

Nucleosynthesis in Binary Stars: A Proposal to the Lorentz Centre

Lorentz Centre, Leiden. Proposed dates: 4-15 April 2005

Organizers

The meeting is being organized under the auspices of the International Astronomical Union's Working Group on Abundances in Red Giants (WGARG). An interim SOC has been formed, sharing considerable overlap with the Organizing Committee of the WGARG:

- Peter Eggleton (ppe@igpp.ucllnl.org),
- Josef Hron (hron@astro.univie.ac.at),
- Robert Izzard (rgi@carolune.net, CO-CHAIR),
- Jordi José (jjose@ieec.fcr.es),
- John Lattanzio (john.lattanzio@sci.monash.edu.au),
- Onno Pols (O.R.Pols@astro.uu.nl),
- Christopher Tout (cat@ast.cam.ac.uk, CO-CHAIR),
- Sophie Van Eck (svaneck@astro.ulb.ac.be),
- Hans Van Winckel (Hans.VanWinckel@ster.kuleuven.ac.be)

We propose Drs Christopher Tout and Robert Izzard as Co-Chairmen. Tout (also a member of the WGARG OC) has an extensive history of work on binary stars, and Izzard, a recent graduate of Cambridge, has performed revolutionary calculations of nucleosynthesis in binary populations, which are a key element of the proposed workshop agenda.

Workshop Aims

The development of 8m-class telescopes makes it possible for us to probe the earliest stages in the life of galaxies and the Universe. A vital part of this effort is determination of the chemical composition of the astronomical objects present at this stage, from Lyman- α systems through the most metal-poor stars and globular clusters. To understand these chemical compositions requires a detailed knowledge of evolution and nucleosynthesis in stars. In this workshop we shall address the contribution binary stars make to all aspects of nucleosynthesis.

Binary stars cause some of nature's most violent explosions, novae and Type Ia supernovae, which play a major role in enriching the ISM. Apart from these obvious examples, there are many indications that binary stars are instrumental

in affecting stellar abundances. Many stars showing abundance peculiarities, such as barium and CH stars, form in binary stars with mass transfer. The same is likely the case in some very metal-poor stars that are carbon- and *s*-process enriched. Other types of star, such as R- and J-type carbon stars, are still poorly understood but there are strong indications that binary stars have played a key role. Many other systems, such as post-AGB stars, planetary nebulae, Wolf-Rayet stars and blue stragglers, have a significant population formed in binary stars.

In the workshop the latest ideas and models of single and binary star evolution and nucleosynthesis will be summarized and uncertainties examined. Population nucleosynthesis models will be introduced as a way to model surface abundances in whole populations of single and binary stars and globular clusters. Progenitor systems of novae and SNeIa will be discussed particularly with regard to pollution of the ISM. Observations of stars (including binary orbital parameters), galaxies and meteorite grains will be summarized. The complicated problem of linking results from theoretical models to observations will be addressed. A draft program is being prepared and can be made available if requested.

Binary star nucleosynthesis is an area of astrophysics in its infancy with several groups (Institute of Astronomy in Cambridge, the Caroline Institute for Quality Astronomy (CIQuA), Utrecht University, Monash University etc.) beginning investigations. It is an ideal time to bring them together to discuss the state of the art in stellar abundance determinations and modelling, outline the current major problems and plan for the future. There are still sufficiently few players that we can hope to bring them together at a single place and time. Talks will be given at the start merely to set the scene for discussion and problem solving that will continue through the workshop. Any significant breakthroughs or challenges will be expounded from day to day at an informal closing meeting. It is expected that junior researchers play a significant role. At the end of the workshop short presentations and papers on progress made over the two weeks as well as plans for the next year will be presented. Participants will be exhorted to attend for the full two weeks and priority will be given to those who commit to do so.

Further, we would like to flag the possibility of a brief follow-up meeting, perhaps just a couple of days, in approximately 24 months. The aim would be to review the results of work inspired by the Leiden meeting, and to modify the research agenda accordingly.

Participants

We shall aim for a group of about 30 with an absolute maximum of 35. Probable key players will be chosen from among the following (an asterisk indicates an already committed speaker), although the final speakers will be decided later:

- Peter Eggleton (stellar evolution)
- Falk Herwig (AGB stars)

- Vanessa Hill (low-metallicity halo stars)
- Josef Hron (stellar atmospheres)
- Robert Izzard* (population nucleosynthesis)
- Jordi José (novae)
- Amanda Karakas (AGB stars)
- David Lambert (abundance observations)
- Norbert Langer (stellar evolution and rotation)
- John Lattanzio (AGB stars, globular cluster abundances)
- Maria Lugaro (meteorite grains)
- Gijs Nelemans (CVs)
- Onno Pols* (binary stars)
- Claudia Travaglio (supernovae)
- Christopher Tout* (binary stars)
- Sophie Van Eck (C-star binaries)
- Hans Van Winckel (post-AGB stars)

Dutch participation will be encouraged by Langer, Nelemans and Pols. The Utrecht group is one of the leading groups in binary nucleosynthesis studies and this workshop will foster stronger international collaborations.