PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF THE PACIFIC, **111**:125–126, 1999 January
© 1999. The Astronomical Society of the Pacific. All rights reserved. Printed in U.S.A.

Conference Highlights

Asymptotic Giant Branch Stars: IAU Symposium 191[1]

IAU Symposium 191 on "Asymptotic Giant Branch (AGB) Stars" was held in Montpellier, France, from 1998 August 27 to September 1. It was attended by 245 participants from 27 countries.

The AGB phase corresponds to the short stage during which intermediate-mass stars attain their highest luminosities but also experience heavy mass loss, which rapidly conducts them toward the planetary-nebula phase and the final cooling to white dwarfs. AGB stars are most revealing for critical issues in stellar structure, nucleosynthesis, and evolution, and their circumstellar envelopes are important interfaces between stellar and interstellar media. Since they correspond to the most luminous stage of a dominant stellar population, understanding AGB stars is necessary to understand external galaxies with old populations.

The timing of the conference was fortunate, in the sense that first mature results were presented from long-standing ambitious projects in the field of large infrared surveys, infrared spectroscopy from space, and high angular resolution observations from the near UV to the mm domain. A cornerstone of the conference was the confrontation of studies of stardust in AGB star envelopes, where dust is formed, and in our solar system, where it can be analyzed directly.

Several high-angular observations, some of them time-dependent, of Miras have been obtained, revealing asymmetries already in early stages. The interpretation of these data in terms of linear diameters is hampered by the fact that the huge sizes of the stars imply that their angular diameters are a multiple of their parallaxes and by the strong wavelength dependence of the observed extension, diameters in the continuum being sometimes more than 3 times smaller than in strong molecular bands. The issue of the pulsation mode of Miras remains more controversial than ever. Dynamical models of the extended atmospheres and shells of AGB stars have attained a high level in sophistication and ask for increasing even further the remarkable angular resolution attained with interferometric devices.

The envelopes of AGB stars are the major factories of cosmic dust. Thanks to the observations with the *Infrared Space Observatory* (*ISO*) and to data obtained from laboratory astrophysics the prospect arises to perform detailed mineralogy of the grains. Before *ISO* astronomical silicates were considered to be essentially amorphous, but the conspicuous presence of crystalline silicates in the circumstellar shells of evolved, as well as young, stars triggered new laboratory research as well. The details of the transition of the grains from the circumstellar environments to the interstellar medium, where only the amorphous component has been observed so far, are mysterious.

A self-consistent theory for oxygen-rich dust formation, which would be able to explain these new data, is still lacking, but various attempts seem promising. On the other hand, the theory of carbon-rich dust formation appears to be on a solid basis, being able to reproduce the data and even allowing for variability. In this field, astrophysics owes much to the literature on combustion, which does not appear on the shelves of the typical astronomer! Furthermore, when coupled with stellar evolution models, this theory seems able to explain the long-term time dependence of the carbon-star mass-loss rates.

Half a thousand of meteorites are not processed and thus presolar. A classical result of the study of these grains is the confirmation of the nucleation of graphite on TiC grains. Isotopic patterns of s-process elements are well reproduced by models of nucleosynthesis in AGB stars. Measured silicon isotopic ratios in SiC grains indicate that many stellar sources are involved in the grains that occurred in the solar nebula. However, the large grains that are observed as inclusions in meteorites are not easily understood in terms of modeling of AGB outflows; it was suggested that these grains originate in the disks that are observed around several AGB and post-AGB stars, that presumably are binary systems.

It now seems plausible that all chemically peculiar red giants and post-AGB stars, and maybe even most RV Tauri stars, are binaries. In wide systems wind accretion of s-process material accounts for the observed peculiarities, but a large number of closer systems requires nonstandard binary evolution: not all interacting binaries become cataclysmic variables or merge. Many spectacular and therefore archetypical AGB and post-AGB objects turn out to be binaries, which should warn us that binarity may introduce an observational bias. A numerous population of very long-period variables detected by the MACHO survey may imply, however, that interacting binaries are also quantitatively an important population.

On the theoretical side, the importance of mixing for dredge-up was pointed out. While hot bottom burning explains the

[1] Conference was held in Montpellier, France in 1998 August. Proceedings will be edited by T. Le Bertre, A. Lèbre, & C. Waelkens and published in the IAU Symposium Series.

lack of optically bright carbon stars in low-metallicity environments, the presence of luminous enshrouded carbon stars in the Magellanic Clouds is explained by the last dredge-ups in the more massive AGB stars. Studies of AGB stars in other external galaxies are now emerging, with a promising potential for stellar population studies.

C. Waelkens, T. Le Bertre, and A. Lebre
Catholic University of Leuven, Belgium, Observatoire de Paris, France, and University of Montpellier II, France