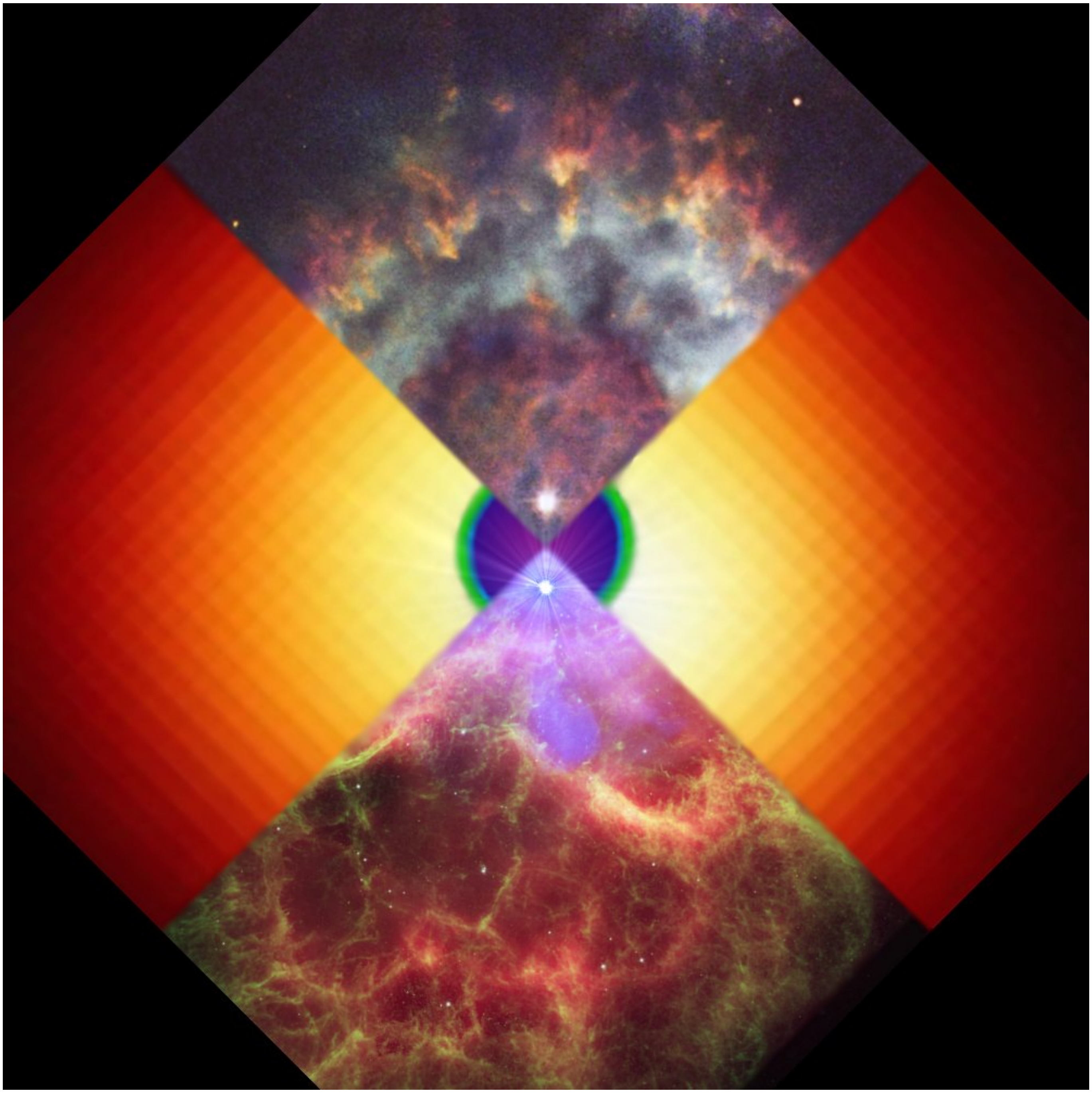
Programme, Abstracts and Participants



Programme

Talks

10:30		**Welcome**
10:35	Alvio Renzini	**Opening remarks**
10:40	Richard Stancliffe	**Key Talk:** Understood, uncertain and unknown physics of super-AGB stars
11:05	Falk Herwig	The physics of burning and convective mixing in super-AGB stars as a function of metallicity
11:20	Pilar Gil-Pons	Evolution of primordial and Z=0.00001 SAGB stars
11:35	Herbert Lau	An Explosive End to Intermediate-Mass Zero-Metallicity Stars
11:45	Kurtis Williams	**Key Talk:** Observational constraints on the most massive white dwarf progenitors
12:10	Klaus Werner	Is the hottest known white dwarf a bare O/Ne stellar core?
12:25	Nye Evans	Implications for SuperAGB stars from neon novae
12:35	Cristina Chiappini	Impact of SAGBs in the early chemical enrichment of the Galaxy
12:50	Maria Lugaro	The r+s CEMP stars and AGB supernovae
13:00		**Lunch break**
14:00	Stephen Smartt	**Key Talk:** Observational constraints on the masses of supernova progenitors
14:25	René Oudmaijer	Properties of post-Red Supergiants
14:40	Jeremy Yates	Caught in the act — bipolarity in the molecular outflow of the SuperGiant and suspected SN progenitor NML Cyg
14:50	Peter Woitke	Understanding the Mass Loss from Red Giant Winds
15:05	Gregory Sloan	Distinguishing high-mass evolved stars in the Magellanic Clouds
15:20	Alvio Renzini	**Closing remarks**
15:30		**The End**

Posters

Backup talk 1	Anita Richards	Maser clues for super-AGB status
Poster 1	Dinah Moreira Allen	A comparison between abundances of barium and post-AGB stars
Poster 2	Mikako Matsuura	Gas and dust outflow from AGB stars
Poster 3	Karim Mahmood Ababakr	Spot Activity of AK Her Binary Stars
Poster 4	Amin Rikhtrehgar Ghiasi	Photometry investigation on some AGNs galaxies

Abstracts

Talks

Key Talk: Understood, uncertain and unknown physics of super-AGB stars
Richard Stancliffe, Institute of Astronomy, Cambridge University (UK)

Abstract pending.

The physics of burning and convective mixing in super-AGB stars as a function of metallicity
Falk Herwig, Keele University (UK)

