THE AGB NEWSLETTER

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

Official publication of the IAU Working Group on Abundances in Red Giants

No. 195 — 1 October 2013

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

Editors: Jacco van Loon and Albert Zijlstra

Editorial

Dear Colleagues,

It is a pleasure to present you the 195$^{\rm th}$ issue of the AGB Newsletter. There is a lot about the envelopes of AGB stars, whether they be attached, detached or lost entirely! Some work concerns the nucleosynthesis and chemistry in and around them. It is also very nice to see results from new facilities such as on Antarctica or the world's largest single optical telescope, SALT.

Do have a look at the two announcements: the Les Houches school on the interaction between stars and the interstellar medium of their galaxies, and a conference on the exciting things one can do with space-based photometry; both will be in France in (proximity of) splendid mountain scenery.

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

Editorially Yours,
Jacco van Loon and Albert Zijlstra

Food for Thought

This month's thought-provoking statement is:

What have we learnt about planetary nebulæ and their progenitors from studies of planetary nebula systems outside the Local Group?

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 population of planetary nebulæ discovered in the Large Magellanic Cloud – IV: The Outer LMC

Warren A. Reid[1,2] *and Quentin A. Parker*[1,2,3]

[1]Department of Physics and Astronomy, Macquarie University, Sydney NSW, Australia

[2]Center for Astronomy, Astrophysics and Astrophotonics, Macquarie University, Sydney, NSW, Australia

[3]Australian Astronomical Observatory, Sydney, Australia

We have extended our PNe survey to the outer ~ 64 deg^2 of the LMC using maps from the Magellanic Cloud Emission Line Survey (MCELS) and the UK Schmidt Telescope (UKST) Hα survey. Although the MCELS survey has poorer $\sim 5''$ resolution than both the UKST Hα survey and the original Hα median stacked map in the LMC's central 25 deg^2, it has the advantage of additional narrow-band filters at Hα, [O III] and [S II] providing improved diagnostic capabilities. Using these data to uncover new emission line candidates we have so far spectroscopically confirmed an extra 63 LMC PNe which we present here for the first time. We have also independently recovered and spectroscopically confirmed 107 of the 109 (98%) PNe that were previously known to exist in the outer LMC. The majority of our newly discovered and previously known PNe were confirmed using the AAΩ multi-object fibre spectroscopy system on the 3.9-m Anglo-Australian Telescope (AAT) and the 6dF multi-object spectrograph on the UKST. These newly identified PNe were cross-checked against extant multi-wavelength imaging surveys in the near and mid-infrared in particular and against the latest emission-line ratio diagnostic plots for improved confidence in PNe identification.

Accepted for publication in MNRAS
Available from arXiv:1308.5484

Multi-periodic pulsations of a stripped red giant star in an eclipsing binary

Pierre F.L. Maxted[1]*, Aldo M. Serenelli*[2]*, Andrea Miglio*[3]*, Thomas R. Marsh*[4]*, Ulrich Heber*[5]*, Vikram S. Dhillon*[6]*, Stuart Littlefair*[6]*, Chris Copperwheat*[7]*, Barry Smalley*[1]*, Elmé Breedt*[4] *and Veronika Schaffenroth*[5,8]

[1]Astrophysics Group, Keele University, Keele, Staffordshire, ST5 5BG, UK

[2]Instituto de Ciencias del Espacio (CSIC–IEEC), Facultad de Ciencias, Campus UAB, 08193, Bellaterra, Spain

[3]School of Physics and Astronomy, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK.

[4]Department of Physics, University of Warwick, Coventry, CV4 7AL, UK.

[5]Dr. Karl Remeis Observatory & ECAP, Astronomical Institute, Friedrich-Alexander University Erlangen-Nuremberg, Sternwartstr. 7, 96049, Bamberg, Germany

[6]Department of Physics and Astronomy, University of Sheffield, Sheffield, S3 7RH, UK.

[7]Astrophysics Research Institute, Liverpool John Moores University, Twelve Quays House, Egerton Wharf, Birkenhead, Wirral, CH41 1LD, UK

[8]Institute for Astro- and Particle Physics, University of Innsbruck, Technikerstraße. 25/8, 6020 Innsbruck, Austria

Low mass white dwarfs are the remnants of disrupted red giant stars in binary millisecond pulsars and other exotic binary star systems. Some low mass white dwarfs cool rapidly, while others stay bright for millions of years due to stable fusion in thick surface hydrogen layers. This dichotomy is not well understood so their potential use as independent clocks to test the spin-down ages of pulsars or as probes of the extreme environments in which low mass white dwarfs form cannot be fully exploited. Here we present precise mass and radius measurements for the precursor to a low mass white dwarf. We find that only models in which this star has a thick hydrogen envelope can match the strong constraints provided by our new observations. Very cool low mass white dwarfs must therefore have lost their thick hydrogen envelopes by irradiation from pulsar companions or by episodes of unstable hydrogen fusion (shell flashes). We also find that this low mass white dwarf precursor is a new type of pulsating star. The observed pulsation frequencies are sensitive to internal processes that determine whether this star will undergo shell flashes.

Published in Nature
Available from arXiv:1307.1654

An interferometric study of the post-AGB binary 89 Herculis – I. Spatially resolving the continuum circumstellar environment at optical and near-IR wavelengths with the VLTI, NPOI, IOTA, PTI, and the CHARA Array

M. Hillen[1], *T. Verhoelst*[2], *H. Van Winckel*[1], *O. Chesneau*[3], *C.A. Hummel*[4], *J.D. Monnier*[5], *C. Farrington*[6], *C. Tycner*[7], *D. Mourard*[3], *T. ten Brummelaar*[6], *D.P.K. Banerjee*[8] *and R.T. Zavala*[9]

