STELLAR END PRODUCTS

THE LOW MASS – HIGH MASS CONNECTION
A workshop focusing on the role of mass loss in the late stages of stellar evolution of stars of all masses

ESO GARCHING
6–10 JULY 2015

Abstract Submission Deadline
– 6 April 2015 –

Scientific Organising Committee
Leen Decin (KU Leuven, Belgium)
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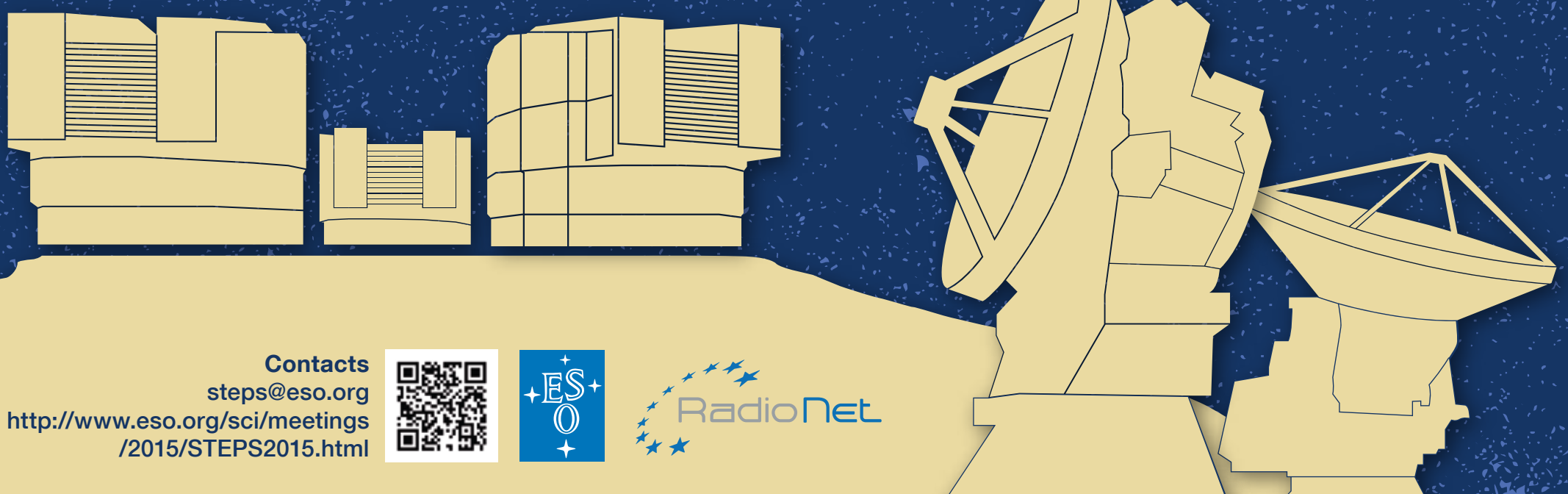
Anita Richards (JBCA, U. Manchester, UK)
Wouter Vlemmings (Chalmers, Sweden)
Jeremy Walsh (ESO, Germany)
Markus Wittkowski (ESO, Germany)

Invited Speakers Include
Jean-Phillipe Berger • Henri Boffin
Valentin Bujarrabal • Graham Harper
Susanne Hoefner • Roberta Humphreys
Joel Kastner • Franz Kerschbaum
Agnes Lebre • Orsola de Marco
Mikako Matsuura • Iain McDonald
Georges Meynet • Benoit Mosser
Hans Olofsson • Claudia Paladini
Sofia Ramstedt • Anita Richards
Laurence Sabin • Nathan Smith
Leonardo Testi • Albert Zijlstra

Local Organising Committee
Stella Chasiotis-Klingner • Jason Grunhut
Liz Humphreys • Kate Maguire
Jeremy Walsh • Markus Wittkowski



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STELLAR END PRODUCTS – THE LOW MASS – HIGH MASS CONNECTION

6-10 July, 2015 in Garching, Germany

Programme Overview

Day 1, Monday 6 July (afternoon)

13:00	**Registration**	
14:00	Tim De Zeeuw	**Welcome and Opening**
14:10	SOC/LOC	Announcements

Session 1: Overview (Chair: Liz Humphreys)

14:20	Albert Zijlstra (invited)	Grand Overview
15:00	Eric Lagadec	Summary of the Recent Physics of Evolved Stars Meeting
15:20	Hans Olofsson (invited)	Radio/Mm/Submm Observations of AGB and RSG stars
15:50	**Break**	
16:20	Roberta Humphreys (invited)	RSGs and AGBs in the Optical and Infrared -- the Evidence for Mass Loss, Circumstellar Ejecta and Episodic Events
16:50	Leonardo Testi (invited)	Mm and Submm Interferometry, Current & Future Capabilities
17:20	Jean-Philippe Berger (invited)	Optical Interferometry: Current & Future Capabilities
17:50	**Reception**	

Day 2, Tuesday 7 July

Session 2: Stellar Evolution & Atmospheres (Chair: Markus Wittkowski)

09:00	Georges Meynet (invited)	Some Open Questions on the Physics of Stars
09:40	Paola Marigo	Linking the Evolution of AGB Stars with the Molecular Chemistry in their Circumstellar Envelopes
10:00	Alain Jorissen	Atmospheric Tomography of Supergiant Stars
10:20	Pierre Kervella (invited)	The Atmosphere of Red Supergiants at High Angular Resolution
10:50	**Break**	
11:20	Michael Gordon	Yellow Supergiants: Unlocking the Mysteries of Post-RSG Evolution
11:40	Ramiro De La Reza	Complex Organic and Inorganic Compounds in Shells of Lithium-Rich K Giant Stars
12:00	Benoit Mosser (invited)	Mixed Modes in Red Giants: a Window on Stellar Evolution
12:30	**Discussion on Stellar Evolution & Atmospheres**	
13:00	**Lunch**	

Session 3: Mass Loss Mechanisms & Dust (Chair: Roberta Humphreys)

14:30	Susanne Hoefner (invited)	Dynamical Atmospheres and Winds of AGB Stars: A Theorist's View
15:00	Sara Bladh	How M-type AGB Stars Bite the Dust
15:20	Theo Khouri	Investigating the Wind-Driving Mechanism in R Doradus
15:40	Ward Homan	Analytical Morphological Models and an Application to the CW Leo ALMA Data
16:00	**Break**	
16:30	Graham Harper (invited)	Testing Theoretical and Semi-Empirical Models of Red Supergiant Extended Atmospheres
17:00	Claudia Paladini (invited)	Surface Features with VLTI
17:30	Xavier Haubois	Probing the Inner Dust Shell of Betelgeuse with Polarimetric Interferometry
17:50	Peter Scicluna	Large Dust Grains in RSG Winds: High-Contrast Polarimetric Observations of VY Canis Majoris

Day 3, Wednesday 8 July

Session 3 Continued: Mass Loss Mechanisms & Dust (Chair: Alain Baudry)

09:00	Anita Richards (invited)	Radio/Sub-mm Clues to the Origins of Asymmetries and Clumps
09:30	Eamon O'Gorman	Spatially Resolved Radio/mm Continuum Studies of Red Supergiants
09:50	Dinesh Shenoy	Probing Hypergiant Mass Loss with Adaptive Optics Imaging and Polarimetry in the Infrared
10:10	Lynn Matthews	Searching for Evidence of Mass Loss on the Cepheid Instability Strip
10:30	**Discussion on Mass Loss Mechanisms and Dust**	
11:00	**Break**	

Session 4: Binaries, Shells & Shaping (Chair: Leen Decin)

11:30	Orsola De Marco (invited)	Binary Stars Across the Mass Spectrum; From Observations to Theory and Back
12:10	Shazrene Mohamed	Shaping the Outflows of Evolved Stars
12:30	Michel Hillen	The First Milli-Arcsecond Image of a Post-AGB Binary: the Inner 10 AU of IRAS08544-4431
12:50	**Lunch**	
14:30	Sofia Ramstedt (invited)	Winds and Circumstellar Morphology of Binary AGB Stars with ALMA
15:00	Miguel Montarges	The Dusty Disk and Companion of L2 Puppis, the Nearest AGB Star, Observed with VLT/SPHERE
15:20	Foteini Lykou	Shaping Nebulae via Disks in AGB Stars
15:40	**Break**	
16:10	Henri Boffin (invited)	Binary Stars - an Interferometric View
16:40	Sebastian Ohlmann	Hydrodynamic Simulations of Common Envelope Phases

Session 5: Magnetic Fields (Chair: Vincent Icke)

17:00	Agnes Lebre (invited)	Surface Magnetism of Cool and Evolved Stars: the Harvest from the Spectropolarimetric Instruments
17:30	**Posters**	Poster viewing with beer and brez'n

Day 4, Thursday 9 July

09:00	Wouter Vlemmings (invited)	Magnetic Fields in Evolved Stars: Theory & Radio/Submm Line Observations
09:30	Laurence Sabin (invited)	Detection of Magnetic Fields in Evolved Stars: From the Envelope to the Photosphere
10:00	Alizee Duthu	Magnetic Fields in C-Rich Evolved Objects
10:20	**Binaries and B-Fields Discussion**	
11:00	**Break**	

Session 6: Evolved Stars and the Cycle of Matter (Chair: Paola Marigo)

11:30	Iain McDonald (invited)	How to Make and Break Dust Around Metal-Poor Stars
12:10	Jonathan Mackey	Cold Gas in Hot Star Clusters: the Fate of Winds from Red Supergiants
12:30	**Discussion on Evolved Stars and the Cycle of Matter**	
12:50	**Group Photo**	
13:00	**Lunch**	

Session 7: Evolutionary End Products, Planetary Nebulae (Chair: Jeremy Walsh)

14:30	Joel Kastner (invited)	Planetary Nebulae: a Contemporary (Multiwavelength) Perspective
15:10	Valentin Bujarrabal (invited)	Molecular Line Observations of Planetary and Protoplanetary Nebulae: Keplerian Disks
15:40	Daniel Tafoya	Sub-millimeter Maser Emission from Water Fountain Nebulae
16:00	**Break**	
16:30	Mark Hollands	Ancient Planetary Systems Around White Dwarfs
16:50	**Discussion on Planetary Nebulae (20 min)**	
19:00	**Conference Dinner**	

Day 5, Friday 10 July

Session 8: Evolutionary End Products, Supernovae (Chair: Jon Marcaide)

09:00	Rubina Kotak (invited)	Supernovae
09:40	Mikako Matsuura (invited)	Supernova 1987A
10:10	Noam Soker	Nebulae Powered by a Central Explosion
10:30	**Break**	
11:00	Santiago Gonzalez	The Rise-Time of Type II Supernovae
11:20	**Discussion on Supernovae**	

