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Editors: Jacco van Loon and Albert Zijlstra

Editorial

Dear Colleagues,

It is a pleasure to present you the 176$^{\rm th}$ issue of the AGB Newsletter– one of the thickest editions with no less than 34 refereed journal papers and various other contributions.

Congratulations and Good Luck to Claudia Paladini for her Ph.D. thesis!

Looking for a postdoctoral position? Consider Hamburg!

Also check out the announcements of the 40$^{\rm th}$ Liège workshop, a training school on using CLOUDY, and the Fizeau exchange programme.

The next issue is planned to be distributed around the 1$^{\rm st}$ of April.

Editorially Yours,
Jacco van Loon and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

Do we understand AGB progenitors?

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

The interaction of Asymptotic Giant Branch stars with the interstellar medium

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We study the hydrodynamical behavior of the gas expelled by moving Asymptotic Giant Branch Stars interacting with the ISM. Our models follow the wind modulations prescribed by stellar evolution calculations, and we cover a range of expected relative velocities (10 to 100 km s^{-1}), ISM densities (between 0.01 and 1 cm^{-3}), and stellar progenitor masses (1 and 3.5 $M_{\odot}$). We show how and when bow-shocks, and cometary-like structures form, and in which regime the shells are subject to instabilities. Finally, we analyze the results of the simulations in terms of the different kinematical stellar populations expected in the Galaxy.

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Available from arXiv:1201.3378

Arcsecond resolution mapping of sulfur dioxide emission in the circumstellar envelope of VY Canis Majoris

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We report Submillimeter Array observations of SO_2 emission in the circumstellar envelope of the red supergiant VY CMa, with an angular resolution of $\approx 1''$. SO_2 emission appears in three distinct outflow regions surrounding the central continuum peak emission that is spatially unresolved. No bipolar structure is noted in the sources. A fourth source of SO_2 is identified as a spherical wind centered at the systemic velocity. We estimate the SO_2 column density and rotational temperature assuming local thermal equilibrium (LTE) as well as perform non-LTE radiative transfer analysis using RADEX. Column densities of SO_2 are found to be $\sim 10^{16}$ cm^{-2} in the outflows and in the spherical wind. Comparison with existing maps of the two parent species OH and SO shows the SO_2 distribution to be consistent with that of OH. The abundance ratio f_{SO_2}/f_{SO} is greater than unity for all radii greater than at least 3×10^{16} cm. SO_2 is distributed in fragmented clumps compared to SO, PN, and SiS molecules. These observations lend support to specific models of circumstellar chemistry that predict $f_{SO_2}/f_{SO} > 1$ and may suggest the role of localized effects such as shocks in the production of SO_2 in the circumstellar envelope.

Published in ApJ 746, 42 (2012)
Available from arXiv:1111.7004

Detailed compositional analysis of the heavily polluted DBZ white dwarf SDSS J073842.56+183509.06: A window on planet formation?

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We present a new model atmosphere analysis of the most metal contaminated white dwarf known, the DBZ SDSS J073842.56+183509.06. Using new high resolution spectroscopic observations taken with *Keck* and *Magellan*, we determine precise atmospheric parameters and measure abundances of 14 elements heavier than helium. We also report new *Spitzer* mid-infrared photometric data that are used to better constrain the properties of the debris disk orbiting this star. Our detailed analysis, which combines data taken from 7 different observational facilities (GALEX, *Gemini*, *Keck*, *Magellan*, MMT, SDSS and *Spitzer*) clearly demonstrate that J0738+1835 is accreting large amounts of rocky terrestrial-like material that has been tidally disrupted into a debris disk. We estimate that the body responsible for the photospheric metal contamination was at least as large Ceres, but was much drier, with less than 1% of the mass contained in the form of water ice, indicating that it formed interior to the snow line around its parent star. We also find a correlation between the abundances (relative to Mg and bulk Earth) and the condensation temperature; refractory species are clearly depleted while the more volatile elements are possibly enhanced. This could be the signature of a body that formed in a lower temperature environment than where Earth formed. Alternatively, we could be witnessing the remains of a differentiated body that lost a large part of its outer layers.

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An approach to effective temperature and surface gravity in post-AGB and RV Tauri stars at the near-IR

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A number of empirical correlations that allows us to calculate the effective temperature and surface gravity for a set evolved post-AGB and RV Tauri stars are determined using as calibrators the intrinsic colours of 2MASS (Two Micron All Sky Survey) photometry. We have analyzed a total sample of 36 stars where 25 are post-AGB and 11 are RV Tauri stars, respectively. A group of 11 stars with parallaxes measures were used as calibrators of the absolute magnitude. The result for $T_{\rm eff}$ and $\log g$ from intrinsic colours $(J–H)_0$ and $(H–K)_0$ at the near-infrared pass bands reach a dispersion of 220 K and 0.27, respectively. We can estimate the absolute magnitude using the intrinsic colour in the near-infrared band with an uncertainty of 0.28 mag. This indicates that $(J–H)_0$ and $(H–K)_0$ show sensivity to the absolute magnitude.

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Available from arXiv:1201.2884

VLBI astrometry of the semiregular variable RX Bootis

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We present distance measurement of the semiregular variable RX Bootis (RX Boo) with its annual parallax. Using the unique dual-beam system of the VLBI Exploration of Radio Astrometry (VERA) telescope, we conducted astrometric observations of a water maser spot accompanying RX Boo referred to the quasar J1419+2706 separated by $1\overset{\circ}{.}69$ from RX Boo. We have measured the annual parallax of RX Boo to be 7.31 ± 0.50 mas, corresponding to a distance of 136^{+10}_{-9} pc, from the one-year monitoring observation data of one maser spot at $v_{\rm LSR} = 3.2$ km s^{-1}. The distance itself is consistent with the one obtained with *Hipparcos*. The distance uncertainty is reduced by a factor of two, allowing us to determine the stellar properties more accurately. Using our distance, we discuss the location of RX Boo in various sequences of Period–Luminosity (PL) relations. We found RX Boo is located in the Mira sequence of PL relation. In addition, we calculated the radius of photosphere and the mass limitation of RX Boo and discussed its evolutionary status.

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High-latitude supergiants: anomalies in the spectrum of LN Hya in 2010

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High-resolution echelle spectra taken with the 6-m telescope in 2003–2011 are used to study features of the optical spectrum and the velocity field in the atmosphere of the semiregular variable LN Hya in detail. The weak symmetric photospheric absorptions indicate radial velocity variations from night to night (by as much as 3 km s^{-1}), resulting from small pulsations. Peculiarities and profile variations were found for strong lines of Fe I, Fe II, Ba II, Si II, etc. The profiles of these lines were asymmetric: their short-wave wings were extended and their cores were either split or distorted by emission. During the 2010 observing season, the position and depth of the Hα absorption component, the intensities of the shortand long-wave emission components, and the intensity ratio of the latter components varied from spectrum to spectrum. Weak emissions of neutral atoms (V I, Mn I, Co I, Ni I, Fe I) appeared in the spectrum of June 1, 2010. All these spectral peculiarities, recorded for the first time, suggest that we have detected rapid changes in the physical conditions in the upper atmospheric layers of LN Hya in 2010.

