
THE AGB NEWSLETTER

An electronic publication dedicated to Asymptotic Giant Branch stars and related phenomena

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

Editors: Jacco van Loon and Albert Zijlstra

Editorial

Dear Colleagues,

It is our pleasure to present you the 116th issue of the AGB Newsletter. Starting the second year of its rebirth, there are currently 400 active users of the newsletter: those readers who have re-registered or who have submitted items for publication in the newsletter (the majority) in 2006. This number continues to grow steadily, making the newsletter an ever more effective way in communicating results or announcements to the AGB star community. By taking a liberal view on what might interest the AGB star community, we hope to continue to stimulate cross-fertilization with ideas of and from adjacent fields of astronomy.

Due to the holidays this issue is thinner than usual, but no less interesting. Check out the refereed publications, conference contribution and review papers, and advertisements for a job in Leuven, a conference on hydrogen-deficient stars in Tübingen, and the opening of the post-AGB star catalogue hosted at Toruń.

We would also like to draw your attention to the "Food for Thought" column, and look forward to receiving your reactions or suggestions.

The next issue will be distributed on the 1st of February; the deadline for contributions is the 31st of January. With the best wishes for 2007,

Editorially Yours,

Jacco van Loon and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

What is the principal question in relation to AGB stars, that you would like to see answered?

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)

Mass loss and yield uncertainty in low-mass asymptotic giant branch stars

Richard J. Stancliffe¹ and C. Simon Jeffery²

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We investigate the uncertainty in surface abundances and yields of asymptotic giant branch (AGB) stars. We apply three different mass loss laws to a $1.5 M_{\odot}$ star of metallicity $Z = 0.008$ at the beginning of the thermally pulsing asymptotic giant branch (TP-AGB) phase. Efficient third dredge-up is found even at very low envelope mass, contrary to previous simulations with other evolution codes. We find that the yield of carbon is uncertain by about 15% and for most other light elements the yield is uncertain at the level of 20-80%. For iron group elements the uncertainty varies from around 30% for the more abundant species to over a factor of two for the less abundant radioactive species, like iron-60. The post-AGB surface abundances for this mass and metallicity are much more uncertain due to the dilution of dredged-up material in differing envelope masses in the later stages of the models. Our results are compared to known planetary nebula (PN) and post-AGB abundances. We find that the models are mostly consistent with observations but we are unable to reproduce observations of some of the isotopes.

Accepted for publication in MNRAS

Available from astro-ph/0612005

A Photometric and Spectroscopic Search for White Dwarfs in the Open Clusters NGC 6633 and NGC 7063

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We present photometric and spectroscopic studies of the white dwarf (WD) populations in the intermediate-age open clusters NGC 6633 and NGC 7063 as part of the ongoing Lick-Arizona White Dwarf Survey (LAWDS). Using wide-field CCD imaging, we locate 41 candidate WDs in the two cluster fields: 32 in NGC 6633, and 9 in NGC 7063. Spectroscopic observations confirm 13 of these candidates to be bona-fide WDs. We describe in detail our Balmer line fitting technique for deriving effective temperatures and surface gravities from optical DA WD spectra and apply the technique to the 11 DA WDs in the sample. Of these, only two DA WDs are at the cluster distance moduli, one in each cluster. Two more DAs lie 0.75 mag foreground to NGC 6633, raising the possibility that these are double degenerate systems in the cluster. If nearly equal-mass binaries, both of these systems likely have combined masses above the Chandrasekhar limit. One DB WD is found to be consistent with membership in NGC 6633, which would make this the third confirmed He-atmosphere WD in an open cluster, though further data are needed to confirm cluster membership. The WD consistent with membership in the cluster NGC 7063 has a low mass ($\sim 0.4 M_{\odot}$), suggesting it may be a He-core WD resulting from close binary evolution. Three of the eleven hydrogen-atmosphere WDs in this study are observed to have Ca II absorption; the number of DAZs in this study is consistent with previous observations that $\sim 25\%$ of field WDs are DAZs.