Session 9: Closing (Chair: Orsola de Marco)

11:40	Franz Kerschbaum (invited)	Closing Remarks: Enriching STEPS in finding clues on complex giants
12:20	SOC/LOC	Announcements
12:30	**End of Meeting**	

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6-10 July, 2015 at ESO, Garching, Germany

List of poster presenters

No.	Last name	First name	Poster
1	Akashi	Muhammed	Forming equatorial rings around dying stars
2	Aringer	Bernhard	The Dusty Environment Around AGB Stars And Supergiants - Comparing Model Approaches
3	Brunner	Magdalena	The ALMA view on W Aquilae: Observations and Modeling of Molecules in the Circumstellar Envelope
4	Cerrigone	Luciano	PNe in the making: monitoring at radio wavelengths
5	Danilovich	Taissa	Sulfur-bearing molecules in the AGB star R Doradus
6	De Smedt	Kenneth	The s-process in post-AGB stars in the Galaxy and Magellanic Clouds
7	Doherty	Carolyn	Super-AGB stars - bridging the divide between low/intermediate-mass and high-mass stars
8	Edelmann	Philipp	Three-dimensional hydrodynamics simulations of stellar interiors
9	Etoka	Sandra	Flaring Miras
10	Fabrika	Sergei	New LBV stars in the Andromeda galaxy (co-authors: S. Fabrika, O. Sholukhova, A. Sarkisyan, D Bizyaev)
11	Gesicki	Krzysztof	Weak emission line stars in multipolar planetary nebulae
12	Gobrecht	David	From nuclei to dust grains: How the AGB machinery works
13	Goldman	Steve	Circumstellar Masers in the Magellanic Clouds
14	Gutierrez Avendano	Claudia Patricia	Linking the type II supernovae analysis to progenitor properties
15	Guzman-Ramirez	Lizette	A review in mixed chemistry of low mass evolved stars
16	Hamedani Golshan	Roya	AGB stars as the Indicators of Star Formation History and Dust Production
17	Homan	Ward	Analytical approach to embedded spiral geometries to interpret high-resolution data
18	Hron	Josef	Spectro-Astrometry of AGB stars with CRIRES
19	Jorissen	Alain	SPH simulations of mass transfer in binaries involving AGB stars
20	Kaeufl	Hans Ulrich	Spectroastrometric Studies of post-AGB-stars
21	Lam	Doan Duc	An investigation of the morphology and kinematics of the circumstellar envelope of AGB star π1 GruisL
22	Matsuura	Mikako	CO thermal emissions and mass loss of red-supergiants beyond the Milky Way
23	Mecina	Marko	The variable mass-loss history of AGB stars -- a far-IR view on detached shells
24	Nanni	Ambra	An investigation of the morphology and kinematics of the

			circumstellar envelope of AGB star π1 GruisL
25	Nicholls	Christine	A CRIRES-POP atlas of the K giant 10 Leo
26	Nozawa	Takaya	Formation of carbon grains in red-supergiant winds of very massive Population III stars
27	Orosz	Gabor	Testing methods of accurate low frequency astrometry for hydroxyl masers
28	Orosz	Gabor	Trigonometric parallax distance and kinematics of the fastest water fountain source
29	Rau	Gioia	The carbon star adventure continued: modelling atmospheres of a set of C-rich AGB stars
30	Saberi	Maryam	Selective photodissociation process in the carbon AGB star R Scl
31	Soker	Noam	Do core collapse supernovae require binary interaction?
32	Srinivasan	Sundar	The SMC dust budget from fits to the multi-epoch, multi-band photometry of evolved stars
33	Takayama	Masaki	The nature in broad-band photometry of long secondary periods in AGB stars
34	Tessore	Benjamin	Magnetic Field of variable cool and evolved stars: Interaction with complex atmospheric dynamics
35	Tomasino	Rachael	Geometric Analysis of the Dusty Mass Loss from Low- to Intermediate Mass Stars
36	Trejo-Cruz	Alfonso	Dust-production rates of AGB stars in the Solar Neighbourhood
37	Tsebrenko	Danny	Type Ia supernovae exploding inside planetary nebulae
38	Uttenthaler	Stefan	News from Miras with changing pulsation periods
39	Uttenthaler	Stefan	Are the dust and gas mass-loss rates from Miras reduced by the third dredge-up?
40	Van De Sande	Marie	Unravelling the dust formation process in oxygen-rich AGB stars
41	Van Eck	Sophie	The temperature and chronology of heavy-element nucleosynthesis in AGB S stars
42	Van Winckel	Hans	6 years of high-resolution spectroscopic monitoring of evolved binaries : lessons learned
43	Vogt	Nikolaus	Mira stars in ASAS: machine-learned results vs. an interactive method with human participation
44	Vogt	Nikolaus	A multi-periodicity analysis of selected MIRA type variables in the ASAS database
45	Warner	Brian	A Dwarf Nova in a previously unrecognised Nova Shell
46	Wittkowski	Markus	VLTI/AMBER studies of the extended atmospheres of AGB and RSG sta

Talk Abstracts

Albert Zijlstra ***(invited overview)***
University of Manchester, UK

Title:
Grand Overview

Abstract:
Stars at the end of their lives return much of their mass back into the interstellar medium. The proces is the dominant driver of the baryonic evolution of galaxies, providing a range of newly created elements and dust seeds. It also creates the stellar remnants, with very different mass distribution from the originating stars. This talk will discuss the current state of the field regarding mass loss and its effects, covering areas such as mass loss formalisms, stellar yields, initial-final mass relations, angular momentum and binary evolution.

Hans Olofsson *(invited)*
Dept. of Earth and Space Sciences, Chalmers University, Sweden

Title:
Radio/mm/sub-mm Observations of AGB and RSG stars

Abstract:
Considerable progress in the study of AGB stars and red supergiants (RSGs) through line and continuum observations at radio/mm/sub-mm wavelengths have been made over the last years, not the least due to data from the Herschel Space Observatory. I will here review some aspects of this research, with a view towards which areas are particularly suitable for the use of ALMA in the future. I will focus on the results obtained for AGB stars, but will also make outlooks towards the RSGs whenever relevant. I will look at what have been learnt from detailed studies of individual sources on such diverse topics as the central stars, chemistry, isotope ratios, physics of the inner circumstellar envelopes (CSEs), and the time variability of some molecular line emission. This will be followed by an overview of studies of larger samples with relevance for chemistry and nucleosynthesis. Also the large-scale structures of CSEs, which carries information on the mass-loss geometry, but also possible effects due to binarity, will be covered. Finally, I will discuss the present situation when it comes to determining accurate mass-loss rates of AGB stars and RSGs through CO radio line emission, and what are the prospects for getting a better understanding of how this parameter depends on the stellar characteristics.

Roberta Humphreys *(invited)*
University of Minnesota, USA

Title:
RSGs and AGBs in the Optical and Infrared -- the evidence for mass loss, circumstellar ejecta and episodic events

Abstract:
We all know that RSGs and AGBs, post-RSGs and AGBs lose mass. I will briefly review the optical and IR evidence for circumstellar ejecta from these stars of different masses and luminosities. Some have exhibited episodic mass loss much more extreme than a slow outflow. The diversity among the RSGs and AGBs raises questions about mass loss mechanisms and their evolutionary state.

Leonardo Testi ***(invited)***
ESO, Germany

Title:
Mm and Submm Interferometry, Current & Future Capabilities

Abstract:
The Atacama Large Millimetre/submillimetre Array has started Early Science operations in 2011 and is now ramping up to Full Science operations. This revolutionary observatory is the leading facility for the observation of the Universe at (sub)mm wavelengths, and will maintain this role for the foreaseeable future. As the third cycle of science operations is abut to be completed and a record setting 1582 observing proposals for the fourth cycle are under review, a steady stream of new scientific results are constantly appearing in the literature. “Behind the scenes” new observing modes are being implemented and the first set of major upgrades are being worked on and will become available to the users in the coming cycles. In this talk I will briefly mention some of the initial ALMA results in the field of stellar evolution and will describe the current and future scientific capabilities and upgrades.

Jean-Philippe Berger *(invited)*
ESO, Germany

Title:
Optical interferometry: current and future facilities

Abstract:
In the last decade optical interferometers have started to produce an increasing number of milli-arcsecond resolution images of circumstellar environments and stellar surfaces. At the same time the development of spectro-interferometry has permitted to probe mass loss and accretion phenomenon, dust and molecular production and evolution.

Building on the experienced gained by a first generation of instruments a second generation is will soon see its first light at VLTI: GRAVITY and MATISSE. With these new tools and PIONIER available at VLTI the evolved star community will have access with a unique capability for spectro imaging from 1.5 to 10 micron at unmatched angular resolutions.

In this presentation I will review the soon-to come capabilities at VLTI and other facilities. I will also try to explore possible avenues for the development of optical interferometry and explain how the evolved stars community should play a central role in defining the path.

Georges Meynet *(invited overview)*
Geneva Observatory, Switzerland

Title:
Some Open Questions on the Physics of Stars

Abstract:
In this talk I shall discuss what we know and what we still do not know so well about the following processes having a large impact on the evolution of stars: mass loss by stellar winds, convection, mixing in radiative zones and impact of magnetic fields. Each of these topics might be the subject of a complete talk. I shall try for each of them to synthesize what we know, what we have to improve, and what are the consequences for the end point of the evolution of stars.

Paola Marigo
University of Padova, Italy

Title:
Linking the evolution of AGB stars with the molecular chemistry in their circumstellar envelopes

Abstract:
I will present a new theoretical study on the molecular chemistry in the inner CSEs of AGB stars. A dynamic model for periodically shocked atmospheres, that includes an extended chemo-kinetic network, is for the first time coupled to detailed evolutionary tracks for the AGB phase computed with the COLIBRI code. The new models recover the measured HCN concentrations as a function of the mass-loss rate and reproduce the observed systematic increase of HCN along the M-S-C spectral sequence. I will discuss the physical implications for the pulsation-induced shocks that propagate through the CSEs.

Alain Jorissen
Université libre de Bruxelles CP226, Belgium

Title:
Atmospheric tomography of supergiant stars

Abstract:
A tomographic technique invented by Alvarez et al. (2001) for pulsating AGB stars has been applied to supergiant atmospheres. It makes it possible to derive the velocity field at different depths in the line-forming region. This velocity field is confronted to 3D models from Freytag & Chiavassa.

Pierre Kervella *(invited)*
CNRS, Universidad de Chile, Obs. de Paris, Chile

Title:
The atmosphere of red supergiants at high angular resolution

Abstract:
The low effective temperature and gravity of red supergiants (RSGs) combine to create a particularly interesting convection regime, characterized by very large cells. The angular diameter of nearby red supergiants as Betelgeuse and Antares is so large that their photosphere is easily resolved by optical interferometry. Further away, the molecular and dusty envelopes are resolvable with single dish optical telescopes and millimeter radio interferometry. I will present an (incomplete) overview of the contributions of high angular resolution observations of RSG atmospheres in the recent years.