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The dynamic atmospheres of Mira stars: comparing the CODEX models to PTI time series of TU And

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Our comprehension of stellar evolution on the AGB still faces many difficulties. To improve on this, a quantified understanding of large-amplitude pulsator atmospheres and interpretation in terms of their fundamental stellar parameters

are essential. We wish to evaluate the effectiveness of the recently released CODEX dynamical model atmospheres in representing M-type Mira variables through a confrontation with the time-resolved spectro-photometric and interferometric PTI data set of TU And. We calibrated the interferometric K-band time series to high precision. This results in 50 nights of observations, covering 8 subsequent pulsation cycles. At each phase, the flux at 2.2 μm is obtained, along with the spectral shape and visibility points in 5 channels across the K-band. We compared the data set to the relevant dynamical, self-excited CODEX models. Both spectrum and visibilities are consistently reproduced at visual minimum phases. Near maximum, our observations show that the current models predict a photosphere that is too compact and hot, and we find that the extended atmosphere lacks H_2O opacity. Since coverage in model parameter space is currently poor, more models are needed to make firm conclusions on the cause of the discrepancies. We argue that for TU And, the discrepancy could be lifted by adopting a lower value of the mixing length parameter combined with an increase in the stellar mass and/or a decrease in metallicity, but this requires the release of an extended model grid.

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Transformations between WISE and 2MASS, SDSS, BVI photometric systems: II. Transformation equations for red clump stars

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We present colour transformations for the conversion of the *Wide-Field Survey Explorer (WISE)* $W1$, $W2$, and $W3$ magnitudes to the Johnson–Cousins (BVI_c), Sloan Digital Sky Survey (gri), and Two Micron All Sky Survey JHK_s photometric systems, for red clump (RC) stars. RC stars were selected from the Third Radial Velocity Experiment (RAVE) Data Release (DR3). The apparent magnitudes were collected by matching the coordinates of this sample with different photometric catalogues. The final sample (355 RC stars) used to obtain metallicity **dependent**-and free of metallicity- transformations between *WISE* and Johnson–Cousins, SDSS, 2MASS photometric systems. These transformations combined with known absolute magnitudes at shorter wavelengths can be used in space density determinations for the Galactic (thin and thick) discs at distances larger than the ones evaluated with JHK_s photometry alone, hence providing a powerful tool in the analysis of Galactic structure.

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Local stellar kinematics from RAVE data: III. Radial and vertical metallicity gradients based on red clump stars

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We investigate radial and vertical metallicity gradients for a sample of red clump stars from the RAdial Velocity Experiment (RAVE) Data Release 3. We select a total of 6781 stars, using a selection of colour, surface gravity and uncertainty in the derived space motion, and calculate for each star a probabilistic (kinematic) population assignment

to a thin or thick disc using space motion and additionally another (dynamical) assignment using stellar vertical orbital eccentricity. We derive almost equal metallicity gradients as a function of Galactocentric distance for the high probability thin disc stars and for stars with vertical orbital eccentricities consistent with being dynamically young, $e_{\rm v} \leq 0.07$, i.e. $d[M/H]/dR_{\rm m} = -0.041 \pm 0.003$ and $d[M/H]/dR_{\rm m} = -0.041 \pm 0.007$ dex kpc^{-1}. Metallicity gradients as a function of distance from the Galactic plane for the same populations are steeper, i.e. $d[M/H]/dz_{\rm max} = -0.109 \pm 0.008$ and $d[M/H]/dz_{\rm max} = -0.260 \pm 0.031$ dex kpc^{-1}, respectively. $R_{\rm m}$ and $z_{\rm max}$ are the arithmetic mean of the perigalactic and apogalactic distances, and the maximum distance to the Galactic plane, respectively. Samples including more thick disc red clump giant stars show systematically shallower abundance gradients. These findings can be used to distinguish between different formation scenarios of the thick and thin discs.

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Convective Babcock–Leighton dynamo models

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We present the first global, three-dimensional simulations of solar/stellar convection that take into account the influence of magnetic flux emergence by means of the Babcock–Leighton (BL) mechanism. We have shown that the inclusion of a BL poloidal source term in a convection simulation can promote cyclic activity in an otherwise steady dynamo. Some cycle properties are reminiscent of solar observations, such as the equatorward propagation of toroidal flux near the base of the convection zone. However, the cycle period in this young sun (rotating three times faster than the solar rate) is very short ($\sim$ 6 months) and it is unclear whether much longer cycles may be achieved within this modeling framework, given the high efficiency of field generation and transport by the convection. Even so, the incorporation of mean-field parameterizations in 3D convection simulations to account for elusive processes such as flux emergence may well prove useful in the future modeling of solar and stellar activity cycles.

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CNO and F abundances in the globular cluster M 22 (NGC 6656)

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Recent studies have confirmed the long standing suspicion that M 22 shares a metallicity spread and complex chemical enrichment history similar to that observed in ω Cen. M 22 is among the most massive Galactic globular clusters and its colour–magnitude diagram and chemical abundances reveal the existence of sub-populations. To further constrain the chemical diversity of M 22, necessary to interpret its nucleosynthetic history, we seek to measure relative abundance ratios of key elements (carbon, nitrogen, oxygen, and fluorine) best studied, or only available, using high-resolution spectra at infrared wavelengths. High-resolution ($R = 50,000$) and high S/N infrared spectra were acquired of nine red giant stars with *Phoenix* at the *Gemini–South* telescope. Chemical abundances were calculated through a standard 1D local thermodynamic equilibrium analysis using *Kurucz* model atmospheres. We derive [Fe/H] = -1.87 to -1.44, confirming at infrared wavelengths that M 22 does present a [Fe/H] spread. We also find large C and N abundance spreads, which confirm previous results in the literature but based on a smaller sample. Our results show a spread in A(C+N+O) of $\sim$ 0.7 dex. Similar to mono-metallic GCs, M 22 presents a strong [Na/Fe]–[O/Fe] anticorrelation as

derived from Na and CO lines in the K band. For the first time we recover F abundances in M 22 and find that it exhibits a 0.6 dex variation. We find tentative evidence for a flatter A(F)–A(O) relation compared to higher metallicity GCs. Our study confirms and expands upon the chemical diversity seen in this complex stellar system. All elements studied to date show large abundance spreads which require contributions from both massive and low mass stars.

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3D simulations of Betelgeuse's bow shock

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Betelgeuse, the bright, cool red supergiant in Orion, is moving supersonically relative to the local interstellar medium. The star emits a powerful stellar wind that collides with this medium, forming a cometary structure, a bow shock, pointing in the direction of motion. We present the first 3D hydrodynamic simulations of the formation and evolution of Betelgeuse's bow shock. The models include realistic low-temperature cooling and cover a range of plausible interstellar medium densities of 0.3–1.9 cm^{-3} and stellar velocities of 28–73 km s^{-1}. We show that the flow dynamics and morphology of the bow shock differ substantially because of the growth of Rayleigh–Taylor or Kelvin–Helmholtz instabilities. The former dominate the models with slow stellar velocities resulting in a clumpy bow shock substructure, whereas the latter produce a smoother, more layered substructure in the fast models. If the mass in the bow shock shell is low, as seems to be implied by the *AKARI* luminosities ($\sim 3 \times 10^{-3}$ $\mathrm{M}_{\odot}$), then Betelgeuse's bow shock is very young and is unlikely to have reached a steady state. The circular nature of the bow shock shell is consistent with this conclusion. Thus, our results suggest that Betelgeuse only entered the red supergiant phase recently.

