THE AGB NEWSLETTER

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

No. 130 — 30 March 2008

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 130$^{\rm th}$ issue of the AGB Newsletter, full of interesting and diverse new findings. We draw your attention to the work by Nicolas Mauron, on carbon stars at large distances in the Galactic halo.

There is also a nice report on IAU Symposium 251, which was held in Hong Kong. We would like to encourage more such reports, in particular (brief) summaries of the scientific content of meetings.

The next issue will be distributed on the 30$^{\rm th}$ of April; the deadline for contributions is the 29$^{\rm th}$ of April.

Editorially Yours,
Jacco van Loon and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

Do metal-poor carbon stars have faster winds than metal-rich carbon stars?

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

A New VLA-*Hipparcos* Distance to Betelgeuse and its Implications

Graham M. Harper[1]*, Alexander Brown*[1] *and Edward F. Guinan*[2]

[1]Center for Astrophysics and Space Astronomy, University of Colorado, Boulder, CO 80309, USA
[2]Department of Astronomy and Astrophysics, Villanova University, PA 19085, USA

The distance to the M supergiant Betelgeuse is poorly known, with the *Hipparcos* parallax having a significant uncertainty. For detailed numerical studies of M supergiant atmospheres and winds, accurate distances are a prerequisite to obtaining reliable estimates for many stellar parameters. New high spatial resolution, multiwavelength, NRAO VLA radio positions of Betelgeuse have been obtained and then combined with *Hipparcos* Catalogue Intermediate Astrometric Data to derive new astrometric solutions. These new solutions indicate a smaller parallax and hence greater distance (197 ± 45 pc), than that given in the original *Hipparcos* Catalogue (131 ± 30 pc) and in the revised *Hipparcos* reduction. They also confirm smaller proper motions in both right ascension and declination, as found by previous radio observations. We examine the consequences of the revised astrometric solution on Betelgeuse's interaction with its local environment, on its stellar properties, and its kinematics. We find that the most likely star formation scenario for Betelgeuse is that it is a runaway star from the Ori OB1 association and was originally a member of a high mass multiple system within Ori OB1a.

Accepted for publication in Astronomical Journal

The Formation of Crystalline Dust in AGB Winds from Binary-induced Spiral Shocks

Richard G. Edgar[1]*, Jason Nordhaus*[1]*, Eric G. Blackman*[1] *and Adam Frank*[1]

[1]Department of Physics and Astronomy, University of Rochester, USA

As stars evolve along the asymptotic giant branch (AGB), strong winds are driven from the outer envelope. These winds form a shell, which may ultimately become a planetary nebula. Many planetary nebulae are highly asymmetric, hinting at the presence of a binary companion. Some post-AGB objects are surrounded by tori of crystalline dust, but there is no generally accepted mechanism for annealing the amorphous grains in the wind to crystals. Here, we show that the shaping of an AGB wind by a binary companion provides a possible mechanism for forming crystalline dust in the orbital plane.

Published in ApJ, 675, L101 (2008)
Available from arXiv:0709.2292

Pollution of Single White Dwarfs by Accretion of Many Small Asteroids

M. Jura[1]

[1]UCLA, USA

Extrapolating from the solar system's asteroid belt, we propose that externally-contaminated white dwarfs without an infrared excess may be experiencing continuous accretion of gas-phase material that ultimately is derived from the tidal destruction of multiple small asteroids. If this scenario is correct, then observations of metal-polluted white dwarfs may lead to determining the bulk elemental compositions of ensembles of extrasolar minor planets.

Accepted for publication in AJ
Available from arXiv:0802.4075

Optical properties of silicon carbide for astrophysical applications I. New laboratory infrared reflectance spectra and optical constants

K. M. Pitman[1], *A. M. Hofmeister*[2], *A. B. Corman*[3] *and A. K. Speck*[3]

[1]Jet Propulsion Laboratory, California Institute of Technology, USA
[2]Department of Earth and Planetary Sciences, Washington University – St. Louis, USA
[3]Department of Physics and Astronomy, University of Missouri – Columbia, USA