Michael Gordon
University of Minnesota, USA

Title:
Yellow Supergiants: Unlocking the Mysteries of Post-RSG Evolution

Abstract:
The most recent generation of Geneva models predict that massive red supergiants may evolve towards the blue side of the HR diagram before ending their lives as WR stars, LBVs, or core-collapse SNe. Due to their short life expectancy, this post-RSG class of stars provides a sensitive laboratory for stellar evolution theory. Through spectral characteristics and SEDs, we present evidence of mass loss in RSGs and intermediate-type YSGs in M31 and M33. With this census of the evolved cool star population, we can identify candidates for post-RSG evolution.

Ramiro de la Reza
Observatorio Nacional/MCTI, Brazil

Title:
Complex organic and inorganic compounds in shells of Lithium-rich K giant stars

Abstract:
Hydrocarbon organic material, as found in the interstellar medium, exists in complex mixture of aromatic and aliphatic forms. It is considered to be originated from carbon enriched giant stars. We show here that the same organic compounds appear to be formed in previous stages of the evolution of giant stars. More specifically, during the first ascending giant branch K-type stars. According to our model this happens only when these stars are being abruptly enriched with lithium together with the formation of a circumstellar shell with a strong mass loss during just a few thousand years.

Benoit Mosser *(invited)*
Observatoire de Paris, France

Title:
Mixed modes in red giants: a window on stellar evolution

Abstract:
The detection of oscillations with a mixed character in red giants allows us to probe the physical conditions in their cores. Kepler data were selected to map various evolutionary stages and stellar masses. This allows us to monitor stellar evolution from the main sequence to the asymptotic giant branch. The seismic information can now be used for stellar modelling, especially for studying the energy transport or for specifying the inner properties of stars entering the red or asymptotic giant branches. Mass loss can be derived from precise mass determination.

Susanne Höfner *(invited)*
Uppsala University, Sweden

Title:
Dynamical Atmospheres and Winds of AGB stars: A Theorist's View

Abstract:
The massive cool outflows observed around AGB stars are usually attributed to a combination of stellar pulsation and radiation pressure on dust. Atmospheric shock waves, triggered by pulsation and giant convection cells, intermittently lift gas to distances above the stellar photosphere where temperatures are low enough for dust condensation. The dust grains which are formed in the dense wakes of the shocks are accelerated outwards by absorption and scattering of stellar photons, and they drag along the surrounding gas by collisions. This scenario is supported by various observations, e.g. high-resolution spectra probing gas velocities in the atmospheres and winds, or interferometry and imaging of nearby objects, showing evidence of atmospheric dynamics and constraining dust condensation distances. In recent years, considerable progress has been made regarding time-dependent dynamical models which follow the flow of matter from the atmosphere into the circumstellar envelope, taking non-equilibrium dust formation and detailed radiative transfer into account in a self-consistent way. Such models, based on first principles, predict mass-loss rates, wind velocities, spectra and photometric variations in good agreement with observations for both M- and C-type AGB stars. In this talk I will focus on recent developments and insights concerning dust species that are wind-driving candidates or prominent in mid-IR spectra, effects of pulsation and convection on atmospheres and winds, as well as the latest generation of 3D star-in-a-box models.

Sara Bladh
University of Padova, Italy

Title:
How M-type AGB stars bite the dust

Abstract:
In the framework of the ongoing STARKEY project, here we report result from the current grid of time-dependent wind models for M-type AGB stars, especially photometric and spectral results and maps of polarized light. The main source of the radiative acceleration will have a strong effect on the resulting spectra and colors. If scattering is the dominant source of the momentum there will be much less circumstellar reddening; changes in the molecular features during the pulsation cycle will be visible at visual wavelengths and there will not be much infrared excess, even though dust is present.

Theo Khouri
Chalmers University of Technology, Sweden

Title:
Investigating the wind-driving mechanism in R Doradus

Abstract:
We present a very comprehensive study of the circumstellar envelope of the oxygen-rich asymptotic giant branch (AGB) star R Doradus. We modelled observations obtained with different instruments: SPHERE/ZIMPOL, PACS, HIFI, SPIRE, the infrared space observatory, and ground-based radio telescopes. This wealth of data probe both the gas- and solid-phase components of the wind in a complementary way. We focus on studying the acceleration region of the wind and our results give important constraints on the poorly-understood wind-driving mechanism of oxygen-rich AGB stars.

Ward Homan
Instituut voor Sterrenkunde, Belgium

Title:
Analytical morphological models and an application to the CW Leo ALMA data

Abstract:
Observations of stellar winds have shown that these outflows are non-homogeneous and might harbour structural complexities on macro- and microscales.Here, we focus on spiral structures with the aim to expand our understanding on the manifestation of such structures in the (one- and three-dimensional) observables of a stellar wind. For this we have developed fully parametrised analytical models. The emission produced by these models is simulated via 3D radiative transfer. We present the results for two different models of an optically thin spiral in an optically thin outflow. The two considered spiral geometries are identical, but for their opening angle, which are respectively low and high. We demonstrate that the low excitation rotational spectral lines of CO hardly reflect this more complex geometry, but that spatial information, in the form of Position-Velocity diagrams, does carry all the fundamental geometrical information. Finally, we briefly present a comparison with the ALMA data of CW Leo. If time permits, we will briefly introduce a similar work on disk morphologies.

Graham Harper *(invited)*
CASA CU-Boulder, USA

Title:
Testing Theoretical and Semi-Empirical Models of Red Supergiant Extended Atmospheres

Abstract:
There are no standard models for explaining the extended atmospheres and large mass-loss rates of red supergiants (RSGs). Theoretical models also face the additional challenges of significant stellar variability and that multiple physical processes may be in play. Advances in our understanding continue to be driven by high spatial- and spectral-resolution observations. In the early 1950's, high spatial-resolution optical spectroscopy revealed that mid-chromospheric scale heights in K4 Ib stars exceeded those from the assumption of hydrostatic equilibrium, and with the advent of space-based UV spectroscopy is was found that the density scale heights continue to increase outwards as the wind accelerates. Theoretical models have attempted to explain these extended atmospheres as a result of magnetohydrodynamic (MHD) wave pressure. Here we consider the pairs of single RSGs and their spectral-type proxies in eclipsing binary systems: alpha Orionis (M2 Iab) and VV Cephei (M2 Iab + B0-2 V), and lambda Velorum (K4 Ib) and zeta Aurigae (K4 Ib + B5 V) to give context to recent modelling and observational studies including convection simulations, MHD models, imaging, interferometric, and NASA-DLR SOFIA mid-IR EXES spectra.

Claudia Paladini ***(invited)***
Université Libre de Bruxelles, Belgium

Title:
Surface Features with VLTI

Abstract:
We have known for years that spots and asymmetric mass ejection must characterise the surface of giant and supergiant stars. We then observed the signature of these ``asymmetries'' with lunar occultations and interferometry. However the interpretation of these structures have been quite challenging because we were limited to the Fourier space and we had no suitable 3D model atmospheres.
Thanks to PIONIER, VLTI was recently transformed in an “imaging machine”. We can finally observe the surface of these stars resolved like the surface of our Sun. In this talk I will give an overview of the recent advances from optical and infrared interferometry in unveiling surface structures on the photosphere of giant and supergiant stars. I will briefly discuss the challenges of image reconstruction, and I will conclude highlighting how our field of research will benefit from the synergy of the current interferometric instrument(s) with the second generation VLTI facilities GRAVITY and MATISSE.

Xavier Haubois
ESO, Chile

Title:
Probing the inner dust shell of Betelgeuse with Polarimetric Interferometry

Abstract:
We report on polarimetric aperture masking observations with VLT/SAMPol of the red supergiant Betelgeuse. A clear polarized signal is resolved at about 1.5 stellar radius in several near-infrared filters. The dependence of this signal with wavelength carries information on the dust grain size that we estimate following similar works on AGBs presented in Norris et al. 2012. To conclude, we put these dust characteristics in perspective with previous MIDI and VISIR observations as well as recently obtained SPHERE polarimetric images to get a global picture of dust distributions in Betelgeuse.

Peter Scicluna
Kiel University, Germany

Title:
Large dust grains in RSG winds: high-contrast polarimetric observations of VY Canis Majoris

Abstract:
I will present a detailed near-infrared and optical polarimetric study of VY Canis Majoris, the nearest and best studied dust-enshrouded red supergiant. Using high-contrast polarimetric imaging from SPHERE, we infer the presence of large (~500nm) dust grains and find evidence for grain size variations. I will also present the first fully-3D self-consistent radiative transfer model for VY CMa. To fit the SED and the optical morphology of the ejecta we require grains from 100nm to >1 micron. The presence of large grains implies that scattering driven winds may also play a role in RSGs mass loss.

Anita Richards *(invited)*
University of Manchester, UK

Title:
Radio/sub-mm clues to the origins of asymmetries and clumps

Abstract:
The bulk properties (such as mass and elemental composition) of the material entering the ISM from cool, evolved stars, seem to be well-understood. This is not the case for smaller scale behaviour, such as the survival of dust grains or the origins of aspherical nebulae around even apparently solitary stars. High-resolution observations show that the winds are clumpy and usually have a preferred axis. The winds can also be multi-phase with different distributions of tracers of different densities/other properties. But, what causes these inhomogeneities and asymmetries? Do they originate from localised mass loss events from the star, and a stellar-centred magnetic field? Or from instabilities further out in the wind? I will report on ALMA, MERLIN and VLBI au-scale imaging of AGB and RSG winds using masers and other lines, related to stellar properties, complementing other talks on larger-scale structure, radio continuum and magnetic fields. I will look forward to the use of ALMA alongside com-wave interferometers to observe multiple maser transitions, revealing not only kinematics but physical conditions with unprecedented precision.

Eamon O'Gorman
Chalmers University of Technology, Sweden

Title:
Spatially Resolved Radio/mm Continuum Studies of Red Supergiants

Abstract:
Spatially resolved radio/mm continuum observations can be a powerful tool to study both the partially ionized extended atmospheres and circumstellar dust around red supergiants. Here, I present the results of our centimeter wavelength campaign to monitor the size and temperature of Betelgeuse's extended atmosphere. I will then discuss the recent ALMA science verification continuum data of VY CMa, which traces dust in its inner circumstellar environment at unprecedented angular resolution.

