude Red Giants (OSARGs) in the Large Magellanic Cloud (LMC). We consider stars below the red-giant tip in this paper. They are multi-periodic and form three sequences in the period–luminosity plane. Comparing the periods and period ratios with our theoretical models, we have found that these sequences correspond to radial first to third overtones, and nonradial dipole p_4 and quadrupole p_2 modes. The red-giant branch stars of OSARGs consist of stars have initial masses of ~ 0.9–1.4 $M_\odot$ which corresponds to a luminosity range of $\log L/L_\odot \simeq 2.8$–$3.4$. With these parameters, the scaled optimal frequency $\nu_{\rm max}$ for solar-like oscillations goes through roughly the middle of the three sequences in the period-luminosity plane, suggesting the stochastic excitation is likely the cause of the pulsations in OSARGs.

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Magnetic fields around evolved stars: further observations of H_2O maser polarization

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Context: A low or intermediate mass star is believed to maintain a spherical shape throughout the evolution from the Main Sequence to the AGB phase. However, many post-AGB objects and Planetary Nebulæ exhibit non-spherical

symmetry. Several possible agents have been suggested as playing a role in this change of morphology, but the problem is still not well understood. Magnetic fields are one of these possible agents.
Aims: We aim to detect the magnetic field and infer its properties around four AGB stars using H_2O maser observations. The sample we observed consists of the following sources: the semi-regular variable RT Vir and the Mira variables AP Lyn, IK Tau, and IRC+60 370.
Methods: We observed the $6_{1,6}$–$5_{2,3}$ H_2O maser rotational transition, in full-polarization mode, to determine its linear and circular polarization. Based on the Zeeman effect, one can infer the properties of the magnetic field from the maser polarization analysis.
Results: We detected a total of 238 maser features, in three of the four observed sources. No masers were found toward AP Lyn. The observed masers are all located between 2.4 and 53.0 au from the stars. Linear and circular polarization was found in 18 and 11 maser features, respectively.
Conclusions: We more than doubled the number of AGB stars in which magnetic field has been detected from H_2O maser polarization, as our results confirm the presence of fields around IK Tau, RT Vir and IRC+60 370. The strength of the field along the line of sight is found to be between 47 and 331 mG in the H_2O maser region. Extrapolating this result to the surface of the stars, assuming a toroidal field ($\propto r^{-1}$), we find magnetic fields of 0.3–6.9 G on the stellar surfaces. If, instead of a toroidal field, we assume a poloidal field ($\propto r^{-2}$), then the extrapolated magnetic field strength on the stellar surfaces are in the range between 2.2 and $\sim$ 115 G. Finally, if a dipole field ($\propto r^{-3}$) is assumed, the field strength on the surface of the star is found to be between 15.8 and $\sim$ 1945 G. The magnetic energy of our sources is higher than the thermal and kinetic energy in the H_2O maser region of this class of objects. This leads us to conclude that, indeed, magnetic fields probably play an important role in shaping the outflows of evolved stars.

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New variable stars in the field of open cluster NGC 188

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A photometric study of variable stars in the field of old open cluster NGC 188 is discussed. Observations were carried out in two bands R and I for 5513 stars up to $R = 17^{\rm m}$ in the field of $1.5^\circ \times 1.5^\circ$ around the cluster. The photometric data were processed by the console application ASTROKIT, which corrects brightness variations associated with the variability of atmospheric transparency and carries out searching for variable stars. We found 18 new variable stars and determined the parameters of one previously known variable. Among discovered stars one is a low-amplitude pulsating variable, one is a EW eclipsing binary, six are eclipsing variables of EA type, five objects are long period variables, and for five stars variability type remains uncertain.