Accepted for publication in The Astronomical Journal

Available from astro-ph/0611929

White Dwarf Mass Distribution in the SDSS

Kepler, S.O.¹, Kleinman, Scot J.², Nitta, Atsuko³, Koester, Detlev⁴, Castanheira, Barbara¹, Giovannini, Odilon⁵, Costa, Alex Fabiano Murillo da¹ and Althaus, Leandro⁶

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We determined masses for the 7167 DA and 507 DB white dwarf stars classified as single and non-magnetic in data release four of the Sloan Digital Sky Survey (SDSS). We obtained revised T_{eff} and $\log g$ determinations for the most massive stars by fitting the SDSS optical spectra with a synthetic spectra grid derived from model atmospheres extending to $\log g = 10.0$. We also calculate radii from evolutionary models and create volume-corrected mass distributions for our DA and DB samples. The mean mass for the DA stars brighter than $g = 19$ and hotter than $T_{\text{eff}} = 12000$ K is $\langle M \rangle_{\text{DA}} = 0.593 \pm 0.016 M_{\odot}$. For the 150 DBs brighter than $g = 19$ and hotter than $T_{\text{eff}} = 16000$ K, we find $\langle M \rangle_{\text{DB}} = 0.711 \pm 0.009 M_{\odot}$. It appears the mean mass for DB white dwarf stars may be significantly larger than that for DAs. We also report the highest mass white dwarf stars ever found, up to $1.33 M_{\odot}$.

Accepted for publication in MNRAS

Available from astro-ph/0612277

Defining the instability strip of pulsating post-AGB binary stars from ASAS and NSVS photometry

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We analyse public domain time-series photometric observations of 30 known and candidate binary post-AGB stars for measuring pulsation and orbital periods. We derive periodicities for 17 stars for the first time in the literature. Besides identifying five new RV Tauri type pulsating variables (three with the RVb phenomenon, i.e. long-term changes of the mean brightness), we find multiply periodic (or possibly irregular) post-AGB stars on the two edges of the instability strip. The temperature dependence of the peak-to-peak light curve amplitudes clearly indicates the changes in excitation as post-AGB stars evolve through the strip. One object, the peculiar Type II Cepheid ST Pup, showed a period increase from 18.5 to 19.2 d, which is consistent with the known period fluctuations in the past. In HD 44179, the central star of the Red Rectangle nebula, we see very similar asymmetric light curve than was measured 10-15 years ago, suggesting a very stable circumstellar environment. In contrast to this, HD 213985 shows coherent but highly non-repetitive brightness modulation, indicating changes in the circumstellar cloud on a similar time-scale to the orbital period.

Accepted for publication in MNRAS

Available from astro-ph/0612217

The late stages of the evolution of intermediate-mass primordial stars: the effects of overshooting

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We compute and analyze the evolution of primordial stars of masses at the ZAMS between $5 M_{\odot}$ and $10 M_{\odot}$, with and without overshooting. Our main goals are to determine the nature of the remnants of massive intermediate-mass primordial stars and to check the influence of overshooting in their evolution. Our calculations cover stellar evolution from the main sequence phase until the formation of the degenerate cores and the thermally pulsing phase. We have obtained the values for the limiting masses of Population III progenitor stars leading to carbon-oxygen and oxygen-neon compact cores. Moreover, we have also obtained the limiting mass for which isolated primordial stars would lead to core-collapse supernovae after the end of the main central burning phases. Considering a moderate amount of overshooting the mass thresholds at the ZAMS for the formation of carbon-oxygen and oxygen-neon degenerate cores shifts to smaller values by about $2 M_{\odot}$. As a by-product of our calculations, we have also obtained the structure and composition profiles of the resulting compact remnants. Opposite to what happens with solar metallicity objects, the final fate of primordial stars is not straightforward determined from the mass of the compact cores at the end of carbon burning. Instead, the small mass-loss rates typically associated to stellar winds of low metallicity stars might allow the growth of the resulting degenerate cores up to the Chandrasekhar mass, on time scales one or two orders of magnitude shorter than the time required to lose the envelope. This would lead to the formation of supernovae for initial masses as small as about $5 M_{\odot}$.