Dinesh Shenoy
University of Minnesota. USA

Title:
Probing Hypergiant Mass Loss with Adaptive Optics Imaging and Polarimetry in the Infrared

Abstract:
We probe hypergiant star mass loss in the infrared. Adaptive optics (AO) imaging polarimetry of IRC +10420 at 2.2μm confirms visual evidence that we view it pole-on, and reveals low-latitude optically thick dust with intrinsic polarization of 30%. Combined with 3-5μm AO imaging we find nebular temperatures well in excess of equilibrium for typical dust. AO imaging and polarimetry of VY CMa's nebula from 1-5μm reveal both optically thick scattering & high intrinsic polarization, which indicates that the depolarizing effect of multiple scatters is mitigated by low albedo, assuming typical dust.

Lynn Matthews
MIT Haystack Observatory, USA

Title:
Searching for Evidence of Mass Loss on the Cepheid Instability Strip

Abstract:
For decades, a discrepancy of 10-15% has persisted between the masses of Cepheid variables derived from stellar evolution models compared with values based on the Period-Luminosity relation. This "Cepheid mass discrepancy" highlights an embarrassing gap in our understanding of the evolution of intermediate mass stars. Mass loss on the Cepheid instability strip has long been postulated as a likely solution to the mass discrepancy, but empirical confirmation has remained elusive. I will summarize results from recent searches for mass loss signatures from Cepheids and discuss their implications.

Orsola De Marco ***(invited overview)***
Macquarie University, Australia

Title:
Binary stars across the mass spectrum; from observations to theory and back

Abstract:
I will review the effects of binarity in stellar evolution, with an emphasis on low and intermediate mass stars. Binary star phenomena have been of great interest for a long time. Binaries have provided tools to determine particular stellar parameters (such as stellar masses, distances or sizes) and have allowed us to probe physical phenomena, such as accretion, that have a wide applicability. Today binarity has gained renewed interest because of the realisation of how commonly stars have binary companions, including planets, which interact with them during their life cycles. This realisation has opened new questions, and provided new avenues to explain well known astrophysical phenomena, such as, for example, the luminous blue variables. Another phenomenon that has been scrutinised with new eyes is the production of collimated planetary nebulae, which are more easily produced in binary interactions than in single stars. However, a large hurdle in generating binary scenarios for any observed phenomena is that the physics is complex and often models, such as hydrodynamics computations, too simplistic. I will review the status of these simulations with an eye to the vital connection between simulations and observations.

Shazrene Mohamed
South African Astronomical Observatory, South Africa

Title:
Shaping the outflows of evolved stars

Abstract:
Cool, evolved stars lose copious amounts of mass and momentum through powerful, dense stellar winds. The interaction of these outflows with their surroundings results in highly structured and complex circumstellar environments, often featuring knots, arcs, shells and spirals. In this talk, I will discuss three of the main mechanisms that shape the outflows of evolved stars: - interaction with the interstellar medium; interaction with a stellar wind (from a previous phase of evolution or the wind from a companion star); and interaction with a companion that has a weak or insignificant outflow.

Michel Hillen
Instituut voor Sterrenkunde, KU Leuven, Belgium

Title:
The first milli-arcsecond image of a post-AGB binary: the inner 10 AU of IRAS08544-4431

Abstract:
In this contribution I wish to present recent highlights of our systematic interferometric and radiative transfer studies of the dusty disks around post-AGB binaries. Recent surveys have shown that about 40% of all optically bright post-AGB stars are in such a system. The formation, evolution and fate of these rotating, circumbinary structures is yet ill-constrained, but intimately linked with the evolution of the central binary. Here I will focus on the first and spectacular milli-arcsecond image that we reconstructed based on very recent PIONIER/VLTI data.

Sofia Ramstedt *(invited)*
Uppsala University, Sweden

Title:
Winds and Circumstellar Morphology of Binary AGB Stars with ALMA

Abstract:
Binary AGB stars are the likely progenitor systems for planetary nebulae and Type Ia supernovae. Both phenomena are fundamentally important for our understanding of stellar evolution and the evolution of the Universe, but the formation of both is poorly understood. To better constrain the necessary conditions for their creation, i.e. the accretion efficiency onto the companion and the effects on the wind properties of the AGB star, we set out to observe the circumstellar envelopes of a small sample of well-studied binary AGB stars with ALMA. The sources: R Aqr, Mira, W Aql, and pi1 Gru; cover a decisive range in binary separation and wind properties. The three larger-separation sources (ranging from about 40 to several 100 AU in separation) have been observed and show fascinating new results enabling us to better understand e.g. the effects of wind-wind interaction and orbit eccentricity. The observational results will be presented and compared to initial attempts at modelling the wind shaping and put into a larger context. I will also discuss lessons learnt and things to keep in mind for future investigations.

Miguel Montargès
IRAM, France

Title:
The dusty disk and companion of L2 Puppis, the nearest AGB star, observed with VLT/SPHERE

Abstract:
We obtained polarimetric images of L2 Pup in the visible with ZIMPOL. The 16 mas angular resolution allowed us to confirm the circumstellar disk previously imaged in the infrared by Kervella et al. (2014) and Lykou et al. (2015). The spectrum and morphology are well reproduced by an almost edge-on amorphous silicate flared disk. Various spirals are visible in the disk, as well as plumes extending perpendicular to the disk. The degree of linear polarization gives access to the 3D geometry. We also discovered a companion at 2 AU, whose photometry is consistent with a late K giant.

Foteini Lykou
University of Vienna, Austria

Title:
Shaping nebulae via disks in AGB stars

Abstract:
Theoretical and observational work have shown that asymmetries found in the post-AGB stars and planetary nebulae may start as early as during the AGB phase. I will present results of our aperture masking observations with the VLT of a sample of AGB stars that were known to present asymmetries at larger spatial scales (e.g. jets or torii). Disk-like structures within less than 20 stellar radii have been found in three of these stars. I will argue on the importance of these characteristics as indicators of binarity as a shaping agent and discuss future prospects for locating such binaries.

Henri Boffin ***(invited)***
ESO, Germany

Title:
Binary stars - an interferometric view

Abstract:
Most stars are born and live in binary systems, and will often interact in one way or another. The study of binary stars is therefore critical to apprehend many of the most interesting classes of stars. Moreover, quite often, the study of stars in binary systems is our only mean to constrain stellar properties, such as masses and radii. Unfortunately, a great fraction of the most interesting binaries are so compact that they can be apprehended by high-resolution techniques only. I will present some results highlighting how interferometry is used in the study of binary stars, from determining the mass of stars to studying mass transfer in symbiotic stars, and tackling luminous blue variables.

Sebastian Ohlmann
Universität Würzburg, Germany

Title:
Hydrodynamic simulations of common envelope phases

Abstract:
To study the impact of binarity on the mass loss in evolved stars, we performed hydrodynamic simulations of the common envelope phase for a system of a 2 Msol RG and a 1 Msol companion using the AREPO code. Its moving-mesh technique enables us to follow small-scale flow features in unprecedented detail. We are thus able to better resolve the conversion of gravitational energy. Our simulation reveals for the first time that large-scale flow instabilities emerge and are dynamically important for the evolution of the system. This may also mark the onset of turbulent convection in the envelope.

Agnès Lèbre *(invited)*
University of Montpellier, France

Michel Aurière, Nicolas Fabas, Renada Konstantinova-Antova, Pascal Petit and Laurence Sabin

Title:
Surface Magnetism of Cool and Evolved Stars: the harvest from the spectropolarimetric instruments

Abstract:
Modern spectropolarimeters (Narval@TBL; ESPaDOnS@CFHT; HARPSol@3.6m) have revealed the presence and the caracteristics of surface magnetic fields in cool and evolved stars. After briefly introducing the technics for observation and analysis of spectropolarimetric data, I will review recent results concerning stars located along the Red Giant Branch, along the Asymptotic Giant Branch and in the subsequent evolutionary stages (post-AGB stars and Planetary Nebulae), as well as their massive counterparts (Red Supergiants). Then, I will present the perspectives from NIR spectropolarimetry (e.g. SPIRou@CFHT).

Wouter Vlemmings *(invited)*
Chalmers University, Sweden

Title:
Magnetic Fields in Evolved Stars: Theory & Radio/Submm Line Observations

Abstract:
While significant progress has been made in the study of AGB mass-loss, the effect of magnetic field is yet poorly studied. The mass lost in the last phases of stellar evolution will, for select sources, become visible as a spectacular planetary nebula (PN). These are however often not spherically symmetric, and the shaping process, linked with the mass loss in the late AGB, post-AGB and pre-PNe phases, remains elusive. Both binaries and magnetic fields have been suggested to be possible agents although a combination of both might also be a natural explanation.

In this talk I will review the current evidence for magnetic fields around AGB and post-AGB stars pre-Planetary Nebulae and PNe themselves. Magnetic fields appear to be ubiquitous in the envelopes of apparently single stars, challenging current ideas on its origin, although we have found that binary companion could easily be hidden from view. There are now also indications of magnetic stellar activity, potentially in an active chromospere. This talk will mainly focus on centimeter and (sub)millimeter wavelength observations in the context of current theoretical understanding. I will also highlight how ALMA will provide a huge leap in our ability to study the magnetic fields around late-type stars.

Laurence Sabin ***(invited)***
UNAM, Mexico

Title:
Detection of Magnetic Fields in Evolved Stars: from the envelope to the photosphere

Abstract:
Our understanding of magnetism in late type stars, such as AGBs, Post-AGBs and PNe, has improved from an observational point of view. We are therefore starting to have a better picture of magnetic fields at different scales: from the envelope to the photosphere.

I will present two different types of polarimetric investigations which ultimately aim at studying the role and influence of magnetic fields on the dynamics (via mass loss control, outflows shaping) and even on the chemistry (e.g. extra mixing) of these stellar objects.

Alizée Duthu
LAB, France

Title:
Magnetic Fields in C-Rich Evolved Objects

Abstract:
During its evolution from Asymptotic Giant Branch to Planetary nebulae, the star's geometry is drastically changing. This transition is characterized by a high mass loss rate. A strong magnetic field may constrain the mass loss geometry of the star. We present here a study aiming to measure magnetic field strength in C-rich AGB and PPN/PN objects by observations of the CN Zeeman effect at 3mm (using IRAM-30m Xpol). We detect magnetic field for two AGB : IRC+10216 (B=2.5 G), RW LMI (0.95 G), one PPN AGFL618 (1.5 G) and PN NGC7027 (2 G) following the analysis described by Crutcher et al. (1996).

Iain McDonald ***(invited overview)***
University of Manchester, UK

Title:
How to Make and Break Dust Around Metal-Poor Stars

Abstract:
In this review, I will summarise the differences between dust formation around metal-poor and solar metallicity stars. I will reflect on how this affects the chemistry and observations of their host populations. I will highlight the current problems the field faces, and possible solutions to them, looking forward to the JWST/ALMA era and beyond. Finally, I will discuss what happens to dust from such stars, how it is affected by the environment these stars are in, with implications for metal-poor and high-redshift galaxies.