Silicon Carbide (SiC) optical constants are fundamental inputs for radiative transfer models of astrophysical dust environments. However, previously published values contain errors and do not adequately represent the bulk physical properties of the cubic (β) SiC polytype usually found around carbon stars. We provide new, uncompromised optical constants for β- and α-SiC derived from single-crystal reflectance spectra and investigate quantitatively whether there is any difference between α- and β-SiC that can be seen in infrared spectra and optical functions. Previous optical constants for SiC do not reflect the true bulk properties, and they are only valid for a narrow grain size range. The new optical constants presented here will allow narrow constraints to be placed on the grain size and shape distribution that dominate in astrophysical environments. In addition, our calculated absorption coefficients are much higher than laboratory measurements, which has an impact on the use of previous data to constrain abundances of these dust grains.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:0803.1210

Chemical analysis of carbon stars in the Local Group: II. The Carina dwarf spheroidal galaxy

C. Abia[1], *P. de Laverny*[2] *and R. Wahlin*[3]

[1]Dpto. Física Teórica y del Cosmos, Universidad de Granada, E-18 071 Granada, Spain
[2]Observatoire de la Côte d'Azur, Dpt. Cassiopée UMR6 202, 06 304 Nice Cedex 4, France
[3]Department of Astronomy and Space Physics, Box 515, 75120 Uppsala, Sweden

We present new results of our ongoing chemical study of carbon stars in Local Group galaxies to test the critical dependence of *s*-process nucleosynthesis on the stellar metallicity. We collected optical spectra with instrument of two carbon stars found in the Carina Dwarf Spheroidal (dSph) galaxy, namely ALW-C6 and ALW-C7. We performed a full chemical analysis using the new generation of hydrostatic, spherically symmetric carbon-rich model atmospheres and the spectral synthesis method in LTE.the VLT/UVES. The luminosities, atmosphere parameters and chemical composition of ALW-C6 and ALW-C7 are compatible with these stars being in the TP-AGB phase undergoing third dredge-up episodes, although their extrinsic nature (external pollution in a binary stellar system) cannot be definitively excluded. Our chemical analysis shows that the metallicity of both stars agree with the average metallicity ([Fe/H]~ -1.8 dex) previously derived for this satellite galaxy from the analysis of both low resolution spectra of RGB stars and the observed colour magnitude diagrams. ALW-C6 and ALW-C7 present strong *s*-element enhancements, [*s*/Fe]$= +1.6, +1.5$, respectively. These enhancements and the derived *s*-process indexes [ls/Fe], [hs/Fe] and [hs/ls] are compatible with theoretical *s*-process nucleosynthesis predictions in low mass AGB stars (~ 1.5 M$_\odot$) on the basis that the ^{13}C(α,n)^{16}O is the main source of neutrons. Furthermore, the analysis of C_2 and CN bands reveals a large carbon enhancement (C/O ~ 7 and 5, respectively), much larger than the values typically found in galactic AGB carbon stars (C/O $\sim 1-2$). This is also in agreement with the theoretical prediction that AGB carbon stars are formed more easily through third dredge-up episodes as the initial stellar metallicity drops. However, theoretical low-mass AGB models apparently fail to simultaneously fit the observed *s*-element and carbon enhancements. On the other hand, Zr is found to be less enhanced in ALW-C7 compared to the other elements belonging to the same *s*-peak. Although the abundance errors are large, the fact that in this star the abundance of Ti (which has a similar condensation temperature to Zr) seems also to be lower than those of others metals, may indicate the existence of some depletion into dust-grains in its photosphere.

Accepted for publication in A&A

Chemical Abundances and Dust in Planetary Nebulae in the Galactic Bulge

S. Gutenkunst[1], *J. Bernard-Salas*[1], *S. R. Pottasch*[2], *G. C. Sloan*[1] *and J. R. Houck*[1]

[1]Center for Radiophysics and Space Research, Cornell University, 106 Space Sciences Building, Ithaca, NY 14853, USA
[2]Kapteyn Astronomical Institute, P.O. Box 800, NL 9700 AV Groningen, The Netherlands