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X-ray emission from an asymmetric blastwave and a massive white dwarf in the γ-ray emitting Nova V407 Cyg

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Classical nova events in symbiotic stars, although rare, offer a unique opportunity to probe the interaction between ejecta and a dense environment in stellar explosions. In this work, we use X-ray data obtained with *Swift* and *Suzaku* during the recent classical nova outburst in V407 Cyg to explore such an interaction. We find evidence of both equilibrium and non-equilibrium ionization plasmas at the time of peak X-ray brightness, indicating a strong asymmetry in the density of the emitting region. Comparing a simple model to the data, we find that the X-ray evolution is broadly consistent with nova ejecta driving a forward shock into the dense wind of the Mira companion. We detect a highly absorbed soft X-ray component in the spectrum during the first 50 days of the outburst that is consistent with supersoft emission from the nuclear burning white dwarf. The high temperature and short turn off time of this emission component, in addition to the observed breaks in the optical and UV lightcurves, indicate that the white dwarf in the binary is extremely massive. Finally, we explore the connections between the X-ray and GeV

γ-ray evolution, and propose that the γ-ray turn-off is due to the stalling of the forward shock as the ejecta reach the red giant surface.

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Radiation transfer in the cavity and shell of Planetary Nebulae

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We develop an approximate analytical solution for the transfer of line-averaged radiation in the hydrogen recombination lines for the ionized cavity and molecular shell of a spherically symmetric planetary nebula. The scattering problem is treated as a perturbation, using a mean intensity derived from a scattering-free solution. The analytical function was fitted to Hα and Hβ data from the planetary nebula NGC 6537. The position of the maximum in the intensity profile produced consistent values for the radius of the cavity as a fraction of the radius of the dusty nebula: 0.21 for Hα and 0.20 for Hβ. Recovered optical depths were broadly consistent with observed optical extinction in the nebula, but the range of fit parameters in this case is evidence for a clumpy distribution of dust.

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Identification of red high proper-motion objects in Tycho-2 and 2MASS catalogues using Virtual Observatory tools

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Aims: With available Virtual Observatory tools, we looked for new M dwarfs in the solar neighbourhood and M giants with high tangential velocities.
Methods: From an all-sky cross-match between the optical Tycho-2 and the near-infrared 2MASS catalogues, we selected objects with proper motions $\mu > 50$ mas yr^{-1} and very red $V_{\rm T} - K_{\rm s}$ colours. For the most interesting targets, we collected multi-wavelength photometry, constructed spectral energy distributions, estimated effective temperatures and surface gravities from fits to atmospheric models, performed time-series analysis of ASAS V-band light curves, and assigned spectral types from low-resolution spectroscopy obtained with CAFOS at the 2.2-m Calar Alto telescope.
Results: We got a sample of 59 bright red high proper-motion objects, including fifty red giants, four red dwarfs, and five objects reported in this work for the first time. The five new stars have magnitudes $V_{\rm T} \approx 10.8$–11.3 mag, reduced proper motions midway between known dwarfs and giants, near-infrared colours typical of giants, and effective temperatures $T_{\rm eff} \approx 2900$–3400 K. From our time-series analysis, we discovered a long secondary period in Ruber 4 and an extremely long primary period in Ruber 6. With the CAFOS spectra, we confirmed the red giant nature of Ruber 7 and 8, the last of which seems to be one of the brightest metal-poor M giants ever identified.

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The magnetised bellows of Betelgeuse

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We present calculations for a magnetised hybrid wind model for Betelgeuse (α Orionis). The model is a direct application of our previously derived theory, combining a canonical Weber–Davis (WD) stellar wind with dust grains in the envelope of an AGB star. The resulting hybrid picture provides a mechanism for solving the problem of lifting stellar material up from the photosphere and into the circumstellar envelope. It also predicts wind velocities in agreement with current estimates. Our approach reveals that magnetic fields in supergiant stars like Betelgeuse, may play a vital role in determining the nature of the stellar outflow and consequently, opens a new avenue of investigation in the field of hybrid stellar winds.

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Weak G-band stars on the H–R diagram: clues to the origin of the Li anomaly

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Aims: Weak G-band (WGB) stars are a rare class of cool luminous stars that present a strong depletion in carbon, but also lithium abundance anomalies that have been little explored in the literature since the first discovery of these peculiar objects in the early 1950s. Here we focus on the Li-rich WGB stars and report on their evolutionary status. We explored different paths to propose a tentative explanation for the lithium anomaly.
Methods: Using archive data, we derived the fundamental parameters of WGB ($T_{\rm eff}$, log g, log ($L/L_{\odot}$)) using *Hipparcos* parallaxes and recent temperature scales. From the equivalent widths of Li resonance line at 6707 Å, we uniformly derived the lithium abundances and applied NLTE corrections when possible following the procedure described by Lind et al. (2009). We also computed dedicated stellar evolution models in the mass range 3.0 to 4.5 $M_{\odot}$, exploring the effects of rotation-induced and thermohaline mixing. These models are used to locate the WGB stars in the H–R diagram and to explore the origin of the abundance anomalies.
Results: The location of WGB stars in the Hertzsprung–Russell diagram shows that these are intermediate mass stars of masses ranging from 3.0 to 4.5 $M_{\odot}$ located at the clump, which implies a degeneracy of their evolutionary status between subgiant/red giant branch and core helium burning phases. The atmospheres of a large proportion of WGB stars (more than 50%) exhibit lithium abundances $A(\rm Li) \geq 1.4$ dex similar to Li-rich K giants. However, the position of WGB stars along with the Li-rich K giants in the H–R diagram, indicates that both are well-separated groups. The combined and tentatively consistent analysis of the abundance pattern for lithium, carbon, and nitrogen of WGB stars seems to indicate that carbon underabundance could be decorrelated from the lithium and nitrogen overabundances.