[1]Instituut voor Sterrenkunde, K.U. Leuven, Belgium

[2]Belgian Institute for Space Aeronomy, Brussels, Belgium

[3]Laboratoire Lagrange, Observatoire de la Côte d'Azur, Nice, France

[4]European Southern Observatory, Garching, Germany

[5]University of Michigan, USA

[6]The CHARA Array of Georgia State University, Mt. Wilson Observatory, USA

[7]Department of physics, Central Michigan University, USA

[8]Physical Research Laboratory, Navrangpura, India

[9]U.S. Naval Observatory, Flagstaff Station, USA

Context: Binary post asymptotic giant branch (post-AGB) stars are interesting laboratories to study both the evolution of binaries as well as the structure of circumstellar disks.
Aims: A multiwavelength high angular resolution study of the prototypical object 89 Herculis is performed with the aim of identifying and locating the different emission components seen in the spectral energy distribution.
Methods: A large interferometric data set, collected over the past decade and covering optical and near-infrared (near-IR) wavelengths, is analyzed in combination with the spectral energy distribution (SED) and flux-calibrated optical spectra. In this first paper only simple geometric models are applied to fit the interferometric data. Combining the interferometric constraints with the photometry and the optical spectra, we re-assess the energy budget of the post-AGB star and its circumstellar environment.
Results: We report the first (direct) detection of a large (35–40%) optical circumstellar flux contribution and spatially resolve its emission region. Given this large amount of reprocessed and/or redistributed optical light, the fitted size of the emission region is rather compact and fits with(in) the inner rim of the circumbinary dust disk. This rim dominates our K band data through thermal emission and is rather compact, emitting significantly already at a radius of twice the orbital separation. We interpret the circumstellar optical flux as due to a scattering process, with the scatterers located in the extremely puffed-up inner rim of the disk and possibly also in a bipolar outflow seen pole-on. A non local thermodynamic equilibrium (non-LTE) gaseous origin in an inner disk cannot be excluded but is considered highly unlikely.
Conclusions: This direct detection of a significant amount of circumbinary light at optical wavelengths poses several significant questions regarding our understanding of both post-AGB binaries and the physics in their circumbinary disks. Although the identification of the source of emission/scattering remains inconclusive without further study on this and similar objects, the implications are manifold.

Accepted for publication in A&A
Available from arXiv:1308.6715

Multi-wavelength radio continuum emission studies of dust-free red giants

Eamon O'Gorman[1], *Graham M. Harper*[1], *Alexander Brown*[2], *Stephen Drake*[3] *and Anita M.S. Richards*[4]

[1]School of Physics, Trinity College Dublin, Dublin 2, Ireland

[2]Center for Astrophysics and Space Astronomy, University of Colorado, 389 UCB, Boulder, CO 80309, USA

[3]NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

[4]Jodrell Bank Centre for Astrophysics, School of Physics and Astronomy, University of Manchester, Manchester M13 9PL, UK

Multi-wavelength centimeter continuum observations of non-dusty, non-pulsating K spectral-type red giants directly

sample their chromospheres and wind acceleration zones. Such stars are feeble emitters at these wavelengths however, and previous observations have provided only a small number of modest signal-to-noise measurements slowly accumulated over three decades. We present multi-wavelength Karl G. Jansky Very Large Array thermal continuum observations of the wind acceleration zones of two dust-free red giants, Arcturus (α Boo: K2 III) and Aldebaran (α Tau: K5 III). Importantly, most of our observations of each star were carried out over just a few days, so that we obtained a snapshot of the different stellar atmospheric layers sampled at different wavelengths, independent of any long-term variability. We report the first detections at several wavelengths for each star including a detection at 10 cm (3.0 GHz: S band) for both stars and a 20 cm (1.5 GHz: L band) detection for α Boo. This is the first time single (non-binary) luminosity class III red giants have been detected at these continuum wavelengths. Our long-wavelength data sample the outer layers of α Boo's atmosphere where its wind velocity is approaching (or possibly has reached) its terminal value and the ionization balance is becoming "frozen-in". For α Tau, however, our long-wavelength data are still sampling its inner atmosphere, where the wind is still accelerating probably due to its lower mass-loss rate. We compare our data with published semi-empirical models based on ultraviolet data, and the marked deviations highlight the need for new atmospheric models to be developed. Spectral indices are used to discuss the possible properties of the stellar atmospheres, and we find evidence for a rapidly cooling wind in the case of α Boo. Finally, we develop a simple analytical wind model for α Boo based on our new long-wavelength flux measurements.

Accepted for publication in The Astronomical Journal
Available from arXiv:1309.0860

Evolution and CNO yields of $Z = 10^{-5}$ stars and possible effects on CEMP production

P. Gil-Pons[1,2], C. Doherty[2], H. Lau[3], S. Campbell[2], T. Suda[4], S. Guilani[1], J. Gutierrez[1] and J.C. Lattanzio[2]

[1]Universitat Politecnica de Catalunya, Spain

[2]Monash Centre for Astrophysics, Monash University, Australia

[3]Argelander Institut für Astronomie, Universität Bonn, Germany

[4]National Astronomical Observatory of Japan, Japan

Our main goals are to get a deeper insight into the evolution and final fates of intermediate-mass, extremely metal-poor (EMP) stars. We also aim to investigate their C, N, and O yields. Using the Monash University Stellar Evolution code we computed and analysed the evolution of stars of metallicity $Z = 10^{-5}$ and masses between 4 and 9 $M_\odot$, from their main sequence until the late thermally pulsing (super) asymptotic giant branch, TP-(S)AGB phase. Our model stars experience a strong C, N, and O envelope enrichment either due to the second dredge-up , the dredge-out phenomenon, or the third dredge-up early during the TP-(S)AGB phase. Their late evolution is therefore similar to that of higher metallicity objects. When using a standard prescription for the mass-loss rates during the TP-(S)AGB phase, the computed stars lose most of their envelopes before their cores reach the Chandrasekhar mass, so our standard models do not predict the occurrence of SNI1/2 for $Z = 10^{-5}$ stars. However, we find that the reduction of only one order of magnitude in the mass-loss rates, which are particularly uncertain at this metallicity, would prevent the complete ejection of the envelope, allowing the stars to either explode as an SNI1/2 or become an electron-capture SN. Our calculations stop due to an instability near the base of the convective envelope that hampers further convergence and leaves remnant envelope masses between 0.25 $M_\odot$ for our 4 $M_\odot$ model and 1.5 $M_\odot$ for our 9 $M_\odot$ model. We present two sets of C, N, and O yields derived from our full calculations and computed under two different assumptions, namely, that the instability causes a practically instant loss of the remnant envelope or that the stars recover and proceed with further thermal pulses. Our results have implications for the early chemical evolution of the Universe.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:1309.0600

Extended envelopes around Galactic Cepheids – IV. T Monocerotis and X Sagittarii from mid-infrared interferometry with VLTI/MIDI

A. Gallenne[1], A. Mérand[2], P. Kervella[3], O. Chesneau[4], J. Breitfelder[2,3] and W. Gieren[1]

[1]Universidad de Concepción, Departamento de Astronomía, Casilla 160-C, Concepción, Chile

[2]European Southern Observatory, Alonso de Córdova 3107, Casilla 19001, Santiago 19, Chile

[3]LESIA, Observatoire de Paris, CNRS UMR 8109, UPMC, Université Paris Diderot, 5 Place Jules Janssen, F-92195 Meudon, France

