POSTERS

NLTE Analysis of Keck HIRES Spectra of K648: Central Star of the Planetary Nebula Ps1 in M15

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Küstner (1921) catalogued K648 in his photographic survey of M15, but it was not recognized as a PN central star until Pease (1928) discovered the nebula, denoted Ps1. As one of very few PN known in globular clusters — it was the *only* known until Gillet *et al.* (1989) reported the discovery of a second in M22 and Jacoby *et al.* (this meeting) announced two new but very faint objects — K648 offers one of the better opportunities to study the post-AGB evolution of extreme Pop. II stars. Previous investigations of the nebula and star (Adams *et al.* 1984; Peña, Torres-Peimbert, & Ruiz 1992; Heber, Dreizler, & Werner 1993) all concluded that the stellar temperature is slightly less than 40000 K. Heber *et al.* also concluded the photospheric He and C abundances were $3 \times$ and $5 \times$ higher than solar.

We have conducted a NLTE model atmosphere analysis of K648 based on optical spectra obtained with the 10 m Keck HIRES echelle spectrograph. The high resolution ($R = \lambda/\Delta\lambda = 35,000$ [4 pixels]), high S/N (140 at H γ) Keck spectra of K648 revealed HI Balmer, HeI, HeII, CIII, and CIV absorption lines, among others. Also evident in the HIRES spectra were weak narrow lines indicating contamination by a metal poor red giant spectrum; by comparing the equivalent widths of the contaminating features to a reference red giant spectrum (metallicity similar to M15), we successfully removed the red giant light (contributing 15% to 25% of the observed continuum) from the K648 spectrum.

Lines of HeI (e.g., $\lambda 4471$ Å) present in the HIRES spectra were particularly significant, enabling use of the HeI/HeII ionization equilibrium to determine T_{eff} more reliably than possible previously. We derive T_{eff} = 43000 K, log g = 3.9, and helium abundance y = 0.08 (nearly solar) for K648; nor does our analysis of the CIII and CIV lines in the HIRES spectra support the high C abundance derived by Heber *et al.* Comparison to evolutionary tracks in the log(g) - log(T_{eff}) plane yields distance-independent estimates of the stellar mass (0.60 M_{\odot}) and post-AGB evolutionary age (2000 y). Finally, we derive a spectroscopic distance to K648, $d = 11.8 \pm 1.5$ kpc, which compares favorably to the 10.4 ± 0.8 kpc accepted distance to M15 (Durrell & Harris 1993) to within the quoted errors. This result strongly supports the reliability of central star spectroscopic distances to PN generally.

REFERENCES

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