We present mid-infrared Spitzer spectra of eleven planetary nebulae in the Galactic Bulge. We derive argon, neon, sulfur, and oxygen abundances for them using mainly infrared line fluxes combined with some optical line fluxes from the literature. Due to the high extinction toward the Bulge, the infrared spectra allow us to determine abundances for certain elements more accurately that previously possible with optical data alone. Abundances of argon and sulfur (and in most cases neon and oxygen) in planetary nebulae in the Bulge give the abundances of the interstellar medium at the time their progenitor stars formed; thus these abundances give information about the formation

and evolution of the Bulge. The abundances of Bulge planetary nebulae tend to be slightly higher than those in the Disk on average, but they do not follow the trend of the Disk planetary nebulae, thus confirming the difference between Bulge and Disk evolution. Additionally, the Bulge planetary nebulae show peculiar dust properties compared to the Disk nebulae. Oxygen-rich dust feature (crystalline silicates) dominate the spectra of all of the Bulge planetary nebulae; such features are more scarce in Disk nebulae. Additionally, carbon-rich dust features (polycyclic aromatic hydrocarbons) appear in roughly half of the Bulge planetary nebulae in our sample, which is interesting in light of the fact that this dual chemistry is comparatively rare in the Milky Way as a whole.

Accepted for publication in The Astrophysical Journal
Available from arXiv:0803.1828

Radio interferometric observations of candidate water-maser-emitting planetary nebulae

José F. Gómez[1], *Olga Suárez*[2], *Yolanda Gómez*[3], *Luis F. Miranda*[1], *José M. Torrelles*[4] *and Óscar Morata*[5]

[1]Instituto de Astrofísica de Andalucía, CSIC, Apartado 3004, E-18080 Granada, Spain
[2]Laboratoire Hippolyte Fizeau, Université de Nice, Parc Valrose, 06108 Nice cedex 02, France
[3]Centro de Radioastronomía y Astrofísica, UNAM, Campus Morelia, Apdo. Postal 3-72, Morelia, Michoacán 58089, México
[4]Instituto de Ciencias de Espacio (CSIC)-IEEC, Facultat de Física, Planta 7a, Universitat de Barcelona, Martí i Franqués, 08028, Barcelona, Spain
[5]Departament d'Astronomia i Meteorologia, Universitat de Barcelona, Martí i Franqués 1, 08028 Barcelona, Spain

We present Very Large Array (VLA) observations of H_2O and OH masers, as well as radio continuum emission at 1.3 and 18 cm toward three sources previously cataloged as planetary nebulae (PNe) and in which single-dish detections of H_2O masers have been reported: IRAS 17443−2949, IRAS 17580−3111, and IRAS 18061−2505. Our goal was to unambiguously confirm their nature as water-maser-emitting PNe, a class of objects of which only two bona-fide members were previously known. We detected and mapped H_2O maser emission toward all three sources, while OH maser emission is detected in IRAS 17443−2949 and IRAS 17580−3111 as well as in other two objects within the observed fields: IRAS 17442−2942 (unknown nature) and IRAS 17579−3121 (also cataloged as a possible PN). We found radio continuum emission associated only with IRAS 18061−2505. Our results confirm IRAS 18061−2505 as the third known case of a PN associated with H_2O maser emission. The three known water-maser-emitting PNe have clear bipolar morphologies, which suggests that water maser emission in these objects is related to non-spherical mass-loss episodes. We speculate that these bipolar water-maser-emitting PNe would have "water-fountain" Asymptotic Giant Branch (AGB) and post-AGB stars as their precursors. A note of caution is given for other objects that have been classified as OHPNe (objects with both OH maser and radio continuum emission, that could be extremely young PNe) based on single-dish observations, since interferometric data of both OH masers and continuum are necessary for a proper identification as members of this class.

Accepted for publication in The Astronomical Journal
Available from arXiv:0803.1644

New reaction rate for $^{16}O(p,\gamma)^{17}F$ and its influence on the oxygen isotopic ratios in massive AGB stars