[4]Nice Sophia-Antipolis University, CNRS UMR 6525, Observatoire de la Côte d'Azur, BP 4229, 06304, Nice Cedex 4, France

Aims: We study the close environment of nearby Cepheids using high spatial resolution observations in the mid-infrared with the VLTI/MIDI instrument, a two-beam interferometric recombiner.
Methods: We obtained spectra and visibilities for the classical Cepheids X Sgr and T Mon. We fitted the MIDI measurements, supplemented by B, V, J, H, K literature photometry, with the numerical transfer code DUSTY to determine the dust shell parameters. We used a typical dust composition for circumstellar environments.
Results: We detect an extended dusty environment in the spectra and visibilities for both stars, although T Mon might suffer from thermal background contamination. We attribute this to the presence of a circumstellar envelope (CSE) surrounding the Cepheids. This is optically thin for X Sgr ($\tau_{0.55\,\mu\mathrm{m}} = 0.008$), while it appears to be thicker for T Mon ($\tau_{0.55\,\mu\mathrm{m}} = 0.15$). They are located at about 15–20 stellar radii. Following our previous work, we derived a likely period-excess relation in the VISIR PAH1 filter, $f_{8.6\,\mu\mathrm{m}}[\%] = 0.81(\pm0.04)P[\mathrm{day}]$. We argue that the impact of CSEs on the mid-IR period–luminosity (P–L) relation cannot be negligible because they can bias the Cepheid brightness by up to about 30%. For the K-band P–L relation, the CSE contribution seems to be lower ($< 5\%$), but the sample needs to be enlarged to firmly conclude that the impact of the CSEs is negligible in this band.

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:1309.0854

Why the globular cluster NGC 6752 contains no sodium-rich second-generation AGB stars

Corinne Charbonnel[1,2], William Chantereau[1], Thibaut Decressin[1], Georges Meynet[1] and Daniel Schaerer[1,2]

[1]Geneva Observatory, Versoix, Switzerland

[2]Institut de Recherche en Astrophysique et Planétologie, Toulouse, France

(Abridged) Globular clusters host multiple stellar populations showing different sodium enrichments. These various populations can be observed along the main sequence, red giant and horizontal branch phases. Recently it was shown, however, that at least in the globular cluster NGC 6752, no sodium-rich stars are observed along the early asymptotic giant branch, posing an apparent problem for stellar evolution. We present an explanation for this lack of sodium-rich stars in this region of the colour–magnitude diagram.

Accepted for publication in A&A
Available from arXiv:1309.2073

Analysis of chemical abundances in planetary nebulæ with [WC] central stars. II. Chemical abundances and the abundance discrepancy factor

Jorge García-Rojas[1,2], Miriam Peña[3], Christophe Morisset[1,3], Gloria Delgado-Inglada[3], Adal Mesa-Delgado[4] and Maria Teresa Ruiz[5]

[1]IAC, Spain

[2]U. La laguna, Spain

[3]IA–UNAM, México

[4]PUC, Chile

[5]U. Chile, Chile

We present the abundance analysis of 12 planetary nebulæ ionized by [WC] type stars and weak emission line stars

("wels") obtained from high-resolution spectrophotometric data. Our main aims are to determine the chemical composition of the nebulæ and to study the behaviour of the abundance discrepancy problem (ADF) in this type of planetary nebulæ. The detection of a large number of optical recombination lines (ORLs) and collisional excited lines (CELs) from different ions (O^+, O^{++}, C^{++}, C^{3+} and Ne^{++}) were presented in Garcia-Rojas et al. (2012). Most of the ORLs are reported for the first time in these PNe, increasing the sample of PNe with detected faint ORLs. Ionic abundances were determined from the available CELs and ORLs, using previously determined physical conditions. Based on both sets of ionic abundances, we derived total chemical abundances in the nebulæ using suitable ionization correction factors (when available). In spite of the [WC] nature of the central stars, moderate ADF(O^{++}), in the range from 1.2 to 4, were found for all the objects. We have found that, when the quality of the spectra is high enough, the ORLs O^{++}/H^+ abundance ratios obtained from different multiplets excited mainly by recombination are very similar. Possible dependence of ADFs with some nebular characteristics such as surface brightness, nebular diameter and others, were analyzed, finding no correlation. Abundances derived from CELs were corrected by determining the t^2 temperature fluctuation parameter. O abundances for PNe, derived from ORLs, are in general larger than the Solar abundance. We derived the C/O ratio from ORLs and N/O and α-element/O ratios from CELs and found that these PNe are, in average, N-and C-richer than the average of large PN samples. About half of our sample is C-rich ($C/O > 1$). The α-elements grow in lockstep with O abundance. Comparing the N/O and C /O ratios with those derived from stellar evolution models, we estimate that about half of our PNe have progenitors with initial masses similar or larger than 4 $M_\odot$. No correlation was found between the stellar [WC] type and the nebular chemical abundances. A rough O abundance gradient computed for our limited PN sample, compared to the gradient given by H II regions, shows that there is a large dispersion in estimates of the PNe O abundance for a given Galactocentric distance. The PN gradient is flatter than the one for H II regions and at the solar distance and farther out, the PNe have larger O abundance than H II regions, similarly to what is found in other spiral galaxies. This fact has no convincing explanation so far.

Accepted for publication in Astronomy & Astrophysics
Available from arXiv:1309.1663

On iron monoxide nanoparticles as a carrier of the mysterious 21 μm emission feature in post-asymptotic giant branch stars

Aigen Li[1] *and J.M. Liu*[2]

[1]University of Missouri, USA
[2]Beijing Normal University, China

A prominent, mysterious emission feature peaking at ~ 20.1 μm – historically known as the "21 μm" feature – is seen in over two dozen Galactic and Magellanic Cloud carbon-rich post-asymptotic giant branch (post-AGB) stars. The nature of its carrier remains unknown since the first detection of the 21 μm feature in 1989. Over a dozen materials have been suggested as possible carrier candidates. However, none of them has been accepted: they either require too much material (compared to what is available in the circumstellar shells around these post-AGB stars), or exhibit additional emission features which are not seen in these 21 μm sources.
Recently, iron monoxide (FeO) nanoparticles seem to be a promising carrier candidate as Fe is an abundant element and FeO emits exclusively at ~ 21 μm. In this work, using the proto-typical protoplanetary nebula HD 56126 as a test case, we examine FeO nanoparticles as a carrier for the 21-μm feature by modeling their infrared emission, with FeO being stochastically heated by single stellar photons. We find that FeO emits too broad a 21-μm feature to explain the observed one and the Fe abundance required to be locked up in FeO exceeds what is available in HD 56126. We therefore conclude that FeO nanoparticles are unlikely responsible for the 21-μm feature.