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The UK Infrared Telescope M 33 monitoring project. III. Feedback from dusty stellar winds in the central square kiloparsec

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We have conducted a near-infrared monitoring campaign at the UK InfraRed Telescope (UKIRT), of the Local Group spiral galaxy M 33 (Triangulum). The main aim was to identify stars in the very final stage of their evolution, and for which the luminosity is more directly related to the birth mass than the more numerous less-evolved giant stars that continue to increase in luminosity. In this third paper of the series, we measure the dust production and

rates of mass loss by the pulsating Asymptotic Giant Branch (AGB) stars and red supergiants. To this aim, we combined our time-averaged near-IR photometry with the multi-epoch mid-IR photometry obtained with the *Spitzer* Space Telescope. The mass-loss rates are seen to increase with increasing strength of pulsation and with increasing bolometric luminosity. Low-mass stars lose most of their mass through stellar winds, but even super-AGB stars and red supergiants lose $\sim$ 40% of their mass via a dusty stellar wind. More than three-quarters of the dust return is oxygenous. We construct a 2-D map of the mass-return rate, showing a radial decline but also local enhancements due to agglomerations of massive stars. We estimate a total mass-loss rate of 0.004–0.005 $M_\odot$ yr^{-1} kpc^{-2}, increasing to $\sim$ 0.006 $M_\odot$ yr^{-1} kpc^{-2} when accounting for eruptive mass loss (e.g., supernovæ); comparing this to the current star formation rate of $\sim$ 0.03 $M_\odot$ yr^{-1} kpc^{-2} we conclude that star formation in the central region of M 33 can only be sustained if gas is accreted from further out in the disc or from circum-galactic regions.

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Discovery of collimated ejection from the symbiotic binary BF Cygni

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Detection of collimated ejection from white dwarfs (WD) in symbiotic binaries is very rare and has employed a variety of methods in X-ray, radio, optical imagery and spectroscopy. To date, its signature in the optical spectra has only been recorded for four objects (MWC 560, Hen 3-1341, StHα 190, and Z And. We present the first observational evidence of highly-collimated bipolar ejection from the symbiotic binary BF Cyg, which developed during its current (2006–12) active phase, and determine their physical parameters. We monitored the outburst with the optical high-resolution spectroscopy and multicolour $UBVR_cI_c$ photometry. During 2009, three years after the 2006 eruption of BF Cyg, satellite components to Hα and Hβ lines emerged in the spectrum. During 2012, they became stable and were located symmetrically with respect to the main emission core of the line. Spectral properties of these components suggest bipolar ejection collimated within an opening angle of less than 15°, whose radiation is produced by an optically thin medium with the emission measure of 1–2 $\times$ 10^{59} $(d/3.8\ \mathrm{kpc})^2$ cm^{-3}. Formation of the collimated ejection a few years after the eruption and its evolution on a timescale of years at a constant optical brightness can aid us in better understanding the accretion process during the active phases of symbiotic stars.

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High spectral resolution imaging of the dynamical atmosphere of the red supergiant Antares in the CO first overtone lines with VLTI/AMBER

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We present high spectral resolution aperture-synthesis imaging of the red supergiant Antares (α Sco) in individual CO first overtone lines near 2.3 μm with VLTI/AMBER. The reconstructed images reveal that the star appears differently in the blue wing, line center, and red wing and shows an asymmetrically extended component. The appearance of the star within the CO lines changes drastically within one year, implying a significant change in the velocity field in the atmosphere. Our modeling suggests an outer atmosphere (MOLsphere) extending to 1.2–1.4 stellar radii with CO column densities of (0.5–1) $\times$ 10^{20} cm^{-2} and a temperature of $\sim$ 2000 K. While the velocity field in 2009 is characterized by strong upwelling motions at 20–30 km s^{-1}, it changed to strong downdrafts in 2010. On the other hand, the AMBER data in the continuum show only a slight deviation from limb-darkened disks and only marginal time variations. We derive a limb-darkened disk diameter of 37.38 ± 0.06 mas and a power-law-type limb-darkening parameter of $(8.7\pm1.6)\times10^{-2}$ (2009) and 37.31 ± 0.09 mas and $(1.5\pm0.2)\times10^{-1}$ (2010). We also obtain $T_{\rm eff} = 3660\pm120$ K and $\log L_\star/L_\odot = 4.88 \pm 0.23$, which suggests a mass of 15 ± 5 $M_\odot$ with an age of 11–15 Myr. This age is consistent with the recently estimated age for the Upper Scorpius OB association. The properties of the outer atmosphere of Antares are similar to those of another well-studied red supergiant, Betelgeuse. The density of the extended outer atmosphere of Antares and Betelgeuse is higher than predicted by the current 3-D convection simulations by at least six orders of magnitude, implying that convection alone cannot explain the formation of the extended outer atmosphere.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:1304.4800
and from http://www.mpifr-bonn.mpg.de/staff/kohnaka/ (movies of the reconstructed images)

