

MDPH480/PHYS480/ASTR480/MAPH480 Research Projects 2009

Project Title: **Stellar nucleosynthesis**

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Abstract of the Proposed Research (use this page only)

Stellar nucleosynthesis and its implications for the evolution of stars in globular clusters.

We choose to study globular clusters because they are excellent laboratories for investigating the chemical enrichment of galaxies. First, they contain the oldest stars, preserving a fossil record of the chemically enriched gas from which they formed. And second, there are well-established techniques for measuring the chemical properties of globular clusters.

Globular clusters also provide insights into the evolution of individual stars. Wylie et al (2006) have shown that the s-process elements (Y, Zr, Nd, La) are enhanced in a small sample of giant stars in the globular cluster, 47 Tuc. The surface enhancement of s-process elements occurs from mixing during a short-lived phase and is a vital part of the element formation and recycling in the cosmos. The presence of s-process enhancements in some stars in this cluster is a real puzzle. There is no known mechanism for the production of such enhancements. They must have been present in the gas from which 47 Tuc formed.

I continue to work in this area with Michael Albrow, post-doc Liz Wylie (RSAA, ANU), PhD students Mita Gopal, Clare Worley, MSc student Jeffrey Simpson and collaborators in Australia, particularly Professors Ken Freeman (RSAA, ANU) and John Lattanzio (Mathematical Sciences, Monash University).

This project would work on an aspect of this work in collaboration with the team.

Background reading:

Worley, C.C., Cottrell, P.L., & Wylie de Boer, E.C., s- and r-process element abundances in the CMD of 47 Tucanæ using the Robert Stobie Spectrograph on SALT, *Publications of the Astronomical Society of Australia*, v25, 2008: 53 – 62.

Wylie, E.C., Cottrell, P.L., Sneden, C.A., & Lattanzio, J.C., Heavy element abundances in giant stars in 47 Tuc. *Astrophys. J.*, v649, 2006: 248-257.

Wylie, E.C. PhD thesis, University of Canterbury, 2006.

Wylie-de Boer, E.C. & Cottrell, P.L., Element enhancements along the entire Asymptotic Giant Branch phase, *Astrophys. J.*, v692: 2009, 522-530.