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Characteristics of solar-like oscillations of secondary red clump stars

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We calculated the populations of core-helium-burning (CHeB) stars and found that the secondary red clump (SRC) stars can form an SRC peak in the distributions of the frequency of maximum seismic amplitude ($\nu_{\rm max}$) and mean large-frequency separation ($\Delta\nu$) of CHeB stars when metallicity $Z > 0.02$. The $\nu_{\rm max}$ and $\Delta\nu$ of CHeB stars are dependent not only on He core mass but on H-shell burning. The SRC peak is composed of the CHeB stars with mass roughly between the critical mass $\rm M_{HeF}$ and $\rm M_{HeF}$+0.2 while He core mass is between about 0.33 and 0.36 $\rm M_{\odot}$. The location of the SRC peak can be affected by the mixing-length parameter α, metallicity Z, and overshooting parameter $\delta_{\rm ov}$. A decrease in α or increase in Z or $\delta_{\rm ov}$ leads to a movement of the SRC peak towards a lower frequency. However, the change in Z and α only slightly affects the value of $\rm M_{HeF}$ but the variation in $\delta_{\rm ov}$ can significantly affects the value of $\rm M_{HeF}$. Thus the SRC peak might aid in determining the value of $\rm M_{HeF}$ and calibrating $\delta_{\rm ov}$. In addition, the effects of convective acceleration of SRC stars and the $\nu_{\rm max}$ of "semi-degenerate" stars decreasing with mass result in the appearance of a shoulder between about 40 and 50 μHz in the $\nu_{\rm max}$ distribution. However, the convective acceleration of stars with $M < M_{\rm HeF}$ leads to the deficit in the $\nu_{\rm max}$ distribution between about 9 and 20 μHz. Moreover, the value of the parameter b of the relation between $\nu_{\rm max}$ and $\Delta\nu$ for the populations with $M > M_{\rm HeF}$ is obviously larger than that for the populations with $M < M_{\rm HeF}$.

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Rubidium, zirconium, and lithium production in intermediate-mass asymptotic giant branch stars

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A recent survey of a large sample of Galactic intermediate-mass (> 3 $\rm M_{\odot}$) asymptotic giant branch (AGB) stars shows that they exhibit large overabundances of rubidium (Rb) up to 100–1000 times solar. In contrast, zirconium (Zr) is not enriched compared to the solar abundances in these stars. These observations set constraints on our theoretical notion of the *slow* neutron capture process (*s* process) that occurs inside intermediate-mass AGB stars. Lithium (Li) abundances are also reported for these stars. In intermediate-mass AGB stars, Li can be produced by proton captures occuring at the base of the convective envelope. For this reason the observations of Rb, Zr, and Li set complementary constraints on different processes occurring in the same stars. We present predictions for the abundances of Rb, Zr, and Li as computed for the first time simultaneously in intermediate-mass AGB star models and compare them to the current observational constraints. We calculate the Rb, Zr, and Li surface abundances for stellar models with masses between 3 and 6.5 $\rm M_{\odot}$ and metallicities between 0.02 and 0.004. We find that the Rb abundance increases with increasing stellar mass, as is inferred from observations but we are unable to match the highest observed [Rb/Fe] abundances. Variations of the reaction rates of the neutron-capture cross sections involved with Rb production and the rate of the $^{22}\rm Ne(\alpha,n)^{25}Mg$ reaction, responsible for neutron production inside these stars, yields only modest variations in the surface Rb content of ≈ 0.3 dex. Inclusion of a partial mixing zone (PMZ) to activate the $^{13}\rm C(\alpha,n)^{16}O$ reaction as an additional neutron source yields significant enhancements in the Rb abundance. However this leads to Zr abundances that exceed the upper limits of the current observational constraints. If the third dredge-up (TDU) efficiency remains as high during the final stages of AGB evolution as during the earlier stages, we can match the lowest

values of the observed Rb abundance range. We predict large variations in the Li abundance, which are observed. Finally, the predicted Rb production increases with decreasing metallicity, in qualitative agreement with observations of Magellanic Cloud AGB stars. However stellar models of $Z = 0.008$ and $Z = 0.004$ intermediate-mass AGB stars do not produce enough Rb to match the observed abundances.

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The *Spitzer* spectroscopic survey of S-type stars

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S-type AGB stars are thought to be in the transitional phase between M-type and C-type AGB stars. Because the composition of the circumstellar environment reflects the photospheric abundances, one may expect a strong influence of the stellar C/O ratio on the molecular chemistry and the mineralogy of the circumstellar dust. In this paper, we present a large sample of 87 intrinsic galactic S-type AGB stars, observed at infrared wavelengths with the *Spitzer* Space Telescope, and supplemented with ground-based optical data. On the one hand, we derive the stellar parameters from the optical spectroscopy and photometry, using a grid of model atmospheres. On the other, we decompose the infrared spectra to quantify the flux-contributions from the different dust species. Finally, we compare the independently determined stellar parameters and dust properties. For the stars without significant dust emission features, we detect a strict relation between the presence of SiS absorption in the *Spitzer* spectra and the C/O ratio of the stellar atmosphere. These absorption bands can thus be used as an additional diagnostic for the C/O ratio. For stars with significant dust emission, we define three distinct groups, based on the relative contribution of certain dust species to the infrared flux. We find a strong link between group-membership and C/O ratio. Furthermore, we show that these groups can be explained by assuming that the dust-condensation can be cut short before silicates are produced, while the remaining free atoms and molecules can then be used to form the observed magnesium sulfides or the carriers of the unidentified 13 μm and 20 μm features. Finally, we present the detection of emission features attributed to molecules and dust characteristic to C-type stars, such as molecular SiS, hydrocarbons and magnesium sulfide grains. We show that we often detect magnesium sulfides together with molecular SiS and we propose that it is formed by a reaction of SiS molecules with Mg.

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Non-LTE effects on the lead and thorium abundance determinations for cool stars

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Knowing accurate Pb abundances of metal-poor stars provides constraints on the Pb production mechanisms in the early Galaxy. Accurately deriving Th abundances permits a nucleo-chronometric age determination of the star. We improve the calculation of the Pb I and Th II lines in stellar atmospheres based on non-LTE line formation and evaluate the influence of departures from LTE on Pb and Th abundance determinations through a range of stellar parameters. Comprehensive model atoms for Pb I and Th II are presented. The departures from LTE lead to systematically depleted total absorption in the Pb I lines and positive abundance corrections. Non-LTE removes the discrepancy between the solar and the meteoritic Pb abundance. With the Holweger & Mueller (1974) solar model atmosphere, $\log \epsilon(\mathrm{Pb, non-LTE}) = 2.09$. We revise the Pb and Eu abundances of the strongly r-process enhanced (r-II) stars CS 31082−001 and HE 1523−0901 and the Roederer et al. (2010) stellar sample. Our results provide strong evidence for universal Pb/Eu relative r-process yields during course of the Galaxy evolution. The stars with $-2.3 <$ [Fe/H] < -1.4 have, on average, 0.51 dex higher Pb/Eu ratios compared with that of the r-II stars suggesting that the s-process synthesis of Pb started as early as the time when Galactic metallicity had grown to [Fe/H] = −2.3. The average Pb/Eu ratio of the $-1.4 <$ [Fe/H] < -0.59 stars is close to the solar value, in line with the predictions of Travaglio et al. (2001) that AGB stars with [Fe/H] ~ -1 provided the largest contribution to the solar s-nuclei of Pb. Non-LTE leads to weakened Th II lines. Overall, the abundance correction does not exceed +0.2 dex when collisions with H I atoms are taken into account in non-LTE calculations.