C. Iliadis[1,2], *C. Angulo*[3], *P. Descouvemont*[4], *M. Lugaro*[5,6] *and P. Mohr*[7]

[1]Department of Physics and Astronomy, University of North Carolina, Chapel Hill, North Carolina, 27599-3255, USA
[2]Triangle Universities Nuclear Laboratory, Durham, North Carolina 27708-0308, USA
[3]Tractebel Engineering (SUEZ), Avenue Ariane 7, 1200 Brussels, Belgium
[4]Physique Nucleaire Theorique et Physique Mathematique, CP229, Université Libre de Bruxelles, B-1050 Brussels, Belgium
[5]Sterrenkundig Instituut, University of Utrecht, Postbus 80000, 3508 TA Utrecht, The Netherlands
[6]Centre for Stellar and Planetary Astrophysics, School of Mathematical Sciences, Monash University, Victoria 3800, Australia
[7]Diakoniekrankenhaus Schwäbisch Hall, D-74523 Schwäbisch Hall, Germany

The $^{16}O(p,\gamma)^{17}F$ reaction rate is revisited with special emphasis on the stellar temperature range of $T = 60 - 100$ MK important for hot bottom burning in asymptotic giant branch (AGB) stars. We evaluate existing cross section data that were obtained since 1958 and, if appropriate, correct published data for systematic errors that were not noticed previously, including the effects of coincidence summing and updated effective stopping powers. The data are interpreted by using two different models of nuclear reactions, that is, a potential model and R-matrix theory. A new astrophysical S-factor and recommended thermonuclear reaction rates are presented. As a result of our work, the $^{16}O(p,\gamma)^{17}F$ reaction has now the most precisely known rate involving any target nucleus in the mass $A \geq 12$ range, with reaction rate errors of about 7% over the entire temperature region of astrophysical interest ($T = 0.01 - 2.5$ GK). The impact of the present improved reaction rate with its significantly reduced uncertainties on the hot bottom burning in AGB stars is discussed. In contrast to earlier results we find now that there is not clear evidence to date for any stellar grain origin from massive AGB stars.

Accepted for publication in Phys.Rev.C
Available from arXiv:0803.2757

Condensation of MgS in outflows from carbon stars

Svitlana Zhukovska[1] *and Hans-Peter Gail*[1]

[1]ZAH, Institut für Theoretische Astrophysik, Germany

The basic mechanism responsible for the widespread condensation of MgS in the outflows from carbon rich stars on the tip of the AGB is discussed with the aim of developing a condensation model that can be applied in model calculations of dust formation in stellar winds. The different possibilities how MgS may be formed in the chemical environment of outflows from carbon stars are explored by some thermochemical calculations and by a detailed analysis of the growth kinetics of grains in stellar winds. The optical properties of core-mantle grains with a MgS mantle are calculated to demonstrate that such grains reproduce the structure of the observed 30 μm feature. These considerations are complemented by model calculations of circumstellar dust shells around carbon stars. It is argued that MgS is formed via precipitation on silicon carbide grains. This formation mechanism explains some of the basic observed features of MgS condensation in dust shells around carbon stars. A weak secondary peak at about 33 ... 36 μm is shown to exist in certain cases if MgS forms a coating on SiC.

Submitted to Astronomy and Astrophysics
Available from arXiv:0803.2994

The Stellar Content of the Post-Starburst SO Galaxy NGC 5102

Tim Davidge[1]

[1]Herzberg Institute of Astrophysics, Canada

The stellar content of the S0 galaxy NGC 5102 is investigated using deep r′ and i′ images obtained with GMOS-S. A modest population of bright main sequence stars and red supergiants (RSGs) is detected throughout the western portion of the disk. Based on the numbers of main sequence stars, the star formation rate (SFR) in NGC 5102 during the past ten million years is estimated to have been 0.02 $M_\odot$ yr^{-1}. The majority of red giant branch (RGB) stars in the disk of NGC 5102 have [M/H] between −0.9 and −0.1, and the metallicity distribution of RGB stars at intermediate galactocentric radii peaks near [M/H]$\sim$ −0.6. RGB stars are traced out to galactocentric distances of 10 kpc, which corresponds to $\sim$14 disk scale lengths. A large population of bright asymptotic giant branch (AGB) stars are seen throughout the western portion of the disk, and the youngest of these have $\log t \sim 8.1$. It is concluded that (1) stars that formed within the past Gyr comprise $\sim$ 20% of the total stellar disk mass, and (2) the SFR during intermediate epochs in the disk of NGC 5102 was at least 1.4 $M_\odot$ yr^{-1}. Thus, large-scale star formation occured throughout the disk of NGC 5102 at approximately the same time that similar elevated levels of star formation occured in the bulge. It is suggested that NGC 5102 was a spiral galaxy that experienced a galaxy-wide episode of star formation that terminated a few hundred Myr in the past, and that much of its interstellar medium was ejected in an outflow.