Accepted for publication in A&A

Available from astro-ph/0612267

Trigonometric Parallaxes of Central Stars of Planetary Nebulae

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Trigonometric parallaxes of 16 nearby planetary nebulae are presented, including reduced errors for seven objects with previous initial results and results for six new objects. The median error in the parallax is 0.42 mas, and twelve nebulae have parallax errors less than 20 percent. The parallax for PHL932 is found here to be smaller than was measured by Hipparcos, and this peculiar object is discussed. Comparisons are made with other distance estimates. The distances determined from these parallaxes tend to be intermediate between some short distance estimates and other long estimates; they are somewhat smaller than estimated from spectra of the central stars. Proper motions and tangential velocities are presented. No astrometric perturbations from unresolved close companions are detected.

Accepted for publication in AJ (February 2007)

Available from astro-ph/0611543

Survival of Nature's Rarest Isotope ^{180}Ta under Stellar Conditions

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The nucleosynthesis of nature's rarest isotope ^{180}Ta depends sensitively on the temperature of the astrophysical environment because of depopulation of the long-living isomeric state via intermediate states to the short-living ground state by thermal photons. Reaction rates for this transition have been measured in the laboratory. These ground

state rates underestimate the stellar rates dramatically because under stellar conditions intermediate states are mainly populated by excitations from thermally excited states in $^{180\text{m}}\text{Ta}$. Full thermalization of ^{180}Ta is already achieved for typical s-process temperatures around $kT = 25$ keV. Consequently, for the survival of ^{180}Ta in the s-process fast convective mixing is required which has to transport freshly synthesized ^{180}Ta to cooler regions. In supernova explosions ^{180}Ta is synthesized by photon- or neutrino-induced reactions at temperatures above $T_9 = 1$ in thermal equilibrium; independent of the production mechanism, freeze-out from thermal equilibrium occurs at $kT \approx 40$ keV, and only $35 \pm 4\%$ of the synthesized ^{180}Ta survive in the isomeric state.

Accepted for publication in Phys. Rev. C, Rapid Communication

Available from astro-ph/0612427

A catalog of Planetary Nebula candidates and H II regions in NGC 3109

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³Observatoire de Meudon, France

Images obtained with the ESO VLT and FORS1 in [O III] 5007 on- and off-band as well as r_Gunn filters are analyzed to search for Planetary Nebula (PN) candidates. In the continuum-subtracted [O III] 5007 on-band images, a large number of emission-line regions were detected. We describe the criteria employed in order to distinguish PN candidates from compact H II regions, finding that the sizes and the properties of the ionizing stars are the most unambiguous discriminators for separating the two classes. Based upon these criteria, we have found 20 PN candidates for which we present coordinates, nebular [O III] fluxes, and stellar magnitudes. The cumulative luminosity function for these PNe is discussed. A catalog of H II regions listing coordinates, nebular [O III] fluxes, stellar magnitudes and other characteristics is also presented. We find that H II regions are rather concentrated towards the disk of the galaxy, while PNe are found also above and below this structure, consistent with their belonging to an older stellar population. Based on observations collected at the European Southern Observatory, VLT, Paranal, Chile (program ID 076.B-0166)

Accepted for publication in Astronomy and Astrophysics

Available from astro-ph/0612553

Conference Paper

Binary life after the AGB – towards a unified picture

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A unified evolutionary scheme that includes post-AGB systems, barium stars, symbiotics, and related systems, explaining their similarities as well as differences. Can we construct it? We compare these various classes of objects in order to construct a consistent picture. Special attention is given to the comparison of the barium pollution and symbiotic phenomena. Finally, we outline a ‘transient torus’ evolutionary scenario that makes use of the various observational and theoretical hints and aims at explaining the observed characteristics of the relevant systems.