Super-AGB stars are in many aspects extreme AGB stars, with the huge internal dynamic range posing a real challenge to simulate the characteristic multi-physics, multi-scale processes that define the peculiar behaviour of super-AGB stars. I will present work done in collaboration with Poelarends, Langer and Heger on the mass an metalicity dependence of the influence of mass loss and dredge-up parameterisations and the resulting estimates for the supernova rate from super-AGB stars. However, this study did not look into the effect of uncertainties in the convection theory that enter 1D stellar evolution models, which I will do in this talk. For example, for super-AGB stars the fact that giant stars are not well described by a solar-scaled mixing-length parameter, for example, becomes very important. Also, the hot-bottom burning as well as the H-burning during dredge-up, coined the hot dredge-up, will be discussed in the context of super-AGB star evolution. In my talk I will also present the most recent high-resolution 3D hydrodynamic simulations of convective boundaries, which add to an emerging general picture of mixing accross convective boundaries (including overshooting) in the stellar interior.

Evolution of primordial and Z=0.00001 SAGB stars
Pilar Gil-Pons, Universitat Politecnica de Catalunya (Spain)

We have computed and analysed the evolution of primordial and $Z = 10^{-5}$ stars from the main sequence until the early stages of the TP-SAGB phase. We have performed our calculations without and with a prescription for overshooting in order to check its effects on the evolution. As a result of our calculations we determine the initial minimum mass allowing carbon burning for these metallicities and give an approximation of the maximum mass that allows the formation of a degenerate oxygen–neon core at the end of the main central burning stages. We describe the occurrence of the dredge–out phenomenon in $Z = 10^{-5}$ models and analyse how the associated mixing and envelope pollution can affect the TP-SAGB phase and, ultimately, the fate of the considered stars.