Published in Astronomical Journal
Available from arXiv:0803.1660

A spectral line survey of NGC 7027 at millimeter wavelengths

Yong Zhang [1]*, Sun Kwok*[1] *and Dinh-V-Trung*[2]

[1]Department of Physics, University of Hong Kong, Pokfulam Road, Hong Kong, China
[2]Institute of Astronomy and Astrophysics, Academia Sinica P.O. Box 23-141, Taipei 106, Taiwan

We report on a recent spectral line survey of the planetary nebula (PN) NGC 7027 using the Arizona Radio Observatory (ARO) 12m telescope and the Heinrich Hertz Submillimeter Telescope (SMT) at millimeter wavelengths. The spectra covering the frequency ranges 71–111GHz, 157–161GHz, and 218–267GHz were obtained with a typical sensitivity of rms$<$ 8 mK. A total of 67 spectral lines are detected, 21 of which are identified with 8 molecular species, 32 with recombination lines from hydrogen and helium, and 14 remains unidentified. As the widths of emission lines from CO, other neutral molecules, molecular ions, as well as recombination of H^+ and He^+ are found to be different with each other, the line strengths and profiles are used to investigate the physical conditions and chemical processes of the neutral envelope of NGC 7027. The column densities and fractional abundances relative to H_2 of the observed molecular species are calculated and compared with predictions from chemical models. We found evidence for overabundance of N_2H^+ and underabundance of CS and HNC in NGC 7027, suggesting that X-ray emission and shock wave may play an important role in the chemistry of the hot molecular envelope of the young PN.

Accepted for publication in ApJ
Available from arXiv:0803.1624

New observations of cool carbon stars in the halo

N. Mauron[1]

[1]GRAAL, University of Montpellier, France

We report new results of our search for rare, cool carbon stars located at large distances from the Galactic plane. Candidate stars were selected in the 2MASS point source catalogue with JHK_s colours typical of N-type carbon stars, with $K_s \geq 6.0$ and with Galactic latitude $|b| > 20°$. Low resolution slit spectroscopy was carried out on 58 candidates. Eighteen new carbon stars were discovered. Six are remarkable by showing the two peculiarities of a strong infrared excess at 12 μm and a large height above the Galactic plane, from 1.7 to 6 kpc. The number of C stars with these properties has been increased to 16. Mass-loss rates were tentatively estimated by assuming that all these 16 stars are Miras and by using the correlation between $\dot{M}$ and the $K-[12]$ colour index. It is found that several stars have large mass loss, with a median $\dot{M}$ of 4×10^{-6} $M_\odot$ yr^{-1} and a dispersion of about a factor of 3 around this value. It would be desirable to detect their CO emission to see whether, like one object already on the list, they display a very low expansion velocity that could be the signature of AGB mass loss at low metallicity. The distances of our new carbon stars were determined by supposing them to be similar to those of the Sagittarius dwarf galaxy. These distances are relatively uncertain, but they do indicate that eight stars might be more than 30 kpc from the Sun, and two at the unprecedented distance of 150 kpc.

Accepted for publication in Accepted by Astronomy and Astrophysics
Available from arXiv:0803.2650

Gomez's Hamburger (IRAS 18059−3211): A pre main-sequence A-type star

V. Bujarrabal[1]*, K. Young*[2] *and D. Fong*[2]

[1]OAN, Spain; v.bujarrabal@oan.es
[2]CfA, USA

We study the nature of Gomez's Hamburger (IRAS 18059−3211), a nebula that has been proposed as a post-AGB object. Such a classification has not been confirmed; instead, we argue that it will be a key object in the study of disks rotating around young stars.
We present high-resolution SMA maps of CO J=2–1 in Gomez's Hamburger. The data are analyzed by means of a code that simulates the emission of a nebula showing a variety of physical conditions and kinematics.
Our observations clearly show that the CO emitting gas in Gomez's Hamburger forms a spectacular disk in keplerian rotation. Model calculations undoubtly confirm this result. The central (mainly stellar) mass is found to be high, ~ 4 $M_\odot$ for a distance of 500 pc. The mass and (relatively low) luminosity of the source are, independent of the assumed distance, very different from those possible in evolved stars. This object is probably transitional between the pre-MS and MS phases, still showing interstellar material around the central star or stellar system.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:0803.1438

