A TEST OF STELLAR EVOLUTION THEORY BY VISUAL BINARIES

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When close visual binaries have good and homogeneous data, they can prove to be precision probes of stellar evolution theory.

This has been demonstrated by using an MK spectral classification survey of 170 visual binaries, south of -25° declination and with separations mostly between one and five arcseconds. The binaries have area scanner photometry in UBV colours (Hurly and Warner 1983; Rakos et al. 1982), which have been tested for accuracy.

The binaries with the most secure colour-magnitude data were used to test new Yale isochrones (Green et al. 1982), which include a mixing length parameter of 1.5 from the outset of the model calculations. An isochrone composition of Y=0.25, Z=0.04 proved best. Small decreases in the mixing length parameter were suggested for the coolest stars, but the good fit of the binaries to the isochrones (mean age difference between the components = 0.0 ±0.1 Gyr) showed that stellar evolution had in general been well modelled by Green et al.

A full account of this test has been submitted to The Astrophysical Journal.

REFERENCES

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Hurly, P.R., and Warner, B.: 1983, M.N.R.A.S., 202, p. 761.
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DISCUSSION

Conti: It is interesting that you have 2 incipient blue stragglers among these binaries. These objects cannot be exchange mass systems but must be explained by other physical effects.

Andersen: 1) An additional important test of the stellar models is of course - provided the masses are accurately known - to see if both observed stars agree with the model predictions for the observed masses.
2) Although Z = 0.04 would make the observed temperatures of also our late-type binaries agree with predictions, it seems to be too high to agree with spectroscopic and other abundance determinations for Pop. I stars. And for Z = 0.04, the eclipsing binaries agree with neither the ZAMS position nor the isochrones, so this value seems uncomfortably high.

Corbally: 1) The importance of accurate masses to this test was why close visual binaries were chosen for this study. While only about 10 % have orbital elements determined, it is hoped that astrometric observations will continue for the remainder and give mass information within a reasonably small number of years.
2) I agree that Z = 0.04 seems too high in relation to abundance determinations. However, the Y = 0.25 is what would be expected, and the Y and Z abundances must change in harmony. It would certainly be interesting to test these binaries against Z = 0.02 isochrones when these are available.

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