Accepted for publication in The Astrophysical Journal
Available from arXiv:1309.1995
and from http://bengal.missouri.edu/~lia/publications.html

The carriers of the interstellar unidentified infrared emission features: constraints from the interstellar C–H stretching features at 3.2–3.5 μm

X.J. Yang[1,2], R. Glaser[1], Aigen Li[1] and J.X. Zhong[2]

[1]University of Missouri, USA

[2]Xiangtan University, China

The unidentified infrared emission (UIE) features at 3.3, 6.2, 7.7, 8.6, and 11.3 μm, commonly attributed to polycyclic aromatic hydrocarbon (PAH) molecules, have been recently ascribed to mixed aromatic/aliphatic organic nanoparticles. More recently, an upper limit of $< 9\%$ on the aliphatic fraction (i.e. the fraction of carbon atoms in aliphatic form) of the UIE carriers based on the observed intensities of the 3.4 and 3.3 μm emission features by attributing them to aliphatic and aromatic C–H stretching modes, respectively, and assuming $A_{3.4}/A_{3.3} \sim 0.68$ derived from a small set of aliphatic and aromatic compounds, where $A_{3.4}$ and $A_{3.3}$ are respectively the band strengths of the 3.4 μm aliphatic and 3.3 μm aromatic C–H bonds.

To improve the estimate of the aliphatic fraction of the UIE carriers, here we analyze 35 UIE sources which exhibit both the 3.3 and 3.4 μm C–H features and determine $I_{3.4}/I_{3.3}$, the ratio of the power emitted from the 3.4-μm feature to that from the 3.3-μm feature. We derive the median ratio to be $\langle I_{3.4}/I_{3.3}\rangle \sim 0.12$. We employ density functional theory and second-order perturbation theory to compute $A_{3.4}/A_{3.3}$ for a range of methyl-substituted PAHs. The resulting $A_{3.4}/A_{3.3}$ ratio well exceeds 1.4, with an average ratio of $\langle A_{3.4}/A_{3.3}\rangle \sim 1.76$. By attributing the 3.4-μm feature exclusively to aliphatic C–H stretch (i.e. neglecting anharmonicity and superhydrogenation), we derive the fraction of C atoms in aliphatic form to be $\sim 2\%$. We therefore conclude that the UIE emitters are predominantly aromatic.

Accepted for publication in The Astrophysical Journal

Available from arXiv:1309.1993

and from http://bengal.missouri.edu/∼lia/publications.html

The planetary nebula population in the halo of M 87

A. Longobardi[1], M. Arnaboldi[2], O. Gerhard[1], L. Coccato[2], S. Okamura[3] and K.C. Freeman[4]

[1]Max-Planck-Institut für Extraterrestrische Physik, Gießenbachstraße, D-85741 Garching bei München, Germany

[2]Southern Observatory, Karl-Schwarzschild-Straße 2, D-85748 Garching bei München, Germany

[3]Department of Advanced Sciences, Faculty of Science and Engineering, Hosei University, Tokyo, 184-8584 Japan

[4]RSAA, Mt. Stromlo Observatory, Australia

We investigate the diffuse light in the outer regions of the nearby elliptical galaxy M 87 in the Virgo cluster, using planetary nebulæ (PNe) as tracers. The surveyed areas (0.43 deg^2) cover M 87 up to a radial distance of 150 kpc, in the transition region between galaxy halo and intracluster light (ICL). All PNe are identified through the on-off band technique using automatic selection criteria based on the distribution of the detected sources in the colour–magnitude diagram and the properties of their point-spread function. We extract a catalogue of 688 objects down to $m_{5007} = 28.4$ mag, with an estimated residual contamination from foreground stars and background Lyα galaxies, which amounts to $\sim 35\%$ of the sample. This is one of the largest extragalactic PN samples in number of candidates, magnitude depth, and radial extent, which allows us to carry out an unprecedented photometric study of the PN population in the outer regions of M 87. We find that the logarithmic density profile of the PN distribution is shallower than the surface brightness profile at large radii. This behaviour is consistent with the superposition of two components associated with the halo of M 87 and with the ICL, which have different luminosity specific PN numbers, the ICL contributing three times more PNe per unit light. Because of the depth of this survey we are also able to study the shape of the PN luminosity function (PNLF) in the outer regions of M 87. We find a slope for the PNLF that is steeper at fainter magnitudes than the standard analytical PNLF formula and adopt a generalised model that treats the slope as a free parameter. Comparing the PNLF of M 87 and the M 31 bulge, both normalised by the sampled luminosity, the M 87 PNLF contains fewer bright PNs and has a steeper slope towards fainter magnitudes.

Accepted for publication in Astronomy & Astrophysics

Available from arXiv:1309.0006

The explosion of supernova 2011fe in the frame of the core-degenerate scenario

Noam Soker[1]*, Enrique Garcia-Berro*[2] *and Leandro G. Althaus*[3]

[1]Technion, Israel

[2]Universitat Politecnica de Catalunya, Spain

[3]Universidad Nacional de La Plata, Argentina

We argue that the properties of the Type Ia supernova (SN Ia) SN 2011fe can be best explained within the frame of the core-degenerate (CD) scenario. In the CD scenario a white dwarf (WD) merges with the core of an asymptotic giant branch (AGB) star and forms a rapidly rotating WD, with a mass close to and above the critical mass for explosion. Rapid rotation prevents immediate collapse and/or explosion. Spinning down over a time of 0–10 Gyr brings the WD to explosion. A very long delayed explosion to post-crystallization phase, which lasts for ~ 2 Gyr leads to the formation of a highly carbon-enriched outer layer. This can account for the carbon-rich composition of the fastest-moving ejecta of SN 2011fe. In reaching the conclusion that the CD scenario best explains the observed properties of SN 2011fe we consider both its specific properties, like a very compact exploding object and carbon rich composition of the fastest-moving ejecta, and the general properties of SNe Ia.