The close circumstellar environment of the semi-regular S-type star π^1 Gruis

S. Sacuto[1,2]*, A. Jorissen*[3]*, P. Cruzalèbes*[1]*, O. Chesneau*[1]*, K. Ohnaka*[4]*, A. Quirrenbach*[5] *and B. Lopez*[1]

[1]Observatoire de la Côte d'Azur, Dpt. Gemini-CNRS-UMR 6203, Avenue Copernic, 06130 Grasse, France
[2]Department of Astronomy, University of Vienna, Turkenschanzstraße 17, 1180 Vienna, Austria
[3]Institut d'Astronomie et d'Astrophysique, Université Libre de Bruxelles, Campus Plaine CP 226, Boulevard du Triomphe, 1050 Bruxelles, Belgium
[4]Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany
[5]ZAH Landessternwarte, Königstuhl 12, 69117 Heidelberg, Germany

We study the close circumstellar environment of the nearby S-type star π^1 Gruis using high spatial-resolution, mid-infrared observations from the ESO/VLTI. Spectra and visibilities were obtained with the MIDI interferometer on the VLT Auxiliary Telescopes. The cool M5 III giant β Gruis was used as bright primary calibrator, and a dedicated spectro-interferometric study was undertaken to determine its angular diameter accurately. The MIDI measurements were fitted with the 1D numerical radiative transfer code DUSTY to determine the dust shell parameters of π^1 Gruis. Taking into account the low spatial extension of the model in the 8–9 μm spectral band for the smallest projected baselines, we consider the possibility of a supplementary molecular shell. The MIDI visibility and phase data are mostly dominated by the spherical 21 mas (694 $R_\odot$) central star, while the extended dusty environment is over-resolved even with the shortest baselines. No obvious departure from spherical symmetry is found on the milliarcsecond scale. The spectro-interferometric observations are well-fitted by an optically thin (τ(dust) < 0.01 in the N band) dust shell that is located at about 14 stellar radii with a typical temperature of 700 K and composed of 70% silicate and 30% of amorphous alumina grains. An optically thin (τ(mol) < 0.1 in the N band) H_2O+SiO

molecular shell extending from the photosphere of the star up to 4.4 stellar radii with a typical temperature of 1000 K is added to the model to improve the fit in the 8–9 μm spectral band. We discuss the probable binary origin of asymmetries as revealed by millimetric observations.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:0803.3077

Magnetohydrodynamic Model of Equatorial Plasma Torus in Planetary Nebulae

K.H. Tsui[1]

[1]Instituto de Fisica, Universidade Federal Fluminense, Brazil

Some basic structures in planetary nebulae are modeled as self-organized magnetohydrodynamic (MHD) plasma configurations with radial flow. These configurations are described by time self-similar dynamics, where space and time dependences of each physical variable are in separable form. Axisymmetric toroidal MHD plasma configuration is solved under the gravitational field of a central star of mass M. With an azimuthal magnetic field, this self-similar MHD model provides an equatorial structure in the form of an axisymmetric torus with nested and closed toroidal magnetic field lines. In the absence of an azimuthal magnetic field, this formulation models the basic features of bipolar planetary nebulae. The evolution function, which accounts for the time evolution of the system, has a bounded and an unbounded evolution track governed respectively by a negative and positive energy density constant H.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:0803.0474

Resolving Stellar Populations outside the Local Group: MAD observations of UKS 2323−326

M. Gullieuszik[1], *L. Greggio*[1], *E. V. Held*[1], *A. Moretti*[1], *C. Arcidiacono*[1], *P. Bagnara*[1], *A. Baruffolo*[1], *E. Diolaiti*[2], *R. Falomo*[1], *J. Farinato*[1], *M. Lombini*[2], *R. Ragazzoni*[1], *R. Brast*[3], *R. Donaldson*[3], *J. Kolb*[3], *E. Marchetti*[3] *and S. Tordo*[3]