Oral contribution, published in Evolution and chemistry of symbiotic stars, binary post-AGB and related objects (Wierzba, Poland, 28-30 August 2006)

Available from astro-ph/0612438

and from <http://www.astro.ulb.ac.be/Html/ps.html#PRS>

On determining the mass-loss rates of red giants and red supergiants based on infrared data

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I review existing methods for determining mass-loss rates of red giants and red supergiants based on infrared data. The simplest method is based on models for the absorption and emission by dust which forms in the dense outflows from these cool stars. I discuss the parameters and assumptions upon which the method relies, review relationships between the mass-loss rate and infrared colours or far-infrared flux density, and propose a new formula for the mass-loss rate as a function of the visual extinction. I also briefly discuss the use of atomic and molecular transitions at infrared wavelengths.

Published in "Why Galaxies Care About AGB Star", Vienna August 2006, eds. Franz Kerschbaum, Corinne Charbonnel & Bob Wing, ASP Conf.Ser.

Available from astro-ph/0612374

and from <http://www.astro.keele.ac.uk/~jacco/research/ecology.html>

Job Advert

Institute for Astronomy - Leuven (Belgium) Postdoctoral research position

The Institute for Astronomy (IvS) of the University of Leuven is inviting applications for a postdoctoral position to work as research scientist in a Spitzer program studying the Galactic Bulge stellar population. Our team participates in an international collaboration to map the inner regions of the Galaxy in the mid-infrared wavelength regime using the IRAC and MIPS instruments of the Spitzer satellite.

The successful candidate is expected to contribute significantly to the data reduction of the Spitzer and also of the groundbased near-infrared imaging data taken quasi-simultaneously. A point-source catalogue will be built combining the different data sets. The candidate is expected to use a Galactic Model to interpret this data set.

This Spitzer project is expected to contribute in different areas like the study of mass loss on the AGB and RGB, extinction maps and the extinction law towards the inner Galaxy, study of the stellar population(s), and a characterization of the nuclear bulge.

The Institute for Astronomy is a young research team of some 40 scientists. Its main themes are in the very broad context of stellar evolution, including star formation and young stars, distances and galactic structure, stellar variability and asteroseismology. The institute has a powerful computing infrastructure. Further information about the institute can be found at <http://www.ster.kuleuven.be/>.

Applicants are required to have a recent Ph.D. (obtained in the last three years) in astronomy and to have experience in data-reduction techniques. Experience in the research domain of AGB stars and/or the Bulge stellar population is considered as a strong asset. As part of functional duties the applicant is required to take part in 1-2 observing runs per year (either in Chile or the Flemish Mercator telescope on La Palma).

There is current funding for a postdoctoral position of 2 years, starting in spring 2007. Applications including CV, publications list, a 1-page statement on how you see your involvement in this project, and three reference letters should be sent by February 15, 2007, to:

Dr Joris Blommaert
Instituut voor Sterrenkunde
Celestijnenlaan 200D
B-3001 Leuven
Belgium
Fax number: +32-16-32.79.99

Questions about the position should be directed to joris.blommaert@ster.kuleuven.be

See also <http://www.ster.kuleuven.be/>

Announcements

HYDROGEN-DEFICIENT STARS

TÜBINGEN, GERMANY, SEPTEMBER 17-21, 2007

We are pleased to announce an international conference on HYDROGEN-DEFICIENT STARS. It will be hosted by the Institute for Astronomy and Astrophysics at the University of Tübingen, Germany.

The rationale for organizing this conference is as follows. Many evolved intermediate- and high-mass stars exhibit H-deficient atmospheres. The H-deficiency can be the result of e.g. single-star evolution, close-binary evolution or double-degenerate mergers. Many of these stellar classes are thought to be related in an evolutionary sense, e.g., Wolf-Rayet (WR) central stars of planetary nebulae (PN) are likely the progenitors of PG1159 stars, while other classes are not related, but share similar physics, e.g., the WR central stars of PN and the massive WR stars.

By gathering experts in all H-deficient stellar classes our meeting will summarize the progress made in the past decade since the last meeting devoted to this topic in Bamberg 1995. We will underline the key questions still standing and hopefully promote a new wave of investigations.