Detailed abundance study of four s-process enriched post-AGB stars in the Large Magellanic Cloud

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Stellar photospheres of post-asymptotic giant branch stars bear witness to the internal chemical enrichment processes, integrated over their entire stellar evolution. Here we study post-AGB stars in the Large Magellanic Cloud (LMC). With their known distances, these rare objects are ideal tracers of AGB nucleosynthesis and dredge-up phenomena.
We used the UVES spectrograph mounted on the Very Large Telescope (VLT) at the European Southern Observatory (ESO), to obtain high-resolution spectra with high signal-to-noise (S/N) of a sample of four post-AGB stars. The objects display a spectral energy distribution (SED) that indicates the presence of circumstellar dust.
All objects are carbon-rich, and strongly enhanced in s-process elements. We deduced abundances of heavy s-process elements for all stars in the sample, and even found an indication of the presence of Hg in the spectrum of one object. The metallicity of all stars except J 053253.51−695915.1 is considerably lower than the average value that is observed for the LMC. The derived luminosities show that we witness the late evolution of low-mass stars with initial masses close to 1 $M_\odot$. An exception is J 053253.51−695915.1 and we argue that this object is likely a binary.
We confirmed the correlation between the efficiency of the third-dredge up and the neutron exposure that is detected in Galactic post-AGB stars. The non-existence of a correlation between metallicity and neutron irradiation is also confirmed and expanded to smaller metallicities. We confirm the status of 21-μm stars as post-Carbon stars. Current theoretical AGB models overestimate the observed C/O ratios and fail to reproduce the variety of s-process abundance patterns that is observed in otherwise very similar objects. Similar results have recently been found for a post-AGB star in the Small Magellanic Cloud (SMC).

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Available from arXiv:1304.7103

Properties of dust grains probed with extinction curves

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Modern data of the extinction curve from the ultraviolet to the near infrared are revisited to study properties of dust grains in the Milky Way (MW) and the Small Magellanic Cloud (SMC). We confirm that the graphite–silicate mixture

of grains yields the observed extinction curve with the simple power-law distribution of the grain size but with a cutoff at some maximal size: the parameters are tightly constrained to be $q = 3.5 \pm 0.2$ for the size distribution a^{-q} and the maximum radius $a_{\rm max} = 0.24 \pm 0.05$ μm, for both MW and SMC. The abundance of grains, and hence the elemental abundance, is constrained from the reddening versus hydrogen column density, $E(B-V)/N_{\rm H}$. If we take the solar elemental abundance as the standard for the MW, $> 56\%$ of carbon should be in graphite dust, while it is $< 40\%$ in the SMC using its available abundance estimate. This disparity and the relative abundance of C to Si explain the difference of the two curves. We find that 50–60% of carbon may not necessarily be in graphite but in the amorphous or glassy phase. Iron may also be in the metallic phase or up to $\sim 80\%$ in magnetite rather than in silicates, so that the Mg/Fe ratio in astronomical olivine is arbitrary. With these substitutions the parameters of the grain size remain unchanged. The mass density of dust grains relative to hydrogen is $\rho_{\rm dust}/\rho_{\rm H} = 1/(120^{+10}_{-16})$ for the MW and $1/(760^{+70}_{-90})$ for the SMC under the elemental abundance constraints. We underline the importance of the wavelength-dependence of the extinction curve in the near infrared in constructing the dust model: if $A_\lambda \propto \lambda^{-\gamma}$ with $\gamma \simeq 1.6$, the power-law grain-size model fails, whereas it works if $\gamma \simeq 1.8$–2.0.