[1]INAF/Osservatorio Astronomico di Padova, Italy
[2]INAF/Osservatorio Astronomico di Bologna, Italy
[3]ESO/Garching, Germany

We present a study aimed at deriving constraints on star formation at intermediate ages from the evolved stellar populations in the dwarf irregular galaxy UKS 2323−326. These observations were also intended to demonstrate the scientific capabilities of the multi-conjugated adaptive optics demonstrator (MAD) implemented at the ESO Very Large Telescope as a test-bench of adaptive optics (AO) techniques. We perform accurate, deep photometry of the field using J and K_s band AO images of the central region of the galaxy. The near-infrared (IR) colour-magnitude diagrams clearly show the sequences of asymptotic giant branch (AGB) stars, red supergiants, and red giant branch (RGB) stars down to ∼1 mag below the RGB tip. Optical-near-IR diagrams, obtained by combining our data with Hubble Space Telescope observations, provide the best separation of stars in the various evolutionary stages. The counts of AGB stars brighter than the RGB tip allow us to estimate the star formation at intermediate ages. Assuming a Salpeter initial mass function, we find that the star formation episode at intermediate ages produced $\sim 6 \times 10^5$ $M_\odot$ of stars in the observed region.

Accepted for publication in A&A Letters
Available from arXiv:0803.3728

Hen 2–104: A close-up look at the Southern Crab

M. Santander-García[2,1], *R. L. M. Corradi*[2,1], *A. Mampaso*[1], *C. Morisset*[3], *U. Munari*[4], *M. Schirmer*[2], *B. Balick*[5] *and M. Livio*[6]

[1]Instituto de Astrofísica de Canarias, 38200 La Laguna, Tenerife, Spain
[2]Isaac Newton Group of Telescopes, Ap. de Correos 321, 38700 Sta. Cruz de la Palma, Spain
[3]Instituto de Astronomía, Universidad Nacional Autónoma de México, México, D. F., México
[4]INAF Osservatorio Astronomico di Padova, via dell'Osservatorio 8, 36012 Asiago (VI), Italy
[5]Department of Astronomy, University of Washington, Seattle, Washington 98195-1580, USA
[6]Space Telescope Science Institute (STScI), 3700 San Martin Drive, Baltimore, MD 21218, USA

The kinematics, shaping, density distribution, expansion distance, and ionized mass of the nebula Hen 2–104, and the nature of its symbiotic Mira are investigated. A combination of multi-epoch HST images and VLT integral field high-resolution spectroscopy is used to study the nebular dynamics both along the line of sight and in the plane of the sky. These observations allow us to construct a 3-D spatio-kinematical

model of the nebula, which together with the measurement of its apparent expansion in the plane of the sky over a period of 4 years, provides the expansion parallax for the nebula. The integral field data featuring the [S II] λλ671.7,673.1 emission line doublet provide us with a density map of the inner lobes of the nebula, which together with the distance estimation allow us to estimate its ionized mass. We find densities ranging from n_e=500 to 1000 cm^{-3} in the inner lobes and from 300 to 500 cm^{-3} in the outer lobes. We determine an expansion parallax distance of 3.3±0.9 kpc to Hen 2–104, implying an unexpectedly large ionized mass for the nebula of the order of one tenth of a solar mass.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:0803.0448

Conference Paper

Search For Iron, Nickel, and Fluorine in PG 1159 Stars

E. Reiff[1], *T. Rauch*[1], *K. Werner*[1], *J.W. Kruk*[2] *and L. Koesterke*[3]

[1]Institute for Astronomy and Astrophysics, Kepler Center for Astro and Particle Physics, University of Tübingen, Sand 1, 72076 Tübingen, Germany
[2]Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD21218, U.S.A.
[3]McDonald Observatory and Department of Astronomy, University of Texas, Austin, TX78712-1083, U.S.A.