Submitted to MNRAS
Available from arXiv:1309.0368

Stripping of nitrogen-rich AGB ejecta from interacting dwarf irregular galaxies

Takuji Tsujimoto[1] *and Kenji Bekki*[2]

[1]National Astronomical Observatory of Japan, Japan

[2]ICRAR, The University of Western Australia, Australia

Dwarf irregular galaxies (dIrrs) including the Magellanic Clouds in the local Universe, in many cases, exhibit an unusually low N/O abundance ratio ($\log N/O \sim -1.5$) in H II regions as compared with the solar value (~ -0.9). This ratio is broadly equivalent to the average level of extremely metal-poor stars in the Galactic halo, suggesting that N released from asymptotic giant branch (AGB) stars is missing in the present-day interstellar matter of these dIrrs. We find evidence for past tidal interactions in the properties of individual dIrrs exhibiting low N/O ratios, while a clear signature of interactions is unseen for dIrrs with high N/O ratios. Accordingly, we propose that the ejecta of massive AGB stars that correspond to a major production site of N can be stripped from dIrrs that have undergone a strong interaction with a luminous galaxy. The physical process of its stripping is made up of two stages: (i) the ejecta of massive AGB stars in a dIrr are first merged with those of the bursting prompt SNe Ia and pushed up together to the galaxy halo, and (ii) subsequently through tidal interactions with a luminous galaxy, these ejecta are stripped from a dwarf galaxy's potential well. Our new chemical evolution models with stripping of AGB ejecta succeed in reproducing the observed low N/O ratio. Furthermore, we perform N-body + hydrodynamical simulations to trace the fate of AGB ejecta inside a dIrr orbiting the Milky Way, and confirm that a tidal interaction is responsible for the efficient stripping of AGB ejecta from dIrrs.

Accepted for publication in MNRAS
Available from arXiv:1309.0526

Variability of M giant stars based on *Kepler* photometry: general characteristics

E. Bányai[1], *L.L. Kiss*[1,2,3], *T.R. Bedding*[2,6], *B. Bellamy*[2], *J.M. Benkő*[1], *A. Bódi*[4], *J.R. Callingham*[2], *D. Compton*[2], *I. Csányi*[4], *A. Derekas*[1,2], *J. Dorval*[2], *D. Huber*[2,5], *O. Shrier*[2], *A.E. Simon*[1,3], *D. Stello*[2,6], *Gy.M. Szabó*[1,3,4], *R. Szabó*[1] *and K. Szatmáry*[4]

[1]Konkoly Observatory, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, H-1121 Budapest, Konkoly Thege M. út 15-17, Hungary

[2]Sydney Institute for Astronomy (SIfA), School of Physics, The University of Sydney, NSW 2006, Australia

[3]ELTE Gothard-Lendület Research Group, H-9700 Szombathely, Szent Imre herceg út 112, Hungary

[4]Department of Experimental Physics and Astronomical Observatory, University of Szeged, H-6720 Szeged, Dóm tér 9., Hungary

[5]NASA Ames Research Center, Moffett Field, CA 94035, USA

[6]Stellar Astrophysics Centre, Department of Physics and Astronomy, Århus University, 8000 Århus C, Denmark

M giants are among the longest-period pulsating stars which is why their studies were traditionally restricted to analyses of low-precision visual observations, and more recently, accurate ground-based data. Here we present an overview of M giant variability on a wide range of time-scales (hours to years), based on analysis of thirteen quarters of *Kepler* long-cadence observations (one point per every 29.4 minutes), with a total time-span of over 1000 days. About two-thirds of the sample stars have been selected from the ASAS-North survey of the *Kepler* field, with the rest supplemented from a randomly chosen M giant control sample.

We first describe the correction of the light curves from different quarters, which was found to be essential. We use Fourier analysis to calculate multiple frequencies for all stars in the sample. Over 50 stars show a relatively strong signal with a period equal to the *Kepler*-year and a characteristic phase dependence across the whole field-of-view. We interpret this as a so far unidentified systematic effect in the *Kepler* data. We discuss the presence of regular patterns in the distribution of multiple periodicities and amplitudes. In the period–amplitude plane we find that it is possible to distinguish between solar-like oscillations and larger amplitude pulsations which are characteristic for Mira/SR stars. This may indicate the region of the transition between two types of oscillations as we move upward along the giant branch.

Accepted for publication in MNRAS

Available from arXiv:1309.1012

Chemistry of the Sagittarius dwarf galaxy: a top-light IMF, outflows and the r-process

Andrew McWilliam[1], *George Wallerstein*[2] *and Marta Mottini*[2]

[1]Carnegie Observatories, USA

[2]University of Washington, USA

From chemical abundance analysis of stars in the Sagittarius dwarf spheroidal galaxy (Sgr), we conclude that the α-element deficiencies cannot be due to the Type Ia supernova (SNIa) time-delay scenario of Tinsley (1979). Instead, the evidence points to low [α/Fe] ratios resulting from an initial mass function (IMF) deficient in the highest mass stars. The critical evidence is the 0.4 dex deficiency of [O/Fe], [Mg/Fe] and other hydrostatic elements, contrasting with the normal trend of r-process $[Eu/Fe]_r$ with [Fe/H]. Supporting evidence comes from the hydrostatic element (O, Mg, Na, Al, Cu) [X/Fe] ratios, which are inconsistent with iron added to the Milky Way (MW) disk trends. Also, the ratio of hydrostatic to explosive (Si, Ca, Ti) element abundances suggests a relatively top-light IMF. Abundance similarities with the LMC, Fornax and IC 1613, suggest that their α-element deficiencies also resulted from IMFs lacking the most massive SNII.

For such a top-light IMF, the normal trend of r-process $[Eu/Fe]_r$ with [Fe/H], as seen in Sgr, indicates that massive Type II supernovæ ($\gtrsim$30 $M_\odot$) cannot be major sources of r-process elements.

High [La/Y] ratios, consistent with leaky-box chemical evolution, are confirmed but ~ 0.3 dex larger than theoretical AGB predictions. This may be due to the ^{13}C pocket mass, or a difference between MW and Sgr AGB stars. Sgr has the lowest [Rb/Zr] ratios known, consistent with low-mass ($\lesssim 2$ M$_\odot$) AGB stars near [Fe/H] $= -0.6$, likely resulting from leaky-box chemical evolution.
The [Cu/O] trend in Sgr and the MW suggest that Cu yields increase with both metallicity and stellar mass, as expected from Cu production by the weak s-process in massive stars.
Finally, we present an updated hfs line list, an abundance analysis of Arcturus, and further develop our error analysis formalism.