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A study of the kinematics and binary-induced shaping of planetary nebula HaTr 4

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We present the first detailed spatio-kinematical analysis and modelling of the planetary nebula HaTr 4, one of few known to contain a post-common-envelope central star system. Common envelope evolution is believed to play an important role in the shaping of planetary nebulae, but the exact nature of this role is yet to be understood. High spatial- and spectral- resolution spectroscopy of the [O III]5007 nebular line obtained with VLT-UVES are presented alongside deep narrowband Hα+[N II]6584 imagery obtained using EMMI–NTT, and together the two are used to derive the three-dimensional morphology of HaTr 4. The nebula is found to display an extended ovoid morphology with an enhanced equatorial region consistent with a toroidal waist – a feature believed to be typical amongst planetary nebulae with post-common-envelope central stars. The nebular symmetry axis is found to lie perpendicular to the orbital plane of the central binary, concordant with the idea that the formation and evolution of HaTr 4 has been strongly influenced by its central binary.

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Formation of a disk-structure and jets in the symbiotic prototype Z And during its 2006–2010 active phase

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We present an analysis of spectrophotometric observations of the latest cycle of activity of the symbiotic binary Z And from 2006 to 2010. We estimate the temperature of the hot component of Z And to be $\approx$ 150,000–170,000 K at minimum brightness, decreasing to $\approx 90,000$ K at the brightness maximum. Our estimate of the electron density in the gaseous nebula is $N_{\rm e} = 10^{10}$–10^{12} cm^{-3} in the region of formation of lines of neutral helium and 10^{6}–10^{7} cm^{-3} in the region of formation of the [O III] and [Ne III] nebular lines. A trend for the gas density derived from helium lines to increase and the gas density derived from [O III] and [Ne III] lines to simultaneously decrease with increasing brightness of the system was observed. Our estimates show that the ratios of the theoretical and observed fluxes in the [O III] and [Ne III] lines agree best when the O/Ne ratio is similar to its value for planetary nebulae. The model spectral energy distribution showed that, in addition to a cool component and gaseous nebula, a relatively cool pseudophotosphere (5250–11,500 K) is present in the system. The simultaneous presence of a relatively cool pseudophotosphere and high-ionization spectral lines is probably related to a disk-like structure of the pseudophotosphere. The pseudophotosphere formed very rapidly-over several weeks – during a period of increasing brightness of Z And. We infer that in 2009, as in 2006, the activity of the system was accompanied by a collimated bipolar ejection of matter. In contrast to the situation in 2006, the jets were detected even before the system reached its maximum brightness. Moreover, components with velocities close to 1200 km s^{-1} disappeared at the maximum, while those with velocities close to 1800 km s^{-1} appeared.

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The curious conundrum regarding sulfur and oxygen abundances in Planetary Nebulae

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Sulfur abundances derived from optical emission line measurements and ionization correction factors in planetary nebulae are systematically lower than expected for the objects' metallicities. We have carefully considered a large range of explanations for this "sulfur anomaly", including: (1) correlations between the size of the sulfur deficit and numerous nebular and central star properties; (2) ionization correction factors which under-correct for unobserved ions; (3) effects of dielectronic recombination on the sulfur ionization balance; (4) sequestering of S into dust and/or molecules; and (5) excessive destruction of S or production of O by AGB stars. It appears that all but the second scenario can be ruled out. However, we find evidence that the sulfur deficit is generally reduced but not eliminated when S^{3+} abundances determined directly from IR measurements are used in place of the customary sulfur ionization correction factor. We tentatively conclude that the sulfur anomaly is caused by the inability of commonly used ICFs to properly correct for populations of ionization stages higher than S^{2+}.

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The Great Escape II: Exoplanet ejection from dying multiple star systems

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Extrasolar planets and belts of debris orbiting post-main-sequence single stars may become unbound as the evolving star loses mass. In multiple star systems, the presence or co-evolution of the additional stars can significantly complicate the prospects for orbital excitation and escape. Here, we investigate the dynamical consequences of multi-phasic, nonlinear mass loss and establish a criterion for a system of any stellar multiplicity to retain a planet whose orbit surrounds all of the parent stars. For single stars which become white dwarfs, this criterion can be combined with the Chandrasekhar Limit to establish the maximum allowable mass-loss rate for planet retention. We then apply the criterion to circumbinary planets in evolving binary systems over the entire stellar mass phase space. Through about 10^5 stellar evolutionary track realizations, we characterize planetary ejection prospects as a function of binary separation, stellar mass and metallicity. This investigation reveals that planets residing at just a few tens of AU from a central concentration of stars are susceptible to escape in a wide variety of multiple systems. Further, planets are significantly more susceptible to ejection from multiple star systems than from single star systems for a given system mass. For system masses greater than about 2 $M_\odot$, multiple star systems represent the greater source of free-floating planets.

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The origin of dust in galaxies revisited: the mechanism determining dust content

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The origin of cosmic dust is a fundamental issue in planetary science. This paper revisits the origin of dust in galaxies, in particular, in the Milky Way, by using a chemical evolution model of a galaxy composed of stars, interstellar medium, metals (elements heavier than helium), and dust. We start from a review of time-evolutionary equations of the four components, and then, we present simple recipes for the stellar remnant mass and yields of metal and dust based on models of stellar nucleosynthesis and dust formation. After calibrating some model parameters with the data from the solar neighborhood, we have confirmed a shortage of the stellar dust production rate relative to the dust destruction rate by supernovae if the destruction efficiency suggested by theoretical works is correct. If the dust mass growth by material accretion in molecular clouds is active, the observed dust amount in the solar neighborhood is reproduced. We present a clear analytic explanation of the mechanism for determining dust content in galaxies after the activation of accretion growth: a balance between accretion growth and supernova destruction. Thus, the dust content is independent of the uncertainty of the stellar dust yield after the growth activation. The timing of the activation is determined by a critical metal mass fraction which depends on the growth and destruction efficiencies. The solar system formation seems to have occurred well after the activation and plenty of dust would have existed in the proto-solar nebula.

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Do novae have optically thick winds during outburst with large deviations from spherical symmetry?

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The evidence for the presence of optically thick winds, produced by classical novae after optical maximum, has been challenged in recent papers. In addition, signs of orbital phase dependent photometric variations, sometimes seen quite early in the development of nova outbursts, are hard to interpret in the framework of optically thick envelopes and especially winds. A general discussion for belief in the presence of optically thick winds with increasing ejection velocities during the early stages of novae after their explosion, must be given. This has to be done in order to clarify ideas about novae as well as to contribute in particular to the understanding of the behaviour of novae V1500 Cyg and V1493 Aql showing phase dependent variations during very early decline after the outburst. Possible ways of overcoming the apparent contradiction of phase dependent variations through the production of deviations from spherical symmetry of the winds, are looked at and order of magnitude estimates are made for different theoretical scenarios, which might produce such deviations. It is found that large deviations from spherical symmetry of the optically thick winds in early phases after the explosion can easily explain the problem of variations. In particular, the presence of a magnetic field might have had a non-negligible effect on the wind of V1500 Cyg, while at the present there is not enough information available concerning V1493 Aql. Optically thick winds/envelopes are almost certainly present in the early stages after optical maximum of a nova, while it is difficult to make pure Hubble flow models fit the observations of those stages. New more detailed observational and theoretical work, in particular including the effects of magnetic fields on the winds, is needed.