Jonathan Mackey
University of Cologne, Germany

Title:
Cold gas in hot star clusters: the fate of winds from red supergiants

Abstract:
The wind of red supergiants that co-exist with O stars in star clusters is photoionized from the outside. This drives a radiative shock into the wind that sets up an almost static dense shell in the stellar wind, about 2000 AU from the star. We apply this model to the recently discovered 0.1Msun static shell around Betelgeuse, and confront it with the circumstellar nebula of the red supergiant W26. For massive red supergiants, the shell can grow to several solar masses, strongly affecting supernova lightcurves, and may be a site of secondary star formation in the most massive star clusters.

Joel Kastner ***(invited overview)***
Rochester Institute of Technology, USA

Title:
Planetary Nebulae: a Contemporary (Multiwavelength) Perspective

Abstract:
Planetary nebulae (PNe) are the luminous, ionized shells of ejecta from asymptotic giant branch (AGB) stars in transition to white dwarfs. As such, PNe represent near-endpoints in the lives of intermediate-mass (~1-8 Msun) stars. Long admired for their beauty and their striking variety of morphologies in optical emission line images, many PNe have now been characterized from radio to X-ray regimes. These multiwavelength campaigns, whose exemplars are the Chandra (X-ray) and Herschel (far-IR) Planetary Nebula Surveys (ChanPlaNS and HerPlaNS), are designed to probe the full range of physical conditions present within PNe and, in so doing, are providing insight into PN progenitor systems, shaping processes, and chemical compositions. To illustrate this contemporary (multiwavelength) perspective on PNe, I will describe recent results from ChanPlaNS and HerPlaNS. I also present new, integrated views of the youngest, most rapidly evolving PNe.

Valentin Bujarrabal *(invited)*
Obseratorio Astronomico Nacional (OAN, IGN), Spain

Title:
Molecular line observations of planetary and protoplanetary nebulae: Keplerian disks

Abstract:
Molecular lines probe most of the nebular material in late-AGB shells and young planetary nebulae (PNe), providing many basic results on this crucial evolutionary phase. Keplerian disks are thought to be one of the components of many of these objects and to play an important role in the shaping and dynamics of PNe, but their identification had been extremely elusive. Only very recently, detailed studies of Keplerian disks have been possible thanks to high-resolution mapping.

Relevant results obtained from molecular lines in young PNe are summarized, focusing on the study of rotating disks.

Daniel Tafoya
National Autonomous University of Mexico, Mexico

Title:
Sub-millimeter maser emission from water fountain nebulae

Abstract:
Water fountain nebulae exhibit water maser spots tracing collimated outflows that expand at high velocities. It is thought that this outflows create cavities within the circumstellar envelope of the AGB star. This represents the origin of the aspherical structures that are seen in the later state of PN. So far, they have been studied through the maser emission at 22 GHz. Recently, we have detected for the first time water masers at 321 GHz. This discovery opens a new window to understand the origin of the fast collimated winds and their interaction with the circumstellar envelop of AGB stars.

Mark Hollands
University of Warwick, UK

Title:
Ancient planetary systems around white dwarfs

Abstract:
White dwarfs are now known to routinely accrete rocky planetesimals that have survived evolution off of the main-sequence. The observational hallmarks of such planetary systems are metal absorption lines in white dwarf atmospheres and excess IR emission from dusty debris discs. Using SDSS spectroscopy, we have identified more than 200 very cool (and hence very old, up to 7 Gyr) metal-polluted white dwarfs, demonstrating an early onset of planet formation in the Galaxy. Serendipitously, we have also found that a large fraction of these objects harbour strong magnetic fields of up to 11 MG.

Rubina Kotak ***(invited overview)***
Queen's University Belfast, UK

Title:
Supernova progenitors: variations on a theme

Abstract:
One of the main challenges of current supernova research is to identify the nature of stars that explode, and link this knowledge to the observed supernova properties. Nowhere is this problem more urgent than for the most massive stars in the local and distant Universe. Recent exciting results have challenged currently accepted paradigms of stellar evolution, and for these supernovae, ever more exotic scenarios are being proposed. I will review aspects of thermonuclear and core-collapse physics where there is general consensus regarding progenitor systems, but will draw upon some special cases within the currently-accepted frameworks that highlight gaps in our knowledge.

Mikako Matsuura *(invited)*
Cardiff University, UK

Title:
Supernova 1987A

Abstract:
The explosion of supernova 1987A was detected in the nearby galaxy, the Large Magellanic Cloud. At a distance of 50 kpc, this supernova is the nearest supernova explosion detected in the last 400 years. Since that, supernova 1987A has unveiled the evolution of supernovae in an unprecedented detail.

This review talk will present the key findings of supernova 1987A, including post-main sequence evolution of the progenitor star, formation of the rings, and formation of dust and molecules in the ejecta of the supernova.

Noam Soker
Technion, Israel

Title:
Nebulae powered by a central explosion

Abstract:
I will discuss the common properties of nebulae of massive and low mass stars powered by explosion: Type Ia supernovae inside planetary nebulae (SNIPs) and nebulae around core-collapse supernovae, such as SN 1987A. Binary systems and jets play crucial roles in shaping the pre-explosion nebulae.

Santiago Gonzalez
Universidad de Chile, Chile

Title:
The Rise-Time of Type II Supernovae

Abstract:
We investigate the early-time light-curves of a large sample of type II supernovae (SNe) having good cadence and many non-detections prior to explosion. We constrain their rise-time durations as a function of wavelength, finding that they are much faster than theoretical models predict. We therefore argue that the SN II rise-times are either a) the shock cooling resulting from the core collapse of red supergiants (RSG) with small and dense envelopes, or b) the delayed and prolonged shock breakout of the collapse of a RSG with an extended atmosphere or embedded in pre-SN circumstellar material.

Franz Kerschbaum ***(invited overview)***
University of Vienna, Austria

Title:
Enriching STEPS in finding clues on complex giants

Abstract:
The concluding talk will provide an overview of the material covered during the meeting, identify remaining key questions and the next steps to tackle them.

Poster Abstracts

1 – Muhammed Akashi
Forming equatorial rings around dying stars

We suggest that clumpy-dense outflowing equatorial rings around evolved giant stars, such as in supernova 1987A and the Necklace planetary nebula, are formed by bipolar jets that compress gas toward the equatorial plane. The jets are launched from an accretion disk around a stellar companion. Using the FLASH hydrodynamics numerical code we perform 3D numerical simulations, and show that bipolar jets expanding into a dense spherical shell can compress gas toward the equatorial plane and lead to the formation of an expanding equatorial ring.

2 – Bernhard Aringer

The Dusty Environment Around AGB Stars And Supergiants - Comparing Model Approaches

Different approaches for describing the dusty environment around AGB stars and Supergiants are compared. We discuss simple radiative transfer codes where the structure and dust condensation need to be assumed, stationary wind models where massloss rate and initial gas velocity have to be given and dynamical models for shocks and dust driven winds where the pulsation is prescribed. The advantages and problems of the methods are investigated and we demonstrate their limitations concerning different astrophysical situations and observables. Emphasis will be put on dust temperatures and opacities.

3 – Magdalena Brunner
The ALMA view on W Aquilae: Observations and Modeling of Molecules in the Circumstellar Envelope

AGB stars suffer strong mass-loss and enrich the ISM with heavy elements. Their C/O ratio classifies them as M, S or C-type, where S-type marks the transition from O- to C-rich chemistry. They are perfect targets to study the varying chemical composition of evolved stars.

We present preliminary results of ALMA Cycle 1 observations and radiative transfer models of molecular lines around the S-type AGB star W Aql. The extent of the line emission is analyzed and modeled, improving the accuracy of abundance estimates, stellar parameters, mass-loss rates and properties of the circumstellar envelope.

4 – Luciano Cerrione
PNe in the making: monitoring at radio wavelengths

The onset of the ionisation is a crucial phase in the evolution of post-AGB stars. Because of the short time scales involved, this is a poorly known evolutionary stage. Multi-frequency and multi-epoch observations at radio wavelengths can be key to tracking this particular phase through the continuum emission from the circumstellar ionised region.

We have observed a sample of objects classified as transiting from the post-AGB to the PN phase with the Very Large Array over several years. In this poster, we report the results obtained for two of our targets, where we detect clear radio variability with contrasting time patterns.

5 - Taissa Danilovich
Sulfur-bearing molecules in the AGB star R Doradus

We present new observations of the sulphur molecules SO and SO2 towards the M-type AGB star R Dor. Combining spectral scan observations from Herschel/HIFI and APEX, we have 16 and 99 lines detected from SO and SO2, respectively. This allows us to put good constraints on the SO and SO2 abundances and their line-emitting regions in the circumstellar envelope of R Dor. We present our new observations and preliminary results from radiative transfer modelling.

6 – Kenneth de Smedt
The s-process in post-AGB stars in the Galaxy and Magellanic Clouds

The AGB nucleosynthesis and associated third dredge-up make low-to intermediate-mass stars important contributors to the cosmic abundances of C, N and elements past the iron peak. Post-AGB stars are ideal probes of the AGB nucleosynthesis. We will report on our detailed abundance analyses of a large sample of post-AGB stars in both the Magellanic Clouds and the Galaxy. We discovered some of the most enriched objects known to date. We will discuss our results and focus on the large discrepancies between the model predictions and our determined C, O and especially lead (Pb) abundances.

7 – Carolyn Doherty
Super-AGB stars - bridging the divide between low/intermediate-mass and high-mass stars

Super-AGB stars are in the mass range ~ 6.5-10 Msun and are characterised by off-centre carbon ignition prior to a thermally pulsing AGB phase. Their fates are quite uncertain and depend primarily on the competition between the core growth and mass-loss rates. If the stellar envelope is removed prior to the core reaching the Chandrasekhar mass, an O-Ne white dwarf will remain, otherwise the star will undergo an electron-capture supernova leaving behind a neutron star. We describe the factors which influence these different fates, determine their relative fractions and provide mass boundaries.

8 – Philipp Edelmann
Three-dimensional hydrodynamics simulations of stellar interiors

Traditional stellar evolution simulations rely on the assumptions of spherical symmetry and hydrostatic equilibrium, treating dynamical phenomena with physically motivated prescriptions tuned to observations. We present a 3D hydrodynamics code, which addresses the uncertainties of the 1D simulations and is specifically adapted to simulations of stellar interiors. It includes nuclear reactions and a general equation of state and it handles low Mach number flows accurately and efficiently. This is illustrated with simulations of shear instabilities and convective overshooting in massive stars.