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Available from arXiv:1301.4024

Conference Papers

Direct ultraviolet imaging and spectroscopy of Betelgeuse

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Direct images of Betelgeuse were obtained over a span of 4 years with the Faint Object Camera on the *Hubble* Space Telescope. These images reveal the extended ultraviolet continuum emission (about 2 times the optical diameter), the varying overall ultraviolet flux levels and a pattern of bright surface continuum features that change in position and appearance over several months or less. Concurrent photometry and radial velocity measures support the model of a pulsating star, first discovered in the ultraviolet from IUE. Spatially resolved HST spectroscopy reveals a larger extention in chromospheric emissions of Mg II as well as the rotation of the supergiant. Changing localized subsonic flows occur in the low chromosphere that can cover a substantial fraction of the stellar disk and may initiate the mass outflow.

Oral contribution, published in the proceedings of the Betelgeuse Workshop, November 2012, Paris, European Astronomical Society Publications Series, 2013, Eds. P. Kervella, T. Le Bertre & Guy Perrin
Available from arXiv:1304.2780

NLTE water lines in Betelgeuse-like atmospheres

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The interpretation of water lines in red supergiant stellar atmospheres has been much debated over the past decade. The introduction of the so-called MOLspheres to account for near-infrared "extra" absorption has been controversial. We propose that non-LTE effects should be taken into account before considering any extra-photospheric contribution. After a brief introduction on the radiative transfer treatment and the inadequacy of classical treatments in the case of large-scale systems such as molecules, we present a new code, based on preconditioned Krylov subspace methods. Preliminary results suggest that NLTE effects lead to deeper water bands, as well as extra cooling.

Oral contribution, published in Proceedings of the Betelgeuse Workshop, Paris, 2012
Available from arXiv:1304.4111

Multiwavelength modeling the SED of very slow novæ PU Vul and V723 Cas

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Evolution in the spectrum of very slow novae PU Vul and V723 Cas during their transition from the optical maximum to the nebular phase is investigated using the method of disentangling the composite UV/optical spectra. Model SEDs suggested that a transient decrease in the WD luminosity, during the decline from the maximum, was caused by a negative beaming effect, when a neutral disk around the WD was formed. When the disk disappeared, the luminosity increased again to values from the beginning of the outburst (in the case of V723 Cas, at/above the Eddington limit). This suggests the presence of a mechanism maintaining a high energy output for a much longer time than it is predicted by the current theories. Similarity of light curves, but enormous difference of the separation between the components of PU Vul and V723 Cas binaries suggest that the mechanism is basically powered by the accretor.

Poster contribution, published in "Stella Novæ: Future and Past Decades", Eds. P.A. Woudt & V.A.R.M. Ribeiro, ASPCS (2013)
Available from arXiv:1303.5454

Announcement

IAUS 302 – Magnetic Fields Throughout Stellar Evolution

Second Announcement

http://iaus302.sciencesconf.org

This is the second announcement for the Symposium 302 of the International Astronomical Union, entitled "Magnetic fields throughout stellar evolution". The conference will be held in Biarritz (France), 26–30 August 2013.

Presentation

Magnetic fields are key actors in the evolution of all stellar objects, through their ability to influence the angular momentum evolution, internal mixing or mass-loss of stars, as well as their activity phenomena or star-planet interactions. The present Symposium is aimed at offering a synthetic view of recent progresses in the young and growing domain of stellar magnetism. This research area is now benefiting from the rapid, combined development of observations and numerical simulations, enabling stellar physicists to take magnetic fields into account in most models of stellar structure and evolution.

Topics

- Stellar structure and evolution
- Magnetized accretion and outflows in young stellar objects
- Magnetic braking of PMS stars
- Solar and stellar activity in photospheres, chromospheres and coronæ, and stellar cycles
- Magnetism in very low-mass stars and brown dwarfs
- Star-planet interaction
- Stellar dynamos across the H–R diagram

- Magnetic field origin and stability in massive stars
- Magnetically-confined winds of massive stars
- Cool active subgiants and giants
- Dynamo and mass-loss in giant and supergiant stars
- Final phases of stellar evolution: magnetism in compact objects