An Explosive End to Intermediate-Mass Zero-Metallicity Stars
Herbert Lau, Insitute of Astronomy, Cambridge (UK)

We use the Cambridge stellar evolution code STARS to model the evolution of 5 and 7 $M_{\odot}$ zero-metallicity stars. With enhanced resolution at the hydrogen and helium burning shell in the AGB phases, we are able to model the entire thermally pulsing asymptotic giant branch (TP-AGB) phase. The helium luminosities of the thermal pulses are significantly lower than in higher metallicity stars so there is no third dredge-up. The envelope is enriched in nitrogen by hot-bottom burning of carbon that was previously mixed in during second dredge-up. There is no s-process enrichment owing to the lack of third dredge up. The thermal pulses grow weaker as the core mass increases and they eventually cease. From then on the star enters a quiescent burning phase which lasts until carbon ignites at the centre of the star when the CO core mass is 1.36 $M_{\odot}$. With such a high degeneracy and a core mass so close to the Chandrasekhar mass, we expect these stars to explode as type 1.5 supernovae, very similar to Type Ia supernovae but inside a hydrogen rich envelope.

Key Talk: Observational constraints on the most massive white dwarf progenitors
Kurtis A. Williams, University of Texas, Austin (USA)

Perhaps the most direct observational constraint on the mass dividing white dwarf progenitors from supernova progenitors is obtained from white dwarfs in intermediate-age star clusters. I will present the best current constraints based primarily on the white dwarf populations of the Pleiades and Messier 35. I will also highlight the limitations of current methods, and conclude by discussing some possible means of circumventing these limitations.

Is the hottest known white dwarf a bare O/Ne stellar core?

Klaus Werner, Institute for Astronomy and Astrophysics, University of Tübingen (Germany)

H1504+65 is the hottest known white dwarf ($T_{\rm eff} = 200,000$ K). It is an exotic object, being hydrogen- *and* helium-deficient. The main atmospheric constituents are C and O, with considerable admixtures of Ne and Mg. It is also a massive white dwarf with about one $M_\odot$. Detailed quantitative analyses of HST, FUSE and Chandra spectra were performed. This bare star might be the only single white dwarf for which we will be able to prove directly its nature as a O/Ne white dwarf and, hence, the existence of white dwarfs being post-super-AGB remnants.

Impact of SAGBs in the early chemical enrichment of the Galaxy

Cristina Chiappini, Observatoire Genève (Switzerland)

This contribution is intended to show the importance of understanding the contribution of super AGB star (SAGBs) to the chemical enrichment of the early phases of the galactic ISM.

Recently, a sample of extremely metal-poor (EMP) normal stars (Spite et al. 2005) was found to show large N/O ratios, suggesting high levels of primary nitrogen in EMP massive stars. Classically the best candidates for the production of primary N are the AGBs, however it is unlikely that AGBs had time to contribute to the enrichment of the ISM at such low metallicities (e.g. Melendez & Cohen 2007). Currently, the most promising mechanism to produce primary nitrogen in massive stars is by fast stellar rotation. One of the consequences of rotation is that carbon and oxygen, produced in the He-burning core, are transported by rotational mixing into the H-burning shell, where they are transformed into primary ^{13}C and ^{14}N. The efficiency of this process increases when the initial mass and rotational velocity increase, producing more N for fast rotators. In fact, chemical evolution models which take into account the contribution of fast rotators can account for the EMP observations, not only of N/O but also C/O and the C-isotopic ratios (Chiappini et al. 2005, 2006ab, 2007).

However, SAGBs could also be important contributors to the enrichment of the ISM in ^{13}C and ^{14}N (Siess 2007). These stars are not included in chemical evolution models as stellar yields for these objects are currently not available. As SAGBs have masses between 8-12 $M_\odot$ (depending on the metallicity) one could wonder if these objects could enrich the ISM early on both in ^{13}C and ^{14}N, thus being good candidates to explain the very metal poor CNO data, without the need of fast rotators. The answer to this question will depend on answers to other questions such as the exact mass range of SAGs, their stellar yields and how they depend on the surface rotation velocities.