9 – Sandra Etoka
Flaring Miras

Long-term monitoring have allowed the discovery of a new class of OH masers towards thin-shell Miras. The 2 main characteristics of these events are their high degree of polarisation and indications that the OH flaring zones are more internal than the standard OH ones. This latter fact has been confirmed by recent mapping. These flaring events have now being recorded towards objects believed to be isolated as well as belonging to a binary system. The overall characteristics of such events and the implications with respect to the standard models will be discussed.

10 – Sergei Fabrika
New LBV stars in the Andromeda galaxy (co-authors: S. Fabrika, O. Sholukhova, A. Sarkisyan, D Bizyaev)

We performed near-infrared and optical spectroscopy of five Luminous Blue Variable (LBV) candidates and two known LBV stars in M31. We use a new approach to the LBV parameters estimation based on the inherent property of LBVs to change their spectral type at constant bolometric luminosity. Two LBV candidates have to be classified as new LBV stars. Two more candidates are, apparently, B[e]-supergiants. Using spectral energy distributions and variability of these stars we estimate temperatures, reddening, radii, luminosities, and mass loss rates.

11 – Krzysztof Gesicki
Weak emission line stars in multipolar planetary nebulae

While analysing 37 Galactic bulge PNe we noticed that nebulae surrounding central stars of wels-type are predominantly multipolar (evidently more than bipolar). This correlation is not fully consistent nevertheless it is remarkable: all 5 wels objects in our sample show multipolar structure while from remaining 4 multipolars 3 central stars show weak emission lines while only one star shows no emissions at all. The 6 regular bi-lobed objects from our sample do not show the emissions characteristic for wels. Considered will be the context of stellar winds, mass-loss and circumstellar disks.

12 - David Gobrecht
From nuclei to dust grains: How the AGB machinery works

With their circumstellar envelopes AGB stars are marvelous laboratories to test our knowledge of microphysics (opacities, equation of state), macrophysics (convection, rotation, stellar pulsations, magnetic fields) and nucleosynthesis (nuclear burnings, neutron capture processes, molecules and dust formation). Unfortunately, due to the completely different environments those processes occur, the interplay between stellar interiors (dominated by mixing events like convection and dredge-up episodes) and stellar winds (characterized by dust formation and wind acceleration) is often ignored.

13 – Steve Goldman
Circumstellar Masers in the Magellanic Clouds

The LMC and SMC, at about one half and one fifth solar metallicity respectively, give us excellent nearby environments where we can test the dependence of mass loss on the metallicity and luminosity of AGB and RSG stars. We will present the results of recent searches for OH/IR stars in the Magellanic Clouds by the Australia Telescope Compact Array and Parkes Telescope. From detections we can derive mass loss rates, which can then be used to test and refine dust-driven wind theory and allow us to better understand the contribution of these stars to the ISM and the regeneration of the universe.

14 – Claudia Patricia Guttierez Avendano
Linking the type II supernovae analysis to progenitor properties

We present a spectroscopic and photometric analysis of type II supernovae (SN II) obtained between 1986 and 2009. We have studied the correlations between their observed properties and their explanations in terms of physical properties, speculating that the most likely parameters which influence in the spectral diversity are the mass and density profile of the hydrogen envelope, together with additional emission components due to circumstellar interaction. Linking these pre-SN properties to initial ZAMS progenitor properties can provide insights into the diversity of SNe II progenitors.

15 – Lizette Guzman-Ramirez
A review in mixed chemistry of low mass evolved stars

During the late stages of their evolution, Sun-like stars bring products of nuclear burning to the surface. Most of the Carbon in the Universe is believed to originate from stars with mass up to a few solar masses. Although there is a chemical dichotomy between oxygen-rich and carbon-rich evolved stars, in the last three decades, a few stars have been shown to display both carbon and oxygen-rich material in their circumstellar envelopes. I will present observations and conclusions of these mixed chemistry objects using Spitzer, HST, UVES, VISIR, and SOFIA.

16 – Roya Hamedani Golshan
AGB stars as the Indicators of Star Formation History and Dust Production

We present the first reconstruction of the star formation history (SFH) for two of the most luminous M31 dwarf satellite galaxies: NGC 147 and NGC 185, using the Long Period Variable stars.

Theoretically, evolved stars, in Asymptotic Giant Branch (AGB) phase achieve their maximum luminosity in infrared wavelengths. Maximum luminosity of a star is related to its birth mass; therefore, it is possible to construct birth mass function and drive SFH.

AGB stars are also important dust factories that by SED fitting on we are able to estimate the mass loss rate and calculate total mass shed into ISM.

17 – Ward Homan

Analytical approach to embedded spiral geometries to interpret high-resolution data.

High-resolution observations have shown that stellar winds may harbour archimedean spiral morphologies (believed to be produced by binary interactions). We have developed an analytical description of the spiral, parametrised in terms of its geometry. To investigate the manifestation of this geometry in the observables we have conducted an extensive parameter study, focusing mainly on the CO rotational transition J=3-2. We have quantified the extent to which the spiral is recognisable in the spectral lines, and analysed the spatial emission by means of wide-slit position velocity diagrams.

18 – Josef Hron
Spectro-Astrometry of AGB stars with CRIRES

We present spectro-astrometry in the M- and K-band for a sample of AGB stars and discuss the potential of this technique also in the context of the METIS instrument.

19 – Alain Jorissen
SPH simulations of mass transfer in binaries involving AGB stars

Preliminary results of our SPH simulations of mass transfer in binaries involving AGB stars will be presented.

20 – Hans Ulrich Kaeufl
Spectroastrometric Studies of post-AGB-stars

Intermediate-mass stars on their way to become white dwarfs chemically enrich the interestellar medium with S-process elements ejected during the AGB phase. Still little is known as to the physical processes and hence the final aggregate state of the ejecta. Will the dust survive and how? Most PNe are to a certain degree asymmetric, including extremely axisymmetric PNe, featuring complex disks, torii or other shaping engines. Infrared spectroastrometry at the VLT allows to study the spatial distribution and kinematics of post AGB objects with a spatial resolution approaching 1mas.

21 – Doan Duc Lam

An investigation of the morphology and kinematics of the circumstellar envelope of AGB star π1 GruisL

The S-type AGB star π1 Gruis has a known companion at a separation of 400 AU. Previous observations of the circumstellar envelope (CSE) show strong deviations from spherical symmetry. We will present our results from the analysis of ALMA-ACA observations of π1 Gruis. The images of the rotational line emission from CO J=2-1 and 3-2 provide good constraints for a model of the morphology and kinematics of the CSE. We model the source using SHAPE to derive the temperature, density and velocity distribution. The results are also compared with hydrodynamic simulations of binary interaction.

22 – Mikako Matsuura
CO thermal emissions and mass loss of red-supergiants beyond the Milky Way

It is crucial for understanding stellar evolution to study how red-supergiants lose their mass. It is particularly poorly studied beyond the Milky Way. Theory predicted that mass loss rate is lower at low metallicity.

Using the Herschel Space Observatory, we observed CO thermal emission lines in red-supergiants in No obvious metallicity effect was found on the gas mass-loss rate. The key parameter for the mass-loss rate appears to be the luminosity of the star.

23 – Marko Mecina

The variable mass-loss history of AGB stars -- a far-IR view on detached shells

Based on observations with Herschel/PACS we investigate the surroundings of evolved AGB stars, which show evidence for a history of highly variable mass-loss. We observe the dust counterparts of known detached CO shells as well as previously unknown structures. Using a 1D radiative transfer code we model the dust in the circumstellar envelope and constrain crucial parameters. We discuss the major uncertainties, such as the influence of dust grain geometry and opacities. Further, physically more comprehensive modelling adopting a stationary wind scenario and the COMA code is presented.

24 – Ambra Nanni

Improving models of stellar populations with mass-losing TP-AGB stars

The STARKEY project aims at providing a large database of models of TPAGB stars calibrated on resolved stellar systems. We describe the improvements in the modelling of the dust chemistry and its effects on the spectra, computed with MoD and coupled with the COMARCS spectral library. Calculations cover a wide range in Z, mass-loss, C/O, L, Teff and M. TP-AGB dusty models are incorporated in our PARSEC+COLIBRI isochrones and in the population synthesis code TRILEGAL to simulate the NIR and MIR photometry of stellar systems. We will present preliminary comparisons with data for the galaxy M33.

25 – Christine Nicholls
A CRIRES-POP atlas of the K giant 10 Leo

CRIRES-POP will provide a database of high res, high S:N, NIR spectra of stars across the HR diagram. Relevant for the AGB community will be high quality reference spectra of several cool evolved giants. These atlases will be valuable for future research, featuring comprehensive line IDs, abundances, isotope ratios, and stellar parameters. Observations are complete, and reduction and analysis of the spectra, with improved telluric subtraction and wavelength calibration, is ongoing. We present a project update and results of the first atlas to be produced, that of K1 III giant 10 Leo.

26 – Takaya Nozawa
Formation of carbon grains in red-supergiant winds of very massive Population III stars

We investigate the possibility of dust formation in a red-supergiant (RSG) wind of a very massive Population III star with a zero-main sequence mass of 500 Msun, based on the wind-gas composition obtained from the calculations of stellar evolution. We show that, in a constant-velocity wind, carbon grains can efficiently form for wide ranges of the mass-loss rate (0.1-3)x10^{-3} Msun/yr and wind velocity 1-100 km/s, producing, at most, 1.7 Msun of carbon grains during the RSG phase. We also discuss the effects of the acceleration of the wind driven by newly formed dust on the dust formation.

27 – Gabor Orosz
Testing methods of accurate low frequency astrometry for hydroxyl masers

LBI astrometry can be used to measure accurate positions of masers relative to reference sources. However at low frequencies the ionosphere degrades the accuracy of maser astrometry, introducing a non-negligible systematic error. Here, we present in-beam VLBA astrometry of stellar OH masers. We give a sub-mas upper limit to the parallax and assess atmospheric errors using different methods. We show that the static ionosphere can cause offsets up to 0.5 mas at L-band even with in-beam phase referencing (0.7 deg source separation). We finally introduce our attempts to correct for these errors.

28 – Gabor Orosz
Trigonometric parallax distance and kinematics of the fastest water fountain source

Water fountains are evolved stars with collimated and high-velocity outflows traced by water masers. Our observed target, IRAS 18113-2503, is the water fountain with the fastest jets known and has the largest velocity dispersion of masers in each lobe. Here, we present its parallax distance (~9 kpc) and maser kinematics yielded by VLBI astrometry with the Japanese VERA network. We find maser proper motions of 6.2–8.5 mas/yr, corresponding to outflow velocities of 300–420 km/s. We discuss the stellar properties, evolution and motion in the Milky Way, and address the variability of the masers.