A possible origin of the iron-deficiency in PG 1159 stars could be neutron captures on Fe nuclei. A nickel overabundance would corroborate this idea. Consequently we are looking for nickel lines in PG 1159 stars. Prime targets are relatively cool objects, because Ni VI is the dominant ionisation stage and the spectral lines of this ion are accessible with UV observations. We do not find such lines in the coolest PG 1159 star observed by FUSE (PG 1707+427, $T_{\rm eff}$ = 85 000 K) and conclude that the nickel abundance is not enhanced. Hence, the Fe-deficiency in PG 1159 stars remains unexplained. In addition, we present results of a wind analysis of the hybrid-PG 1159 star NGC 7094 and the [WC]–PG 1159 transition-type object Abell 78 in order to derive F abundances from the F VI 1139.5 Å line. In both cases, we find F overabundances, in agreement with results of photospheric analyses of many PG 1159 stars. Surprisingly, we find indications for a very low O abundance in NGC 7094.

Oral contribution, published in Hydrogen-Deficient Stars, Tübingen, Germany, Sept. 17–21, 2007, eds. K. Werner and T. Rauch, ASP Conf. Series
Available from arXiv:0803.0066
and from http://astro.uni-tuebingen.de/publications/paper_07_16c.shtml

Announcement

IAU Symposium 251: Organic Matter in Space

IAU Symposium 251: Organic Matter in Space was successfully held on February 18–22, 2008 in Hong Kong. The meeting was attended by 162 participants from 22 countries and 2 regions. The symposium brought together researchers in three separate disciplines: astronomy, solar system, and laboratory spectroscopy to tackle the current issues of the detection and identification of organic matter in space. A total of 58 orals talks and 79 posters were presented.

The meeting was held in the historical Loke Yew Hall of the University of Hong Kong. In addition to travel grants from the IAU, the Local Organizing Committee received financial assistance from the Lee Hysan Foundation, National Natural Science Foundation of China, The Croucher Foundation, Fong Shu Fook Tong Foundation, K.C. Wong Education Foundation, and the University of Hong Kong.

A welcome reception was held in the Renaissance Harbour View Hotel in the evening of February 17. The conference itself was opened by the President of the IAU, Dr. Catherine Cesarsky. After the opening review by Ewine van Dishoeck, the first day of the meeting was devoted to astronomical observations of gas-phase organic molecules in the interstellar medium, including emissions from molecules in star formation regions and absorptions in the diffuse interstellar medium. Also discussed was the role played by organic molecules on the formation of the diffuse interstellar bands. During the lunch break, the participants were welcomed with a traditional lion dance and a cutting of a roasted pig ceremony.

The second day of the meeting was devoted to the observations of organic molecules and solids in circumstellar environments, spectral line surveys, and the observation of organic species in external galaxies. On the third day, the analysis of organic materials in interplanetary dust particles, meteoroids, planetary surfaces, asteroids, and comets were discussed. Analysis of the organic content of the comet Wild 2 based

on results from the Stardust sample return were also presented. The afternoon was free and many participants joined our tour of Hong Kong.

On the fourth day, discussions on the solar system continued, with emphasis on the planetary satellites Europa and Titan. Issues relating to presolar grains and their relations with AGB stars were also addressed. In the evening, the conference banquet was held in the historical Repulse Bay Hotel, where the participants enjoyed a fascinating "face-change" show. Our after-dinner speaker was Prof. Clifford Matthews, who was a student of the University of Hong Kong and prisoner of war in Japan after his capture by the Japanese after the surrender of Hong Kong in 1941. Prof. Matthews is well-known for his theory on the role played by HCN polymers in the origin of life on Earth, and the recitation of his war-time experience has brought him a standing ovation after his speech at the banquet. The sessions on Friday was devoted to laboratory studies, including the simulations of molecular synthesis and the spectroscopic properties of possible laboratory analogs of interstellar organic compounds such as PAH, QCC, and HAC.

After the conference, some participants joined the tour of the Lantau Island and the Po Lin Monastery.

Overall the comments from the participants have been highly positive. Many expressed appreciation to the fact that they met new colleagues in other fields, and that the talks and posters in the meeting have been stimulating to them for the exploration of new ideas and interdisciplinary studies. Almost all agree that this is an important field and many unsolved astronomical problems may find solutions in a better understanding of organic chemistry in space.

A complete conference proceedings (Sun Kwok and Scott Sandford, editors), including selected discussions, will be published by the Cambridge University Press as part of the IAU symposium proceedings series. Expected publication date is this summer.

See also www.hku.hk/science/iau251