The r+s CEMP stars and AGB supernovae

Maria Lugaro, University of Utrecht (The Netherlands)

A significant fraction of carbon-enhanced metal-poor (CEMP) stars show abundance patterns characteristic of both the slow and the rapid neutron capture processes — the s process and the r process, respectively. Since the s process occurs in AGB stars, while the r process is believed to occur in supernovae, one of the possible scenario to explain these observations is pollution from a binary companion that went throught the AGB phase and then exploded as a supernova of some kind. I will review the light- and heavy-element abundance signatures expected from AGB stars of different masses at metallicities between 1/100 and 1/1000 of solar, typical of r+s CEMP stars. Using this information, I will then attempt to discuss the feasibility of the AGB supernova scenario.

Key Talk: Observational constraints on the masses of supernova progenitors

Stephen Smartt, Queen's University Belfast (UK)

The HST archive is a rich source of deep and multi-colour images of galaxies in the nearby Universe and when a core-collapse supernova explodes in these galaxies, we can attempt direct detection of the progenitor star. I will present the results of a 10 year survey for the progenitors of core-collapse supernovae, particularly focusing on the most common type of II-P (the type II plateau events). Several red-supergiant progenitors of masses between 8-15 $M_\odot$ have been discovered but suprisingly none above this mass range. The results from the progenitor searches has allowed us to place a mass range on the progenitors. A maximum-likelyhood analysis would suggest a best estimate for the lower mass limit for core-collapse supernovae is 7.5 ± 1 $M_\odot$. And at the 95% confidence limit is lower than 9.5 $M_\odot$. Super-AGB stars have been suggested as viable progenitors of some faint type II-P SNe. I will show for one case (SN2005cs) that this is unlikely to be true. The nature of these faint events, and also the source of Ib/c SNe remain unclear.

Properties of post-Red Supergiants
René Oudmaijer, University of Leeds (UK)

The yellow hypergiants are found in a stage between the massive Red Supergiants and the Wolf-Rayet stars, objects thought to be Gamma Ray Burst progenitors. It is a phase similar to the lower mass post-AGB phase, and can arguably be called "super-post-AGB". This presentation will address current issues concerning the evolution of massive stars, concentrating on the transitional post-Red Supergiant phase.
Few yellow hypergiants are known and even fewer show evidence for having evolved off the Red Supergiant branch. Indeed, only two such rare objects with a strong infrared excess due to circumstellar dust, the remnant of the previous mass losing phase, are commonly accepted to be in this phase, IRC +10420 and HD 179821. The talk will review their properties, discuss their real-time evolution and the geometry of their circumstellar material. Finally, recent results employing near-infrared interferometry, integral field spectroscopy and polarimetry will be presented.

Caught in the act — bipolarity in the molecular outflow of the SuperGiant and suspected SN progenitor NML Cyg
Jeremy Yates, University College London (UK)

The supergiant NML Cyg has long been thought to be a possible supernova progenitor. Recent MERLIN observations of its 22 GHz water maser emission now show clear evidence of a fast bipolar wind developing, suggesting the star is now leaving the red supergiant phase and entering the final Wolf Rayet stages of stellar evolution.

Understanding the Mass Loss from Red Giant Winds
Peter Woitke, UK ATC Edinburgh (UK)

Red giant stars are the main dust factories in the universe. Their massive winds are the key to understand late stages of stellar evolution.
Radiation pressure on dust grains forming close to the star and shock waves created by the stellar pulsation are important for the acceleration of these winds. In this talk, I will highlight some results of 2D dynamical models for these winds, which include a time-dependent treatment of dust formation and coupled frequency-dependent Monte-Carlo radiative transfer.
For carbon stars ($C > O$), these models are in fine agreement with obervations. However, in the more common oxygen-rich case ($C < O$), the models fail to predict the magnitude of observed mass-loss rates, because most oxygen-rich condensates like Al_2O_3, Mg_2SiO_4, etc. have glassy opacities, i.e. they are almost transparent in the optical and near-IR spectral region where the star releases most of its energy. Thus, the details of the wind driving mechanism of red giants are still puzzling.