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UV properties of Galactic globular clusters with GALEX I. The color–magnitude diagrams

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We present GALEX data for 44 Galactic globular clusters obtained during 3 GALEX observing cycles between 2004 and 2008. This is the largest homogeneous data set on the UV photometric properties of Galactic globular clusters ever collected. The sample selection and photometric analysis are discussed, and color–magnitude diagrams are presented. The blue and intermediate-blue horizontal branch is the dominant feature of the UV color–magnitude diagrams of old Galactic globular clusters. Our sample is large enough to display the remarkable variety of horizontal branch shapes found in old stellar populations. Other stellar types that are obviously detected are blue stragglers and post core-He burning stars. The main features of UV color–magnitude diagrams of Galactic globular clusters are briefly discussed. We establish the locus of post-core He burning stars in the UV color–magnitude diagram and present a catalog of candidate AGB-manqué, post early-AGB, and post-AGB stars within our cluster sample.

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Discovery of the host cluster for the fundamental Cepheid calibrator ζ Gem

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New and existing CORAVEL, $UBVJHK_{\rm s}$, HST, HIP/*Tycho*, ARO, KPNO, and DAO observations imply that the fundamental Cepheid calibrator ζ Gem is a cluster member. The following parameters were inferred for ζ Gem from cluster membership and are tied to new spectral classifications (DAO) established for 26 nearby stars (e.g., HD 53588/B7.5IV, HD 54692/B9.5IV): $E(B-V) = 0.02 \pm 0.02$, $\log t = 7.85 \pm 0.15$, and $d = 355 \pm 15$ pc. The mean distance to ζ Gem from cluster membership and six recent estimates (e.g., IRSB) is $d = 363 \pm 9$(se)$\pm$26(sd) pc. The results presented here support the color-excess and HST parallax derived for the Cepheid by Benedict et al. (2007). Forthcoming precise proper motions (DASCH) and *Chandra*/XMM–*Newton* observations of the broader field may be employed to identify cluster members, bolster the cluster's existence, and provide stronger constraints on the Cepheid's fundamental parameters.

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On the sodium overabundance of giants in open clusters: The case of the Hyades

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Sodium abundances have been determined in a large number of giants of open clusters but conflicting results, ranging from solar values to overabundances of up to five orders of magnitude, have been found. The reasons for this disagreement are not well-understood. As these Na overabundances can be the result of deep mixing, their proper understanding has consequences for models of stellar evolution. As discussed in the literature, part of this disagreement comes from the adoption of different corrections for non-LTE effects and from the use of different atomic data for the same set of lines. However, a clear picture of the Na behaviour in giants is still missing. To contribute in this direction, this work presents a careful redetermination of the Na abundances of the Hyades giants, motivated by the recent measurement of their angular diameters. An average of [Na/Fe] = +0.30, in NLTE, has been found. This overabundance can be explained by hydrodynamical models with high initial rotation velocities. This result, and a trend of increasing Na with increasing stellar mass found in a previous work, suggests that there is no strong evidence of Na overabundances in red giants beyond those values expected by evolutionary models of stars with more than ~ 2 $M_{\odot}$.

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A possible physical connection between helium-rich stellar populations of massive globular clusters and the UV upturn of galactic spheroids

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We discuss a possible physical connection between helium-rich ($Y > 0.35$) stellar populations of massive globular clusters (GCs) and the ultraviolet (UV) upturn of galactic spheroids by using analytical and numerical models. In

our model, all stars are initially formed as bound or unbound star clusters (SCs) formed from giant molecular clouds (GMCs) and the SCs can finally become GCs, open clusters, and field stars depending on physical properties of their host GMCs. An essential ingredient of the model is that helium-rich stars are formed almost purely from gas ejected from massive asymptotic giant branch (AGB) stars. The helium-rich star formation is assumed to occur within massive SCs if the masses of the progenitor GMCs are larger than a threshold mass (M_{thres}). These massive SCs can finally become either massive GCs or helium-rich field stars depending on whether they are disintegrated or not. Using this model, we show that if the initial mass functions (IMFs) in galactic spheroids are mildly top-heavy, then the mass fractions of helium-rich main-sequence stars (F_{He}) can be as large as ~ 0.1 for $M_{thres} = 10^7$ $M_\odot$. F_{He} is found to depend on IMFs and M_{thres} such that it can be larger for shallower IMFs and smaller M_{thres}. The inner regions of galactic spheroids show larger F_{He} in almost all models. Based on these results, we suggest that if the UV upturn of elliptical galaxies is due to the larger fractions of helium-rich stars, then the origin can be closely associated with top-heavy IMFs in the galaxies.

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Three-dimensional interferometric, spectrometric, and planetary views of Procyon

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Context: Procyon is one of the brightest stars in the sky and one of our nearest neighbours. It is therefore an ideal benchmark object for stellar astrophysics studies using interferometric, spectroscopic, and asteroseismic techniques.
Aims: We use a new realistic three-dimensional (3D) radiative-hydrodynamical (RHD) model atmosphere of Procyon generated with the Stagger Code and synthetic spectra computed with the radiative transfer code Optim3D to re-analyze interferometric and spectroscopic data from the optical to the infrared. We provide synthetic interferometric observables that can be validated using observations.
Methods: We computed intensity maps from a RHD simulation in two optical filters centered on 500 and 800 nm (Mark III) and one infrared filter centered on 2.2 μm (Vinci). We constructed stellar disk images accounting for the center-to-limb variations and used them to derive visibility amplitudes and closure phases. We also computed the spatially and temporally averaged synthetic spectrum from the ultraviolet to the infrared. We compare these observables to Procyon data.
Results: We study the impact of the granulation pattern on center-to-limb intensity profiles and provide limb-darkening coefficients in the optical as well as in the infrared. We show how the convection-related surface structures affect the visibility curves and closure phases with clear deviations from circular symmetry, from the 3rd lobe on. These deviations are detectable with current interferometers using closure phases. We derive new angular diameters at different wavelengths with two independent methods based on 3D simulations. We find that $\theta_{\rm Vinci} = 5.390 \pm 0.03$ mas, which we confirm by comparison with an independent asteroseismic estimation ($\theta_{\rm seismic} = 5.360 \pm 0.07$ mas. The resulting $T_{\rm eff}$ is 6591 K (or 6556 K depending on the bolometric flux used), which is consistent with the value of $T_{\rm eff,IR} = 6621$ K found with the infrared flux method. We measure a surface gravity $\log g = 4.01 \pm 0.03$ [cm s^{-2}] that is higher by 0.05 dex than literature values. Spectrophotometric comparisons with observations provide very good agreement with the spectral energy distribution and photometric colors, allowing us to conclude that the thermal gradient in the simulation matches Procyon fairly well. Finally, we show that the granulation pattern of a planet-hosting Procyon-like star has a non-negligible impact on the detection of hot Jupiters in the infrared using

interferometry closure phases. It is then crucial to have a comprehensive knowledge of the host star to directly detect and characterize hot Jupiters. In this respect, RHD simulations are very important to achieving this aim.