Scientific Organizing Committee

- Gibor Basri (Univ. California, USA)
- Matthew Browning (Univ. Toronto, Canada)
- Corinne Charbonnel (Geneva Observatory, Switzerland)
- José-Dias do Nascimento (Univ. Natal, Brazil)
- Siraj Hasan (IIA, India)
- Moira Jardine (Univ. St. Andrews, Scotland, co-chair)
- Oleg Kochukhov (Univ. Uppsala, Sweden)
- Renada Konstantinova-Antova (Bulgarian Academy of Sciences, Bulgaria)
- Hiroaki Isobe (Univ. Kyoto, Japan)
- Stephen Marsden (James Cook University, Australia)
- Pascal Petit (Univ. Toulouse, France, chair)
- Sami Solanki (MPS, Germany)
- Henk Spruit (MPA, Germany, co-chair)
- Klaus Strassmeier (AIP, Germany)
- Asif ud-Doula (Penn State, USA)
- Gregg Wade (RMC, Canada)

Confirmed speakers

Jonathan Braithwaite – Sacha Brun – Rim Fares – Jason Grunhut – Gaitee Hussain – Oleg Kochukhov – Heidi Korhonen – Ryuichi Kurosawa – Norbert Langer – François Lignières – Stuart Littlefair – Stan Owocki – Ralph Pudritz – Nanda Rea – Ansgar Reiners – Andreas Reisenegger – Karel Schrijver – Saku Tsuneta – Aline Vidotto – Wouter Vlemmings – Lucianne Walkowicz

Venue

The conference will be held at Casino Municipal, Biarritz (France). Situated on the French Atlantic coast, at the western end of the Pyrénées mountain range, Biarritz is a friendly and attractive town benefiting from the mild weather of southern France. It can be easily reached by plane or train and offers more than 2,300 hotel rooms. With 6 km of beaches, Biarritz is the historical capital of surfing in Europe. You can also find there the second oldest golf course in Europe, 5 thalasso therapy centres and a casino.

The town is just a stone's throw away from Spain and is less than 150 km away from Bilbao and its famous Guggenheim museum. Biarritz is also located at less than 200 km from Bordeaux and its world-famous wineries. It is a perfect starting point to explore the Basque country, with its authentic countryside and charming villages. A half-day excursion will bring the participants to selected spots around the town, and the symposium diner will be the opportunity to enjoy French gastronomy.

Accommodation

Biarritz is very attractive during the month of August, and hotels get fully booked very early. We therefore very strongly recommend to book your hotel as soon as possible! A list of hotels is available here:
http://iaus302.sciencesconf.org/resource/page/id/9

Social events

The conference dinner will take place on Thursday night (29 Aug 2013), at Salle des Ambassadeurs (Casino Municipal). The banquet cost is 40 EUR per person.

Three optional Wednesday tours are proposed, to be chosen between a visit of Domaine Brana (winery), a discovery of the Basque coast by boat, and a visit of Château–Observatory Abbadia. Additional fees of 20 EUR per person apply for the tours.

Registration

Registration fee is 350 EUR per participant. The fee allows access to the conference venue, the welcome cocktail on Sunday night, the coffee breaks, four lunches, and a hard copy of proceedings. Addditionnal fee is requested for conference dinner (40 EUR) and Wednesday tours (20 EUR).

The online payment interface is available here: http://iaus302.irap.omp.eu

Cancellations: Requests for cancellation with a 50% fee refund will only be accepted through 1 July 2013.

Abstract submission

Abstracts can be submitted at the following address:
http://iaus302.sciencesconf.org/submission/submit

Visa information

General information for preparing your entry in France and applying to a French Visa is available here:
http://www.diplomatie.gouv.fr/en/france/coming-to-france/getting-a-visa/

Invitation letters will be provided to registered participants whenever needed. Should you require a letter, we invite you to contact the organizers by email (iaus302@sciencesconf.org).

Proceedings

The proceedings of the Symposium will be published by Cambridge University Press. A hardcopy of the proceedings will be sent to each registered participant. Further information will follow about page limits and LaTeX templates. The deadline for submission of the proceedings is 30 September 2013.

Important dates

- Abstract deadline for contributed talks: 13 May 2013

- Abstract deadline for posters: 21 June 2013
- Deadline for registration: 15 July 2013
- Deadline for proceedings submission: 30 September 2013

Contact

Any inquiry about the conference should be addressed to iaus302@sciencesconf.org

We hope to see as many of you as possible in Biarritz this summer!

Best regards,
the SOC and LOC

See also http://iaus302.sciencesconf.org