29 – Gioia Rau
The carbon star adventure continued: modelling atmospheres of a set of C-rich AGB stars

We present a study of a set of C-rich AGB stars to improve our understanding of the dynamic processes happening in their atmospheres. For the first time we compare in a systematic way spectrometric, photometric and interferometric measurements with different types of model atmospheres:
1) hydrostatic models+MOD-dusty added a posteriori;
2) self-consistent dynamic model atmospheres that allow to interpret in a coherent way the dynamic behaviour of gas and dust. Results demonstrate that the combined use of different types of observations is crucial for understanding the atmosphere of C-rich AGBs.

30 – Maryam Saberi
Selective photodissociation process in the carbon AGB star R Scl

We are studying selective photodissociation process in the circumstellar envelope of carbon AGB star R Scl by means of probing carbon-bearing molecules isotope ratio in the inner envelope. ALMA observation of 12CO and 13CO shows a big discrepancy between 12CO/13CO ratio in the inner part (>60) and detached shell (~19), Vlemmings et al. 2013. An unexpectedly high 12CO/13CO in the present-day mass loss compared to the photospheric 12C/13C is more likely due to selective photodissociation of 13CO which is less shielded compared to 12CO against the UV radiation field.

The H12CN/H13CN~ 5 line ratio (H12CN (J=4-3) SEST telescope data, Olofsson et al. 1996 and H13CN (J=4-3) ALMA data) is in accord with carbon photospheric ratio. Even by considering optical depth effect, it is difficult to reconcile this result with the present-day mass-loss ratio by V13.

The additional photodissociation in the inner part might be due to either a hidden binary companion or chromospheric activity. Numerous UV-spectra indicates the presence of an active chromosphere in the outer atmosphere of carbon stars (Eaton & Johnson 1988). On the other hand, the rate of binary companions of AGB stars is unknown. Mapping of other carbon-bearing molecules, as well as the photodissociation products in the inner part, lead constraining the possible hypothesises and explain the strange behaviour of 13CO isotope in the inner part of R Scl.

31 – Noam Soker
Do core collapse supernovae require binary interaction?

Maybe yes. Many core-collapse supernovae (CCSNe) seem to come from binary interaction: SN 1987A, type Ib and Ic SNe that lost a large fraction of their envelope, and SN IIn.

I will discuss the possibility that all CCSNe come from binary interaction. The companion is required to spin-up the core in order to launch jets that explode the star in the jittering jets mechanism. Single star form a black hole, and it maybe that no nickel is synthesized to light up the explosion. These are termed Nickless SNe.

This speculative classification has implications on pre-explosion mass loss processes.

32 – Sundar Srinivasan

The SMC dust budget from fits to the multi-epoch, multi-band photometry of evolved stars

AGB/RSG-star outflows drive galactic evolution, requiring an accurate estimate of the ejection rate. We estimate the SMC global dust budget by fitting Spitzer photometry of AGB/RSGs with a grid of dusty evolved-star models (GRAMS; Sargent+ 2011, Srinivasan+ 2011). Our results agree with previous estimates (Boyer+ 2012, Matsuura+ 2013).

The dust ejection is dominated by a small fraction of very red sources. It is likely that such elusive sources hide in the IR data. Finding them is crucial to constrain the dust budget; sub-mm observations might identify similar candidates in the Milky Way/MCs.

33 – Masaki Takayama

The nature in broad-band photometry of long secondary periods in AGB stars

The long secondary periods (LSPs) in AGB stars are one of the most mysterious phenomenon in red giant variables. The length of LSPs is roughly 400d – 1500d, which is about 4 times longer than the periods of the radial fundamental mode of Mira type variables in the same luminosity. We examined the nature of LSPs by using long-term V, I, J, H, K band photometric data provided by OGLE and IRSF/SIRIUS camera and found that the color variations during LSP cycles are different between oxygen rich stars and carbon stars.

34 – Benjamin Tessore

Magnetic Field of variable cool and evolved stars: Interaction with complex atmospheric dynamics.

Recent spectropolarimetric studies have revealed the presence of magnetic fields at the surface of cool and evolved stars, such as Red Super Giants, Asymptotic Giant Branch (AGB) stars and Post AGB stars. With NARVAL@TBL we have initiated in March 2015 a 2-years campaign dedicated to a sample of cool and evolved stars. We intend to monitor along their pulsation period the variables targets among this sample, namely Mira (AGB) and RV Tauri (Post-AGB) stars, so as to study the interaction between the complex atmospheric dynamics and their surface magnetic field. First results will be presented.

35 – Rachael L.Tomasino

Geometric Analysis of the Dusty Mass Loss from Low- to Intermediate Mass Stars

The work presented here focuses on the characterization of the geometric properties of the circumstellar dust shells. This is achieved by subtracting the aligned, scaled template PSF image from the image of the circumstellar shell. By subtracting the PSF, we are able to uncover the circumstellar dust distribution undisturbed by the presence of the still bright central star, which will allow better characterization of the mass-loss history. By assessing the mass-loss history for individual sources, we aim to establish general trends in the mass-loss history for AGB stars.

36 – Alfonso Treja-Cruz
Dust-production rates of AGB stars in the Solar Neighbourhood

AGB stars are a very important contributor to the total dust mass injected into the ISM in galaxies. Due to foreground extinction and the large uncertainties in the distances for dusty objects, the dust-production rate by AGB stars in the Galaxy remains hard to evaluate. Using the GRAMS model frid, we determine the total dust mass-loss rate from AGB stars in the Milky Way using a 1 kpc distance-limited sample. The last estimate of this dust injection rate was done in the late '80s. Using new all-sky infrared facilities (WISE, 2MASS, and others), it is possible to provide a better estimate.

37- Danny Tsebrenko
Type Ia supernovae exploding inside planetary nebulae

Using three independent directions we estimate that the fraction of type Ia supernovae exploding inside planetary nebulae, termed SNIPs, is at least ~20%. We perform numerical simulations supporting SNIP origin for two supernova remnants (SNRs), Kepler's SNR and SNR G1.9+0.3. In particular, we explore the role of jets blown during or a little time before the supernova on the shape of the supernova remnant, and study the interaction of the supernova ejecta with previously ejected circumstellar matter and ISM.

38 – Stefan Uttenthaler
News from Miras with changing pulsation periods

Most Miras have pulsation periods that are constant for centuries, but a few are known to exhibit a significantly changing period. In a previous paper we investigated the evolutionary state of Miras with changing periods, showing that not all of them are likely to have recently undergone a thermal pulse. Since then we have followed up on some of these stars and present new observations of their period and spectral type evolution as well as their mass-loss properties. These observations give insight into decisive, short-time evolutionary events of AGB stars.

39 – Stefan Uttenthaler

Are the dust and gas mass-loss rates from Miras reduced by the third dredge-up?

We recently presented evidence that Miras that
show the 3DUP indicator Tc in their atmosphere have a lower dust ML rate than Miras at comparable pulsation periods but without Tc. This suggests that the dust ML rate is reduced by the occurrence of 3DUP. In this talk we present further evidence in support of this finding. Most importantly, the available data of CO radio lines, although scarce for Miras without Tc, suggests that also the gas ML rate is reduced by the 3DUP. Possibly, this finding teaches us an important lesson about connections between 3DUP, pulsation and ML mechanism of AGB stars

40 – Marie van de Sande
Unravelling the dust formation process in oxygen-rich AGB stars

It is generally accepted that the mass-loss mechanism in AGB stars is based on pulsations and radiation pressure on newly formed dust grains. However, oxygen-rich AGB stars suffer from the so called 'acceleration deficit' dilemma.

We aim to unravel the coupling between micro-scale chemical processes and macro-scale dynamical processes in oxygen-rich AGB stars by combining observations with radiative transfer models and novel forward chemistry models. Here we present the preliminary results obtained for R Dor, a low mass-loss oxygen-rich AGB star.

41 – Sophie van Eck
The temperature and chronology of heavy-element nucleosynthesis in AGB S stars

Detailed abundance determinations in AGB S stars and extrinsic S stars allow to put new strong constraints on the s-process nucleosynthesis.

The s-process temperature can be determined using zirconium and niobium abundances, independently of stellar evolution models. The radioactive pair 93Zr–93Nb used to estimate the s-process temperature also provides, together with the pair 99Tc–99Ru, chronometric information on the time elapsed since the start of the s-process, which we determine to be one million to three million years in AGB S stars (Nature 2015, 517,174–176).

42 – Hans van Winkel

6 years of high-resolution spectroscopic monitoring of evolved binaries : lessons learned

With our high-resolution spectrograph HERMES we initiated a monitoring programme with the aim to characterise and study binary evolutionary channels. We focus on wide binaries with evolved components. The ultimate goal is to connect the zoo of different objects, into a sound evolutionary picture which accounts for the chemical peculiarities.

43 – Nikolaus Vogt

Mira stars in ASAS: machine-learned results vs. an interactive method with human participation

Mira variables play an important role in the Milky Way recycling processes. However, systematic studies of their observational parameters are still scarce. ASAS is a valuable light curve source of about 2800 Mira stars, but many pulsation periods given by ASAS are not correct. We have developed a PYTHON code which determines the ephemeris of each ASAS Mira star, requiring interaction with a human operator. We compare our resulting periods and those given by the GCVS, as well as those determined with the machine-learned automatic procedure of Richards et al. (2012: ApJ Suppl. 203, 32).

44 – Nikolaus Vogt

A multi-periodicity analysis of selected MIRA type variables in the ASAS database

During a systematic determination of the ephemeris data of Mira variable stars in ASAS, we found about 50 stars with significant multi-periodicity. We determined their periods with a program based on Discrete Fourier Transform (PERIOD 04) and analyzed the relations between them in the same way as Fuentes-Morales & Vogt (2014: AN 335, 1072), searching for sequences in the "double period" and the "Petersen" diagrams. Since we suppose that most of these stars could belong to the semi-regular type, we compare our results with the variability class obtained by Richards et al. (2012: ApJS 203, 32).

45 - Brian Warner
A Dwarf Nova in a previously unrecognised Nova Shell

We have found an eclipsing dwarf nova which is surrounded by an old nova shell, identified tentatively with an ancient Chinese nova. Orbital light curves, outburst light curves and spectra are used to deduce the principal parameters of this cataclysmic variable star.

46 - Markus Wittkowski
VLTI/AMBER studies of the extended atmospheres of AGB and RSG stars

We present VLTI/AMBER studies of the extended molecular atmospheres of AGB and RSG stars. Observationally, both types of stars show similar atmospheric extensions. Comparisons to theoretical pulsating model atmospheres and to 3D convection simulations show that both types of models can equally well explain the extensions of AGB stars, while neither of them can currently explain the extensions of RSG stars.