Accepted for publication in ApJ
Available from arXiv:1309.2974

Photometry of variable stars from Dome A, Antarctica: results from the 2010 observing season

Lingzhi Wang[1,2,3,4], *Lucas Macri*[2], *Lifan Wang*[2,3,5], *Michael Ashley*[6], *Xiangqun Cui*[3,7], *Long-Long Feng*[3,5], *Xuefei Gong*[3,7], *Jon Lawrence*[6,8], *Qiang Liu*[3,4], *Daniel Luong-Van*[6], *Carl Pennypacker*[9], *Zhaohui Shang*[3,10], *John Storey*[6], *Huigen Yang*[3,11], *Ji Yang*[3,5], *Xiangyan Yuan*[3,7], *Donald York*[12], *Xu Zhou*[3,4], *Zhenxi Zhu*[3,5] *and Zonghong Zhu*[1,3]

[1]Department of Astronomy, Beijing Normal University, China
[2]Mitchell Institute for Fundamental Physics & Astronomy, Department of Physics & Astronomy, Texas A&M University, USA
[3]Chinese Center for Antarctic Astronomy, China
[4]National Astronomical Observatory of China, China
[5]Purple Mountain Observatory, China
[6]School of Physics, University of New South Wales, Australia
[7]Nanjing Institute of Astronomical Optics and Technology, China
[8]Australian Astronomical Observatory, Australia
[9]Center for Astrophysics, Lawrence Berkeley National Laboratory, USA
[10]Tianjin Normal University, China
[11]Polar Research Institute of China, China
[12]Department of Astronomy and Astrophysics and Enrico Fermi Institute, University of Chicago, USA

We present results from a season of observations with the Chinese Small Telescope ARray (CSTAR), obtained over 183 days of the 2010 Antarctic winter. We carried out high-cadence time-series aperture photometry of 20,000 stars with $i < 15.3$ mag located in a 23-deg^2 region centered on the south celestial pole.
We identified 188 variable stars, including 67 new objects relative to our 2008 observations, thanks to broader synoptic coverage, a deeper magnitude limit and a larger field of view.
We used the photometric data set to derive site statistics from Dome A. Based on two years of observations, we find that extinction due to clouds at this site is less than 0.1 and 0.4 mag during 45% and 75% of the dark time, respectively.

Accepted for publication in Astronomical Journal
Available from arXiv:1309.3325
and from http://casdc.china-vo.org/data/cstar

Cross-section measurements of the ^{86}Kr(γ, n) reaction to probe the s-process branching at ^{85}Kr

R. Raut[1,2,3], A.P. Tonchev[1,2,4], G. Rusev[1,2,5], W. Tornow[1,2], C. Iliadis[6,2], M. Lugaro[7], J. Buntain[7], S. Goriely[8], J.H. Kelley[2,9], R. Schwengner[10], A. Banu[11] and N. Tsoneva[12,13]

[1]Department of Physics, Duke University, Durham, North Carolina 27708, USA

[2]Triangle Universities Nuclear Laboratory, Durham, North Carolina 27708, USA

[3]Present address: UGC–DAE Consortium for Scientific Research, Kolkata Centre, Kolkata, India

[4]Present address: Lawrence Livermore National Laboratory, Livermore, California, USA

[5]Present Address: Los Alamos National Laboratory, Los Alamos, New Mexico, USA

[6]Department of Physics & Astronomy, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27695-8202, USA

[7]Monash Centre for Astrophysics (MoCA), Monash University, Victoria 3800, Australia

[8]Institut d'Astronomie et d'Astrophysique, Université Libre de Bruxelles, CP 226, 1050 Brussels, Belgium

[9]Department of Physics, North Carolina State University, Raleigh, North Carolina 27695, USA

[10]Institut für Strahlenphysik, Helmholtz-Zentrum Dresden-Rossendorf, 01314 Dresden, Germany

[11]Department of Physics and Astronomy, James Madison University, Harrisonburg, Virginia 22807, USA

[12]Institut für Theoretische Physik, Universität Gießen, Gießen, D-35392, Germany

[13]Institute of Nuclear Research and Nuclear Energy, 1784 Sofia, Bulgaria

We have carried out photodisintegration cross-section measurements on ^{86}Kr using monoenergetic photon beams ranging from the neutron separation energy, $S_n = 9.86$ MeV, to 13 MeV. We combine our experimental ^{86}Kr(γ,n)^{85}Kr cross section with results from our recent ^{86}Kr(γ,γ') measurement below the neutron separation energy to obtain the complete nuclear dipole response of ^{86}Kr. The new experimental information is used to predict the neutron capture cross section of ^{85}Kr, an important branching point nucleus on the abundance flow path during s-process nucleosynthesis. Our new and more precise ^{85}Kr(n,γ)^{86}Kr cross section allows to produce more precise predictions of the ^{86}Kr abundance from s-process models. In particular, we find that the models of the s-process in asymptotic giant branch stars of mass < 1.5 M$_\odot$, where the ^{13}C neutron source burns convectively rather than radiatively, represent a possible solution for the highest ^{86}Kr/^{82}Kr ratios observed in meteoritic stardust SiC grains.

Accepted for publication in Physical Review Letters
Available from arXiv:1309.4159

PO and PN in the wind of the oxygen-rich AGB star IK Tau

E. De Beck[1,2], T. Kamiński[1], N.A. Patel[3], K.H. Young[3], C.A. Gottlieb[3], K.M. Menten[1] and L. Decin[2,4]

[1]Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany

[2]Instituut voor Sterrenkunde, Departement Natuurkunde en Sterrenkunde, Celestijnenlaan 200D, 3001 Heverlee, Belgium

[3]Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, MS78, Cambridge, MA 02138, USA

[4]Sterrenkundig Instituut Anton Pannekoek, University of Amsterdam, Science Park 904, 1098 Amsterdam, The Netherlands

Context: Phosphorus-bearing compounds have only been studied in the circumstellar environments of the asymptotic giant branch star IRC +10°216 and the protoplanetary nebula CRL 2688, both carbon-rich objects, and the oxygen-rich red supergiant VY CMa. The current chemical models cannot reproduce the high abundances of PO and PN derived from observations of VY CMa. No observations have been reported of phosphorus in the circumstellar envelopes of oxygen-rich asymptotic giant branch stars.
Aims: We aim to set observational constraints on the phosphorous chemistry in the circumstellar envelopes of oxygen-rich asymptotic giant branch stars, by focussing on the Mira-type variable star IK Tau.
Methods: Using the IRAM 30-m telescope and the Submillimeter Array, we observed four rotational transitions of PN (J = 2–1, 3–2, 6–5, 7–6) and four of PO (J = 5/2–3/2, 7/2–5/2, 13/2–11/2, 15/2–13/2). The IRAM 30-m observations were dedicated line observations, while the Submillimeter Array data come from an unbiased spectral survey in the frequency range 279–355 GHz.
Results: We present the first detections of PN and PO in an oxygen-rich asymptotic giant branch star and estimate abundances $X(\mathrm{PN/H_2}) \approx 3 \times 10^{-7}$ and $X(\mathrm{PO/H_2})$ in the range 0.5–6.0 $\times 10^{-7}$. This is several orders of magnitude

higher than what is found for the carbon-rich asymptotic giant branch star IRC +10°216. The diameter ($\leq 0\farcs7$) of the PN and PO emission distributions measured in the interferometric data corresponds to a maximum radial extent of about 40 stellar radii. The abundances and the spatial occurrence of the molecules are in very good agreement with the results reported for VY CMa. We did not detect PS or PH_3 in the survey.
Conclusions: We suggest that PN and PO are the main carriers of phosphorus in the gas phase, with abundances possibly up to several 10^{-7}. The current chemical models cannot account for this, underlining the strong need for updated chemical models that include phosphorous compounds.