We will address all subtypes of H-deficient stars both of intermediate and high mass. The distinction between the two mass categories is well understood. By discussing them within the same venue we hope for the two fields to cross pollinate and promote new research avenues. Examples of H-deficient intermediate mass stars are R Coronae Borealis stars, extreme He-B stars, WR type central stars of PN, PG1159 stars, non-DA white dwarfs and He-rich subdwarfs. Of particular interest are fast-evolving stars like FG Sge and Sakurai's object. We will emphasize close-binary evolution leading to H-deficiency (AM CVn stars and ultracompact low-mass X-ray binaries, relation to SNIa).

On the high mass front we will discuss Pop.I WR star properties. Much research on the wind driving mechanism as been carried out in this field in the last decade, some of which can be applied to the intermediate-mass stars. In addition, massive WR stars are intimately related to Galactic chemical evolution and the enigmatic Gamma-ray bursts, both fields which have received much recent attention.

We plan to have a number of topics and sessions. The sessions will be introduced by invited speakers and followed by contributions on the given subject. The planned topics and speakers are:

Topics	Invited Speakers
Statistics of various classes	Sion
Observational hints for evol. links	Lambert
RCrBs: status of observational data	Rao
RCrBs: model atmospheres	Asplund (+)
RCrBs: evolution	Clayton
RCrBs: formation of dust	Woitke
EHe-Bs	Jeffery
Pulsations in RCrB, EHe-B etc.	Saio
Origin of H-def pAGB stars: late He flash	Herwig
Origin of H-def pAGB stars: alternatives	de Marco
FG Sge, V605 Aql, Sakurai	Schönberner
Progenitor AGB evolution	Lattanzio
Wolf-Rayet stars as GRB progenitors	Langer
WR analysis	Hamann
WR pulsations	Glatzel
[WC] analysis	Crowther
[WC] PN properties	Górny
PG1159 analysis	Werner
DO/DB white dwarfs	Liebert
Pulsations in PG1159/DBs	Quirion
He-rich subdwarfs	Heber
AM CVn	Nelemans (+)
H-deficient LMXB donors	Marsh
Close binary evolution AMCVn, LMXB, SNIa	Podsiadlowski (+)
Double-degenerate merger simulations	Fryer
Which path toward SNIa	Bildsten (+)

(+) to be finally confirmed

If you are interested to participate and to contribute an oral or poster presentation please fill out and send the registration form before August 1st, 2007. In general, the number of topics one person may contribute to is not limited. However, the SOC may redirect some contributions from the oral to the poster presentation in case of necessity.

In case of positive assessment by the German Science Foundation, limited funds will be available to assist with a part of travel expenses. We intend to publish the proceedings with ASP. The registration fee will be about 200 Euro.

For REGISTRATION and detailed INFORMATION see our Conference Website:

<http://astro.uni-tuebingen.de/rauch/HYDEF07.html>

E-mail contact:

hydef07@astro.uni-tuebingen.de

We suggest to book your hotel room as early as possible.

Scientific Organizing Committee:

- M. Asplund (Australia)
- G.C. Clayton (USA)
- O. De Marco (USA)
- W.-R. Hamann (Germany)
- U. Heber (Germany)
- F. Herwig (UK)
- C.S. Jeffery (Northern Ireland)

N.K. Rao (India)
E.M. Sion (USA)
R. Tylenda (Poland)
K. Werner (Germany, chair)

Local Organizing Committee:
H. Lenhart, T. Nagel, H. Oberndörffer, T. Rauch (chair)

On behalf of the SOC & LOC,
K. Werner and T. Rauch

See also <http://astro.uni-tuebingen.de/~rauch/HYDEF07.html>

An evolutive catalogue of Galactic post-AGB and related objects

We would like to announce the opening of *the Toruń catalogue of Galactic post-AGB and related objects*. The related paper has been just submitted to *Astronomy & Astrophysics* and will become available as soon as possible.

Comments and/or suggestions are welcome via e-mail address: postagb@ncac.torun.pl

On behalf of the authors,

Ryszard Szczerba

See also <http://www.ncac.torun.pl/postagb>