STELLAR END PRODUCTS: THE LOW MASS - HIGH MASS CONNECTION

6-10 July, 2015 at ESO, Garching, Germany

List of Participants

Last	First	Institute
Akashi	Mohammad	Technion, Israel
Aringer	Bernhard	University of Padova
Barlow	Mike	UCL
Baudry	Alain	Univ. Bordeaux
Berger	Jean-Phillipe	ESO
Bladh	Sara	University of Padova
Brodsky	Evgeny	Hemda-Center for Science Education
Boffin	Henri	ESO
Brunner	Magdalena	University of Vienna
Bufano	Filomena	INAF-Osservatorio Astrofisico Catania
Bujarrabal	Valentin	Obseratorio Astronomico Nacional (OAN, IGN)
Cabrera-Ziri	Ivan	ESO
Cerrigone	Luciano	ASTRON
Chasiotis-Klingner	Stella	ESO
Danilovich	Taissa	Chalmers University of Technology
De La Reza	Ramiro	Observatorio Nacional/MCTI
De Marco	Orsola	Macquarie University
De Smedt	Kenneth	KULeuven
De Zeeuw	Tim	ESO
Decin	Leen	KU Leuven
Doherty	Carolyn	Monash University
Duthu	Alizee	Lab
Edelmann	Philipp	Heidelberg Institute for Theoretical Studies
Ertel	Steve	ESO Santiago
Etoka	Sandra	University of Hamburg
Fabrika	Sergei	Special Astrophysical Observatory
Gesicki	Krzysztof	Nicolaus Copernicus University
Gobrecht	David	OA Teramo
Goldman	Steve	Keele University
Gonzalez	Santiago	Universidad de Chile
Gordon	Michael	University of Minnesota
Gray	Malcolm	University of Manchester
Groenewegen	Martin	Koninklijke Sterrenwacht van Belgie
Grunhut	Jason	ESO
Gutierrez	Claudia	ESO - Universidad de Chile
Guzman-Ramirez	Lizette	ESO
Hamedani Golshan	Roya	Institute for Research in Fundamental Sciences
Haubois	Xavier	ESO/CHILE
Herpin	Fabrice	Laboratoire d'Astrophysique de Bordeaux
Hillen	Michel	Instituut voor Sterrenkunde, KU Leuven
Hoefner	Susanne	U. Uppsala
Hollands	Mark	The University of Warwick
Homan	Ward	Instituut voor sterrenkunde

Hron	Josef	University of Vienna
Humphreys	Liz	ESO
Humphreys	Roberta	U. Minnesota
Icke	Vincent	Universiteit Leiden
Jones	Terry	University of Minnesota
Jorissen	Alain	Université libre de Bruxelles CP226
Kaeufl	Hans Ulrich	ESO
Kastner	Joel	Rochester Institute of Technology
Kerschbaum	Franz	University of Vienna
Kervella	Pierre	CNRS, Universidad de Chile, Obs. de Paris
Khouri	Theo	Chalmers University of Technology
Kotak	Rubina	Queens University Belfast
Kravchenko	Kateryna	Universite Libre de Bruxelles
Lagadec	Eric	OCA
Lam	Doan Duc	Uppsala University
Lebre	Agnes	University of Montpellier
Lykou	Foteini	University of Vienna
Mackey	Jonathan	University of Cologne
Maguire	Kate	ESO
Marcaide	Jon	Univ. Valencia
Marigo	Paola	U. Padova
Matsuura	Mikako	Cardiff University
Matthews	Lynn	MIT Haystack Observatory
McDonald	Iain	University of Manchester
Mecina	Marko	University of Vienna
Meynet	Georges	Geneva Observatory
Mohamed	Shazrene	South African Astronomical Observatory
Montargès	Miguel	IRAM
Mosser	Benoît	Observatoire de Paris
Nanni	Ambra	University of Padova
Nicholls	Christine	University of Vienna
Nozawa	Takaya	NAOJ
Nyman	Lars-Ake	Joint ALMA Observatory
Oettl	Silvia	Universität Innsbruck
O'Gorman	Eamon	Chalmers University of Technology
Ohlmann	Sebastian	Universität Würzburg
Olofsson	Hans	Chalmers Inst. of Technology
Orosz	Gabor	Kagoshima University
Paladini	Claudia	Université Libre de Bruxelles
Ramsay	Suzanne	ESO
Ramstedt	Sofia	Uppsala University
Randall	Suzanna	ESO
Rau	Gioia	Institut für astrophysik, Wien
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Rey	Soo-Chang	Chungnam National University
Richards	Anita	University of Manchester
Saberi	Maryam	Chalmers University of Technology
Sabin	Laurence	UNAM
Scicluna	Peter	Kiel University
Shenoy	Dinesh	University of Minnesota
Soker	Noam	Technion
Srinivasan	Sundar	Academia Sinica Institute of Astronomy & Astrophysics

		(ASIAA)
Tafoya	Daniel	National Autonomous University of Mexico
Takayama	Masaki	University of Tokyo
Tessore	Benjamin	University of Montpellier
Testi	Leonardo	ESO
Tomasino	Rachael	University of Denver
Trejo Cruz	Alfonso	ASIAA
Tsebrenko	Danny	Technion
Uttenthaler	Stefan	University of Vienna
Van De Sande	Marie	KU Leuven
Van Eck	Sophie	Université Libre de Bruxelles
Van Winckel	Hans	Institute of Astronomy, KU Leuven
Vlemmings	Wouter	Chalmers
Vogt	Nikolaus	Universidad de Valparaiso
Walsh	Jeremy	ESO
Warner	Brian	University of Cape Town
Wittkowski	Markus	ESO
Xu	Siyi	ESO
Zijlstra	Albert	University of Manchester

Note to participants

HOW TO REACH ESO

The workshop venue can be easily reached with the underground train (U-Bahn), line U6.

The U-Bahn station in Garching is centrally located, within close reach of all hotels and indicated with a large blue "U"-sign.

Take the underground train (U-Bahn) line U6, with destination "Garching Forschungszentrum" (Garching Research Campus) - this is the last stop on the line. Exit the station at the rear end of the train and follow the sign for ESO.

For different public transport travel schedules you can also use the public journey planner.

Metro tickets

For those who stay in Garching it is cheapest to buy a 10 stripes card and to stamp one stripe per journey. Each stripe card contains 10 stripes and costs 13 EUR.

For those who are accommodated in the city centre it is advisable to buy a weekly IsarCard ticket valid for 8 zones. This ticket costs 32.70 EUR and allows you to make as many journeys as desired within the workshop week.

Ticket machines are located at all metro stops/stations as well as at the airport.

WORKSHOP VENUE

The workshop is held in the New Auditorium “Eridanus”. Please walk through the ESO main entrance and follow the signs.

REGISTRATION

Registration takes place on **Monday between 13:00-14:00** at the entrance to the New Auditorium Eridanus and the new cafeteria respectively.
In case you arrive on a later date, please pick up your name badge at the ESO reception at the main entrance.

PLEASE NOTE THAT FOR SECURITY REASONS, YOU SHOULD WEAR YOUR NAME BADGE AT ALL TIMES DURING THE WORKSHOP!

REGISTRATION FEE

The registration fee was payable by June 6, 2015. It covers the welcome reception at the end of the first workshop day, the reception during the poster session on Wednesay, July 8 as well as the workshop dinner on Thursday, July 9. It also includes all coffee breaks. For more detailed information on the various social events please read the subitem “social events”.

INTERNET AND EMAIL

Open wireless internet is available in most parts of the ESO building. In addition, 4 PCs as well as a printer will be set up in meeting room A.2.02 - Tucana for internet and email connection (only via WEBMAIL service). Signs with the respective account name and password can be found in the room as well as in the workshop venue (Auditorium "Eridanus").

TALKS

We will have available a Mac and Windows laptop with standard presentation software. To smooth the switch-over from one speaker to the next we have to request that speakers send their presentations in advance to steps@eso.org naming it with your surname and initials (e.g. GalileoG.pdf). This is the only way to load your talk on the presentation laptop before the respective session and to test it in time. If you have any complicated animations etc. please make sure all required files are included and contact us about a rehearsal during a break earlier than the one immediately before your

talk. Please send us your presentation at least one session before your scheduled talk. To be on the safe side please also bring your presentation on a memory stick (pdf or ppt) and give it to any of the LOC members wearing a yellow badge well before the session in which you talk.

To see what session your presentation is in, check the program here.

PLEASE NOTE THAT USING YOUR OWN LAPTOP IS STRONGLY DISCOURAGED!

POSTER PAPERS

The poster papers will be on display around the glass pillar opposite to the meeting rooms Pavo (A.2.01) and Tucana (A.2.02) throughout the meeting. The poster panels are 120cm high and 100cm wide, allowing posters up to A0 portrait size. Pins, etc. will be available on the boards. You can find all scheduled poster presentations here. The poster boards will be numbered according to the poster paper list published on the workshop webpages. Please place your poster at the board carrying the number mentioned next to your name in this list.

N.B.: Please remember to take down your poster by 12:30 on Friday. ESO will not store workshop posters. Therefore the janitors will dispose all remaining posters after the end of the workshop.

SOCIAL EVENTS/ LUNCHES

- **Welcome Reception - Monday at 17:50 in the Foyer of the New Auditorium**

  We will serve pretzels and beer (also nonalcoholic) and soft drinks in the Foyer of the New Auditorium at the end of the first workshop day. All workshop participants are invited to join, without additional charge.

- **Welcome Reception - Wednesday at 17:30 at poster display area**

  We will serve pretzels and beer (also nonalcoholic) and soft drinks during the poster session. All workshop participants are invited to join, without additional charge.

- **Lunches provided at canteen (not covered by registration fee) - Tuesday to Thursday**

  The MPI canteen is located a good 5-minute walk from ESO. Please note that only cash is accepted. Prices for a main course range from about 5 to 10 EUR. Tables for the workshop participants have been reserved in the dining hall.

- **Social dinner at the restaurant** Neuwirt **in Garching on Thursday at 19:00**

  A welcome drink as well as the dinner including one accompanying drink are free of charge for all workshop participants. Additional drinks may be paid IN CASH on-site.
  We ask participants who won't attend the social dinner to inform the LOC at steps@eso.org in advance so that a realistic number of guests can be confirmed to the restaurant.

TAXIS

A sign up sheet will be provided at the door of the auditorium "Eridanus" where you can request a taxi pick up to the airport until Thursday 16 p.m. at the latest. The sheet will then be forwarded to the ESO main reception so that the requested pick-ups can be grouped and arranged according to the preferred departure times. You will find a sheet carrying all scheduled taxi pick-ups at the ESO main reception.

BANK SERVICE

There are banks and cash-points in Garching. All main credit and debit cards are accepted (with PIN code). Please note that the banks may close during lunch time and have opening hours differing from shops. There is also a cash-point (Kreissparkasse) on the Campus, at the bus stop Lichtenbergstrasse 4 (TUM Chemie).

Looking forward to welcoming you in Garching!