Accepted for publication in Astronomy & Astrophysics
Available from http://www.aanda.org/articles/aa/pdf/forth/aa21349-13.pdf

SALT reveals the barium central star of the planetary nebula Hen 2-39

B. Miszalski[1,2], *H.M.J. Boffin*[3], *D. Jones*[3], *A.I. Karakas*[4], *J. Köppen*[5], *A.A. Tyndall*[3,6], *S.S. Mohamed*[1], *P. Rodríguez-Gil*[7,8,9] *and M.Santander-García*[10,11]

[1]South African Astronomical Observatory, P.O. Box 9, Observatory, 7935, South Africa
[2]Southern African Large Telescope Foundation, P.O. Box 9, Observatory, 7935, South Africa
[3]European Southern Observatory, Alonso de Cordova 3107, Casilla 19001, Santiago, Chile
[4]Research School of Astronomy and Astrophysics, Australian National University, Canberra, ACT 2611, Australia
[5]Observatoire astronomique de Strasbourg, Université de Strasbourg, CNRS, UMR 7550, 11 rue de l'Université, F-67000 Strasbourg, France
[6]Jodrell Bank Centre for Astrophysics, School of Physics and Astronomy, University of Manchester, M13 9PL, UK
[7]Departamento de Astrofísica, Universidad de La Laguna, La Laguna, E-38204, Santa Cruz de Tenerife, Spain
[8]Instituto de Astrofísica de Canarias, Vía Láctea, s/n, La Laguna, E-38205, Santa Cruz de Tenerife, Spain
[9]Isaac Newton Group of Telescopes, Apartado de Correos 321, Santa Cruz de La Palma, E-38700, Spain
[10]Observatorio Astronómico Nacional, Ap. 112, 28803 Alcalá de Henares, Spain
[11]CAB, INTA–CSIC, Ctra. de Torrejón a Ajalvir, km 4, 28850 Torrejón de Ardoz, Madrid, Spain

Classical barium stars are binary systems which consist of a late-type giant enriched in carbon and slow neutron capture (s-process) elements and an evolved white dwarf (WD) that is invisible at optical wavelengths. The youngest observed barium stars are surrounded by planetary nebulae (PNe), ejected soon after the wind accretion of polluted material when the WD was in its preceding asymptotic giant branch (AGB) phase. Such systems are rare but powerful laboratories for studying AGB nucleosynthesis as we can measure the chemical abundances of both the polluted star and the nebula ejected by the polluter. Here we present evidence for a barium star in the PN Hen 2-39 (PN G 283.8−04.2) as one of only a few known systems. The polluted giant is very similar to that found in WeBo 1 (PN G 135.6+01.0). It is a cool ($T_{\rm eff} = 4250 \pm 150$ K) giant enhanced in carbon ([C/H] $= 0.42 \pm 0.02$ dex) and barium ([Ba/Fe] $= 1.50 \pm 0.25$ dex). A spectral type of C-R3 $C_2$4 nominally places Hen 2-39 amongst the peculiar early R-type carbon stars, however the barium enhancement and likely binary status mean that it is more likely to be a barium star with similar properties, rather than a true member of this class. An AGB star model of initial mass 1.8 $M_\odot$ and a relatively large carbon pocket size can reproduce the observed abundances well, provided mass is transferred in a highly conservative way from the AGB star to the polluted star (e.g., wind Roche-lobe overflow). It also shows signs of chromospheric activity and photometric variability with a possible rotation period of ~ 5.5 days likely induced by wind accretion. The nebula exhibits an apparent ring morphology in keeping with the other PNe around barium stars (WeBo 1 and A 70) and shows a high degree of ionization implying the presence of an invisible hot pre-WD companion that will require confirmation with UV observations. In contrast to A 70, the nebular chemical abundance pattern is consistent with non-Type I PNe, in keeping with the trend found from nebular s-process studies that non-Type I PNe are more likely to be s-process enhanced.

Accepted for publication in MNRAS
Available from arXiv:1309.5239

The evolution of planetary nebulæ – VIII. True expansion rates and visibility times

R. Jacob[1], *D Schönberner*[1] *and M. Steffen*[1]

[1]Leibniz-Institut für Astrophysik Potsdam, An der Sternwarte 16, D-14482 Potsdam, Germany

The visibility time of planetary nebulæ (PNe) in stellar systems is an essential quantity for estimating the size of a PN population in the context of general population studies. For instance, it enters directly into the PN death rate determination. The basic ingredient for determining visibility times is the typical nebular expansion velocity, as a suited average over all PN sizes of a PN population within a certain volume or stellar system. The true expansion speed of the outer nebular edge of a PN is, however, not accessible by spectroscopy – a difficulty that we surmount by radiation-hydrodynamics modelling. We find a mean true expansion velocity of 42 km s^{-1}, i.e. nearly twice as high as the commonly adopted value to date. Accordingly, the time for a PN to expand to a radius of, say 0.9 pc, is only 21000 ± 5000 years. This visibility time of a PN holds for all central star masses since a nebula does not become extinct as the central star fades. There is, however, a dependence on metallicity in the sense that the visibility time becomes shorter for lower nebular metal content. With the higher expansion rate of PNe derived here we determined their local death-rate density as $(1.4 \pm 0.5) \times 10^{-12}$ PN pc^{-3} yr^{-1}, using the local PN density advocated by Frew (2008).

Accepted for publication in Astronomy and Astrophysics
Available from arXiv:1307.6189

ExoMol line lists – II. The ro-vibrational spectrum of SiO

Emma J. Barton[1], *Sergei N. Yurchenko*[1] *and Jonathan Tennyson*[1]

[1]Department of Physics and Astronomy, University College London, London WC1E 6BT, UK

Accurate rotational–vibrational line lists are calculated for silicon monoxide. Line lists are presented for the main isotopologue, $^{28}Si^{16}O$, and for four monosubstituted isotopologues ($^{29}Si^{16}O$, $^{30}Si^{16}O$, $^{28}Si^{18}O$ and $^{28}Si^{17}O$), in their ground electronic states. These line lists are suitable for high temperatures (up to 9000 K), including those relevant to exoplanetary atmospheres and cool stars. A combination of empirical and *ab initio* methods is used: the potential energy curves are determined to high accuracy by fitting to extensive data from the analysis of both laboratory and sunspot spectra; a high-quality *ab initio* dipole moment curve is calculated at the large basis set, multireference configuration interaction level. A partition function plus full line lists of rotational–vibrational transitions are made available in an electronic form as Supplementary Information to this article and at www.exomol.com.