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CRIRES-POP: A library of high resolution spectra in the near-infrared

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New instrumental capabilities and the wealth of astrophysical information extractable from the near-infrared wavelength region have led to a growing interest in the field of high resolution spectroscopy at 1–5 μm. We aim to provide a library of observed high-resolution and high signal-to-noise-ratio near-infrared spectra of stars of various types throughout the Hertzsprung–Russell diagram. This is needed for the exploration of spectral features in this wavelength range and for comparison of reference targets with observations and models. High quality spectra were obtained using the CRIRES near-infrared spectrograph at ESO's VLT covering the range from 0.97 to 5.3 μm at high spectral resolution. Accurate wavelength calibration and correction for of telluric lines were performed by fitting synthetic transmission spectra for the Earth's atmosphere to each spectrum individually. We describe the observational strategy and the current status and content of the library which includes 13 objects. The first examples of finally reduced spectra are presented. This publication will serve as a reference paper to introduce the library to the community and explore the extensive amount of material.

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Kinematics & chemistry of Halo substructures: The vicinity of the VOD

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We present observations obtained with the AAT's 2dF wide field spectrograph AAOmega of K-type stars located within a region of the sky which contains the Virgo Over-Density and the leading arm of the Sagittarius Stream. On the basis of the resulting velocity histogram we isolate halo substructures in these overlapping regions including Sagittarius and previously discovered Virgo groups. Through comparisons with *N*-body models of the Galaxy–Sagittarius interaction, we find a tri-axial dark matter halo is favoured and we exclude a prolate shape. This result is contradictory with other observations along the Sagittarius leading arm, which typically favour prolate models. We have also uncovered K-giant members of Sagittarius that are notably more metal poor ($\langle$[Fe/H]$\rangle = -1.7 \pm 0.3$ dex) than previous studies. This suggests a significantly wider metallicity distribution exists in the Sagittarius Stream than formerly considered. We also present data on five carbon stars which were discovered in our sample.

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Conference Papers

Magnetic towers and binary-formed disks: New results for PN evolution

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We present new results of 3-D AMR MHD simulations focusing on two distinct aspects of PPN evolution. We first report new simulations of collimated outflows driven entirely by magnetic fields. These Poynting flux dominated "magnetic towers" hold promise for explaining key properties of PPN flows. Our simulations address magnetic tower evolution and stability. We also present results of a campaign of simulations to explore the development of accretion disks formed via wind capture. Our result focus on the limits of disk formation and the range of disk properties.

Oral contribution, published in IAU Symposium 283 "Planetary Nebulae, an Eye to the Future", Puerto de la Cruz, Tenerife, Spain
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A new variable star SBS 0802+529 from the Second Byurakan Survey

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A new emission line star was discovered on the plates of the Second Byurakan Survey (SBS). The follow up spectroscopy demonstrates that the object has a spectrum dominated by a late type giant star with superposed hydrogen emission lines. The object resembles a pulsating Mira, but the amplitude of variability and a rapid UV variability are quite unusual for a single star and we tentatively classify the object as a symbiotic nova.

Oral contribution, published in Asiago meeting on symbiotic stars
Available from http://www.astro.unipd.it/Symbiotic_Stars/.Proofs/proceedings.pdf

The X-ray evolution of the symbiotic star V407 Cygni during its 2010 outburst

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We present a summary of *Swift* and *Suzaku* X-ray observations of the 2010 nova outburst of the symbiotic star, V407 Cyg. The *Suzaku* spectrum obtained on day 30 indicates the presence of the supersoft component from the white

dwarf surface, as well as optically thin component from the shock between the nova ejecta and the Mira wind. The *Swift* observations then allow us to track the evolution of both components from day 4 to day 150. Most notable is the sudden brightening of the optically thin component around day 20. We identify this as the time when the blast wave reached the immediate vicinity of the photosphere of the Mira. We have developed a simple model of the blast wave-wind interaction that can reproduce the gross features of the X-ray evolution of V407 Cyg, and explore a parameter space of ejected mass, binary separation and Mira mass-loss rate. If the model is correct, the binary separation is likely to be larger then previously suggested and the mass-loss rate of the Mira is likely to be relatively low.

Oral contribution, published in "First Asiago Meeting on Symbiotic Stars", July 10–11 2011, Asiago, Italy
Available from arXiv:1201.5645

Review Paper

Asymptotic Giant Branch variables in the Galaxy and the Local Group

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AGB variables, particularly the large amplitude Mira type, are a vital step on the distance scale ladder. They will prove particularly important in the era of space telescopes and extremely large ground-based telescopes with adaptive optics, which will be optimized for infrared observing. Our current understanding of the distances to these stars is reviewed with particular emphasis on improvements that came from *Hipparcos* as well as on recent work on Local Group galaxies. In addition to providing the essential calibration for extragalactic distances Gaia may also provide unprecedented insight into the poorly understood mass-loss process itself.

Published in Astrophysics and Space Science
Available from arXiv:1201.2997
and from http://www.springerlink.com/content/x5073u16422p7827/

Thesis

Interferometry of carbon rich AGB stars

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This thesis deals with the comparison of interferometric data of Asymptotic Giant Branch (AGB) stars with hydrostatic and dynamic model atmospheres.
The AGB is the late evolutionary stage of stars with masses below 8 $M_{\odot}$. These stars are characterised by a C–O degenerated core and 2 shell with ongoing nuclear reactions (He and H shells), a convective envelope and a very extended atmosphere with molecules and dust formation. As a star evolves along the AGB, it becomes subject to photometric variability and mass loss. As it gets older and more luminous the mass loss becomes significant, enriching the interstellar medium with the products of stellar nucleosynthesis.
If the AGB star has enough mass, the convective envelope will extend into the region with nuclear reactions, thereby, bringing processed material to the surface (dredge-up). The "third" dredge-up is responsible for the existence of

Carbon Stars. The spectrum of these stars is characterised by features of carbon-bearing molecules (C_2, C_2H_2, C_3, CN, HCN). Dust is mostly present in the outflows as amorphous carbon influencing the spectral energy distribution. Studying AGB stellar atmospheres is essential for a better comprehension of the late stage of stellar evolution, to understand the complicate influence of pulsation on the stellar atmosphere, the dynamic process of dust formation and mass loss. Due to their extended atmospheres and brightness in the red and infrared range, AGB stars are perfect candidates for interferometric investigations. For pulsating, mass-losing carbon stars available atmospheric models are more advanced than for oxygen-rich stars because the dust formation is better understood. Nevertheless, in literature very few interferometric studies were dedicated to this class of objects so far. Therefore, this work is concentrated on carbon stars.