Distinguishing high-mass evolved stars in the Magellanic Clouds
Gregory C. Sloan, Cornell University (USA)

Intermediate-mass stars become carbon rich on the asymptotic giant branch (AGB). As a result, evolved stars associated with silicate dust and other forms of oxygen-rich mass loss can either arise from low-mass or high-mass progenitors. To further complicate the picture, the more massive stars can be either supergiants or AGB stars. Thus, an oxygen-rich evolved star can belong to one of three populations. Infrared spectral surveys of the Magellanic Clouds with the Spitzer Space Telescope have produced a sample of about 90 oxygen-rich evolved stars. This sample includes objects from both the Large and Small Magellanic Clouds, allowing a comparison to Galactic samples and a study of how the mass-loss and dust-formation processes depend on metallicity. Relating each of these stars to their progenitor population is an important step in understanding the samples as a whole.

Posters

Maser clues for super-AGB status

Anita Richards, University of Manchester (UK)

One of the best guides to the mass of a solitary AGB star is its radius, but that is hard to determine — the star may be very obscured even if the distance is known. Some maser properties do appear to scale with stellar size. The diameter of water maser clumps (typically at 10 $R_\star$) appears very similar to the stellar diameter where both have been measured (suggesting a 'birth-radius' ~ 0.1 $R_\star$); this is the case both for AGB stars and for RSG. Water masers also provide a distance-independent diagnostic; the lifetime over which the same clumps can be re-identified scales with the sound-crossing time — emission from individual clouds around AGB stars fades in between a few months and 2 yr; RSG clouds can survive a decade or more. These stellar-relative properties vary by an order of magnitude or more between AGB and RSG stars. This is in contrast to properties which are determined by local physics, such as outflow velocity, which vary by a factor of a few, or those which depend on the cumulative mass loss which change dramatically over the lifetime of the stage — a young RSG may have an OH shell no bigger than a mature OH/IR star. The relative overall sizes and intensities of the whole maser shells of various species are nonetheless valuable guides to the evolutionary stage. It is also likely that CSEs start off poorly-filled and asymmetric, then plump out to almost spherical shells in at least some species, followed by increasingly axisymmetric or biconical morphologies late in life.

Water masers are very variable so more than one epoch of data are needed to measure the average cloud size reliably as well as their survival. Both high senstivity and milli-arcsec resolution are needed to measure unbeamed cloud size as well as masing lifetime. We can collect MERLIN and other interferometry data, complemented by single dish monitoring from Puschino, and any known measurements of the stellar mass or radius, to extend the AGB:RSG comparison to investigations of mass-dependent properties within the AGB itself and diagnostics for high-mass stars. We also invite participation in an e-MERLIN legacy proposal to measure directly the radio photospheres of AGB/RSG stars and mass loss through the maser zone.

Spot Activity of AK Her Binary Star

Karim Mahmood Ababakr, Sallahaden University-Soran Educational College (Iraq)

In this investigation B and V filters light curves of the AK Her are presented. Their light curves notice O'Connell effect phenomenon in which the level of the primary maxima peak being higher than that of the secondary ones or contrarily in both filters. Photometric solutions were carried out by using the latest version (2003) of the W-D program; the presented light curves are analyzed. The spot model has been applied to fit the asymmetric light curves in order to explain the O'Connell effect. The explanation of the O'Connell effect by spot model of AK Her binary carried out for the first time by cool spot on the primary component and the spot parameters of such system have been determined. It has been observed that by changing only the spot parameters, the model light curves can fit the observed light curves. This indicates that the variation of the spot location, size and its temperature is the main reason for changing the shape of light curves. The spot effect has been calculated to compare how much the light curve is distorted by the star spot; also the spot area has been calculated. It is found that the system is over-contact of A-subtype. From our data analysis, the fundamental orbital, physical and geometrical parameters were determined, and the absolute parameters have been determined.

A comparison between abundances of barium and post-AGB stars

Dinah Moreira Allen, University of Hertfordshire (UK)

Barium stars present large excesses of the elements due to the neutron capture s-process, although these stars are not evolved enough to self-enrich during the thermal pulses in the AGB phase. The standard explanation for their peculiarities is a binary status. The former primary, more massive, evolves faster and goes into the AGB phase, whereby it convectively enriches its atmosphere with s-process products. The former secondary is enriched by mass accretion from the stellar wind of its companion, and presents in its atmosphere vestiges of the nucleosynthesis of the former AGB star, being presently observed as the barium star. In this work, abundances obtained through spectrum synthesis for a number of heavy elements is presented for a relatively large sample of barium stars, for what, high-resolution spectra were obtained with the FEROS spectrograph at the ESO-1.52m Telescope. The atmospheric parameters were found to be in the range $4300 < T_{\rm eff}({\rm K}) < 6500$, $-1.2 < [{\rm Fe/H}] < 0.0$, and $1.3 < \log g < 4.6$. The comparison of the abundances obtained for the sample barium stars and those of post-AGB stars taken from the literature supports the hypothesis of binarity for the barium star formation.