Published in MNRAS, 434, 1469 (2013)
Available from arXiv:1307.2300

Conference Papers

Revision of the derivation of stellar rates from experiment and impact on Eu s-process contributions

T. Rauscher[1,2,3]

[1]Centre for Astrophysics Research, University of Hertfordshire, Hatfield, UK
[2]ATOMKI, Debrecen, Hungary
[3]Department of Physics, University of Basel, Basel, Switzerland

A new, general formalism to include experimental data in revised stellar rates is discussed, containing revised uncertainties. Application to the s-process shows that the actual uncertainties in the neutron capture rates can be larger

than would be expected from the experimental errors alone. As a specific example for how astrophysical conclusions can depend on the approach selected to derive stellar rates, the ^{151}Eu/(^{151}Eu+^{153}Eu) abundance ratio from AGB star models is presented. Finally, a recommended workflow for the derivation of stellar rates from experiment is laid out.

Oral contribution, published in J. Phys. Conf. Ser., Proc. Nuclear Physics in Astrophysics VI, Lisbon, Portugal 2013
Available from arXiv:1309.0041

Pulsation and mass loss across the HR diagram: from OB stars to Cepheids to red supergiants

Hilding R. Neilson[1]

[1]East Tennessee State University, USA

Both pulsation and mass loss are commonly observed in stars and are important ingredients for understanding stellar evolution and structure, especially for massive stars. There is a growing body of evidence that pulsation can also drive and enhance mass loss in massive stars and that pulsation-driven mass loss is important for stellar evolution. In this review, I will discuss recent advances in understanding pulsation driven mass loss in massive main sequence stars, classical Cepheids and red supergiants and present some challenges remaining.

Oral contribution, published in IAUS 301: "Precision Asteroseismology Celebration of the Scientific Opus of Wojtek Dziembowski"
Available from arXiv:1309.4115

Long-term polarization observations of Mira variable stars suggest asymmetric structures

Hilding R. Neilson[1]*, Richard Ignace*[1] *and Gary D. Henson*[1]

[1]East Tennessee State University, USA

Mira and semi-regular variable stars have been studied for centuries but continue to be enigmatic. One unsolved mystery is the presence of polarization from these stars. In particular, we present 40 years of polarization measurements for the prototype *o* Ceti and V CVn and find very different phenomena for each star. The polarization fraction and position angle for Mira is found to be small and highly variable. On the other hand, the polarization fraction for V CVn is large and variable, from 2–7%, and its position angle is approximately constant, suggesting a long-term asymmetric structure. We suggest a number of potential scenarios to explain these observations.

Poster contribution, published in IAUS 301: "Precision Asteroseismology Celebration of the Scientific Opus of Wojtek Dziembowski"
Available from arXiv:1309.4117

Announcements

Advanced School: The interaction of stars with the interstellar medium of galaxies

Les Houches Physics School
20–25 of April 2014

The objective of this school is to provide a comprehensive view of the different physical and chemical processes acting in H II regions, photodissociation regions (PDRs) and shocks in the interstellar medium, as well as the resulting observational characteristics. The school will be complemented with practical activities involving analysis and interpretation of observational data and theoretical models.

The lecturers are:

- John Bally (University of Colorado at Boulder, USA)
- Jacques Le Bourlot (Université Paris-Diderot & Observatoire de Paris, France)
- Romano Corradi (Instituto de Astrofísica de Canarias, Spain)
- Gary Ferland (University of Kentucky, USA)
- David Flower (Durham University, UK)
- Pierre Hily-Blant (Université Joseph Fourier, France)
- Margaret Meixner (Space Telescope Science Institute, USA)

The school will be held at Les Houches Physics School (http://houches.ujf-grenoble.fr), in the village of Les Houches. Les Houches is a village located in Chamonix valley, in the French Alps. Established in 1951, the Physics School is situated at 1150 m above sea level in natural surroundings, with breathtaking views on the Mont-Blanc mountain range.

The school is addressed to postgraduate students and postdocs in Astrophysics. The participation is limited to 50 individuals. The registration for the school is now open and the deadline is 15^{th} December 2013, 12:00 pm CET.

There will be no registration fee. All participants will be staying at Les Houches School of Physics. The costs of accommodation (individual bedrooms in "chalets") and meals during the school (from Sunday 20^{th} night to Friday 25^{th} morning) is 375 euros. The participants are expected to cover their own travel expenses. There are however very limited funds available to cover partially the expenses of some participants. See the website for more information.

Information on how to register, as well as more details about the school, can be found on the website:

http://ism2014.strw.leidenuniv.nl

Organizing Committee:

- Isabel Aleman (Leiden Observatory)
- Alessandra Candian (Leiden Observatory)
- Jacques Le Bourlot (Observatoire de Paris)
- Xander Tielens (Leiden Observatory)

See also http://ism2014.strw.leidenuniv.nl

CoRoT3-KASC7: The Space Photometry Revolution

First announcement
The Space Photometry Revolution
CoRoT Symposium 3, Kepler KASC-7 joint meeting
6–11 July 2014
Toulouse, France
http://corot3-kasc7.sciencesconf.org/

Dear colleagues,

This is the first announcement for CoRoT Symposium 3, Kepler KASC-7 joint meeting entitled The Space Photometry Revolution. The conference will be held in Toulouse (France), 6–11 July 2014. Preregistration is now open!

Topics include:

1. Probing stellar structure and evolution with asteroseismology
2. Extrasolar planets and planet systems
3. Binarity and star-planet interactions
4. Stellar activity and rotation
5. Present and future ground-based and space projects. Synergies

Important dates:

⋆	Preregistration opens:	20 Sep 2013
⋆	Registration opens:	15 Dec 2013
⋆	Deadline for early registration:	01 Mar 2014
⋆	Abstract deadline for contributed talks:	31 Mar 2014
⋆	Abstract deadline for posters:	15 May 2014
⋆	Deadline for registration and payment:	15 May 2014

We invite you to express your interest by sending an e-mail to corot3-kasc7@sciencesconf.org

We hope to see as many of you as possible in Toulouse next year!

Best regards,
Rafael A. García & Jérôme Ballot (on behalf of the SOC and LOC)

See also http://corot3-kasc7.sciencesconf.org/