The first part of this thesis is devoted to the interferometric analysis of synthetic intensity profiles and visibility. profiles using Johnson JHK broad-band filters, and some narrow filters defined *ad hoc* to sample features of the infrared spectra of C-stars. These profiles are computed for a specified set of hydrodynamic models for stars with different mass-loss rates. Most of the previous studies concerning interferometry of red giant stars used simple approximations for interpreting visibility profiles. Following the same approach used in literature as for M-stars, the computed visibility profiles are fitted with analytical functions (uniform discs) to investigate their dependence on wavelength, pulsation phase and stellar parameters. It was found that the radius predicted by the models increases with wavelength, and the dependence on pulsation phase is not strictly sinusoidal. The $L-$band turned out to be crucial region for parameter determinations.

In the second part of this work newly obtained spectroscopic and interferometric data are presented for a sample of five objects with very limited dynamic effects. The observations are compared with models and the full set of stellar parameters ($T_{\rm eff}$, C/O, mass and $\log g$) could be derived. The parameters determined in this way are then compared with evolutionary tracks. The distance determination remains a crucial problem. Nevertheless, very accurate effective temperature determinations can be obtained from $L-$band spectroscopy, and interferometry is the only tool that can give access to the mass of the object.

In the third and fourth part of the work the radial structure of the atmosphere of the C-rich semiregular variable R Scl and the carbon-Mira R For are investigated with spectro-interferometric observations in the mid-infrared. The $N-$band variability, the stratification of the atmosphere, and the geometry of the circumstellar envelope are presented. The observations are compared with dynamic model atmospheres confirming the interferometric technique as a very powerful tool to constrain our knowledge of dynamic processes (i.e. dust formation and mass-loss process).

Thesis defended 14 December, 2011
Available from http://tiny.cc/fb90g

Job Advert

University of Hamburg Postdoctoral position in radio astronomy

A postdoc position is opened at Hamburger Sternwarte / Germany for candidates with a background in radio interferometry. The position is for a period of two years with a possibility of extension for one more year.

The position is coupled to responsibilities for supporting the research project 'Distances to OH/IR stars', funded by the Deutsche Forschungsgemeinschaft (DFG). The applicant will be responsible for the data reduction of interferometric observations of OH masers taken with the *Karl Jansky* VLA, eMERLIN and the EVN. The applicant will be involved in the supervision of a radio monitoring program of OH/IR stars currently underway with the Nançay Radio Telescope, and is expected to participate in the scientific analysis of the data. Own independent research by the applicant is welcomed and supported.

Applications may be submitted by e-mail to D. Engels (Hamburger Sternwarte) along with a curriculum vitae, list of publications, and names and addresses of two referees. Review of applications will begin May 1, 2012, and continue until the position is filled.

For further details please visit www.hs.uni-hamburg.de/nrt-monitoring or contact
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Tel: 49-40-428388536

See also www.hs.uni-hamburg.de/nrt-monitoring

Announcements

40^{th} Liège International Astrophysical Colloquium

First Announcement
Ageing low mass stars: from red giants to white dwarfs
40^{th} Liège International Astrophysical Colloquium
Liège, July 9–13 2012
http://www.ago.ulg.ac.be/PeM/Coll/Liac40/
Contact: E-Mail: liac2012@misc.ulg.ac.be

Scientific rationale

The main topic of this colloquium is evolved low-mass stars: red giants, extreme horizontal branch stars and white dwarfs. The aim is to focus on the physical processes affecting their structure and evolution, and on what we can learn on these stars from asteroseismology.

Registration is now open to all colleagues and financial support may be available.

Programme & invited talks

I. Stellar evolution

Overview (general introduction) (M. Catelan)

Open problems (A. Weiss)

Rotation and stellar evolution (P. Eggenberger)

II. Stellar evolution: Stellar populations

Milky Way (C. Chiappini)

Stellar clusters (M. Salaris)

III. Red giants (RG)

RG evolution and specific problems (RGB, He flash, red clump, 2^{nd} red clump) (A. Bressan)

RG seismic aspects (J. Montalbán)

RG observations (B. Mosser)

Asteroseismology of stellar populations (A. Miglio)

IV. Hot B subdwarfs (sdB)

sdB formation, also in connexion with observations (S. Geier)

sdB asteroseismology (S. Charpinet)

The mass distribution of sdBs and constraints for stellar evolution (V. Van Grootel)

V. White dwarfs

Overview (G. Fontaine)

White dwarf cosmochronology (J. Isern)

Pulsating white dwarfs (I) (H. Saio)

Pulsating white dwarfs (II) (H. Shibahashi)

Deadlines

15	February	2012	Conference registration opens
15	March	2012	Request financial support deadline
15	May	2012	Abstract submission deadline (talks & posters)
30	May	2012	Selection of contributed talks
30	May	2012	Grant support decision
15	June	2012	Conference registration closes
9	July	2012	Conference starts!

SOC

Gilles Fontaine(Univ. de Montréal)
Annie Baglin(Obs. Paris-Meudon)
Corinne Charbonnel(Univ. de Genève)
Stéphane Charpinet (IRAP, Toulouse)
Francesca D'Antona (INAF–Oss. di Roma)
Marc-Antoine Dupret (Univ. de Liège)
Wojtek Dziembowski (Univ. of Warsaw)
Zhanwen Han (Yunnan Obs.)
Alain Jorissen (Univ. de Bruxelles)
Josefina Montalbán (Univ. de Liège)
Arlette Noels (Univ. de Liège)
Valerie Van Grootel (Univ. de Liège)

See also http://www.ago.ulg.ac.be/PeM/Coll/Liac40/

Fizeau exchange visitors program – call for applications

Dear colleagues!

The Fizeau exchange visitors program in optical interferometry funds (travel and accommodation) visits of researchers to an institute of his/her choice (within the European Community) to perform collaborative work and training on one of the active topics of the European Interferometry Initiative. The visits will typically last for one month, and strengthen the network of astronomers engaged in technical, scientific and training work on optical/infrared interferometry. The program is open for all levels of astronomers (Ph.D. students to tenured staff). Applicants are strongly

encouraged to seek also partial support from their home or host institutions.

The deadline for applications is the 15th of March for visits starting 1st of May.

Note that an early next call may be issued in June for visits starting in July.

Further informations and application forms can be found at www.european-interferometry.eu

The program is funded by OPTICON/FP7.

Please distribute this message also to potentially interested colleagues outside of the your community!

Looking forward to your applications,
Josef Hron & Laszlo Mosoni
(for the European Interferometry Initiative)

See also www.european-interferometry.eu

Summer school on CLOUDY, and the physics and spectroscopy of the ISM

I am organizing a weeklong school on CLOUDY, spectroscopy, and the physics of interstellar matter, to be held this summer in Lexington KY USA. This is in early planning stages and the details will depend on participant interest. Classes will include a mix of textbook study, based on Osterbrock & Ferland (2006), and hands-on experience running CLOUDY. The specific examples we discuss will reflect the research interests of the participants.

The date is not yet set but is likely to be the last week of May 2012. Participants should have access to a copy of Osterbrock & Ferland and a laptop to run CLOUDY or connect to other computers. This will be free of charge, but there is no financial support. If you think you might be interested or would like more information please contact me at *gary at pa dot uky dot edu*.

Gary Ferland

See also http://trac.nublado.org/