Gas and dust outflow from AGB stars

Mikako Matsuura, NAOJ (Japan)

AGB stars are considered as one of the important sources of gas and dust grains in the interstellar medium (ISM) of galaxies. It has been predicted that both the nuclear synthesis and mass-loss rate of AGB stars strongly depend on their metallicity. Using the Spitzer Space Telescope, we have obtained near- and mid-infrared spectra of AGB stars in nearby galaxies, including the Large and Small Magellanic Clouds, Fornax and Sagittarius dwarf Spheroidal galaxies. The metallicity ranges from 1/10 to 1/2 of the solar metallicity. Mass-loss rates were estimated from these spectra and equivalent widths of molecular bands have been analysed. We discuss whether the mass-loss rates and molecular abundances depend on the initial metallicity of the stars represented by the metallicities of the galaxies themselves, or on the self-produced elements synthesized in these stars.

Photometry investigation on some AGNs galaxies

Amin Rikhtrehgar Ghiasi, Crimean Astrophysical Observatory (Ukraine)

I present result of CCD BVRI observations of comparison stars in the fields of 22 active galactic nuclei, mainly Seyfert galaxies.

Participants

Karim Mahmood Ababakr	Sallahadin University / Soran Educational College, Erbil	Iraq
Michael Bennett	Keele University	UK
Cristina Chiappini	Observatoire Genève	Switzerland
Srabani Datta	University of Manchester	UK
Leen Decin	University of Leuven	Belgium
John Eldridge	Institute of Astronomy, Cambridge University	UK
Nye Evans	Keele University	UK
Stewart Eyres	University of Central Lancashire	UK
Amin Rikhtrehgar Ghiasi	Crimean Astrophysical Observatory	Ukraine
Pilar Gil-Pons	Universitat Politecnica de Catalunya	Spain
Tim Gledhill	University of Hertfordshire	UK
Jordi Gutiérrez	Universitat Politecnica de Catalunya	Spain
Falk Herwig	Keele University	UK
Robert Izzard	University of Utrecht	The Netherlands
Atefeh Javadi	Azzahra University, Tehran	Iran
Simon Jeffery	Armagh Observatory	UK
Herbert Lau	Institute of Astronomy, Cambridge University	UK
Maria Lugaro	University of Utrecht	The Netherlands
Claudia Maraston	University of Portsmouth	UK
Mikako Matsuura	NAOJ	Japan
June McCombie	University of Nottingham	UK
Iain McDonald	Keele University	UK
Shazrene Mohamed	Oxford University	UK
Dinah Moreira Allen	University of Hertfordshire	UK
Ralf Napiwotzki	University of Hertfordshire	UK
Joana Oliveira	Keele University	UK
René Oudmaijer	University of Leeds	UK
Marco Pignatari	Keele University	UK
Alvio Renzini	University of Padova	Italy
Anita Richards	University of Manchester	UK
Mark Rushton	University of Central Lancashire	UK
Gregory Sloan	Cornell University	USA
Stephen Smartt	Queen's University Belfast	UK
Kristof Smolders	University of Leuven	Belgium
Richard Stancliffe	Institute of Astronomy, Cambridge University	UK
Seyed Alireza Tabatabaei	Queen Mary, University of London	UK
Griet van de Steene	Royal Observatory of Belgium	Belgium
Peter van Hoof	Royal Observatory of Belgium	Belgium
Jacco van Loon	Keele University	UK
Tijl Verhoelst	University of Leuven	Belgium
Klaus Werner	University of Tübingen	Germany
Kurtis Williams	University of Texas, Austin	USA
Peter Woitke	ATC Edinburgh	UK
Jeremy Yates	University College London	UK