Multi-Wavelength Observations of the Peculiar Red Giant HR 3126

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The M2 II star HR 3126 (HD 65750) is remarkable because it sits near the center of a $0.7M_{\odot}$ butterfly-shaped reflection nebula of several **arc minutes** extent (Dachs *et al.* 1978, *A & A* **63**, 353.). If it is a member of the nearby open cluster NGC 2516, the distance (375 pc), main sequence turnoff age ($\sim 10^8$ years) and implied mass ($\sim 5M_{\odot}$) suggest that HR 3126 is a red bright giant past the initiation of helium burning in its core.

Ultraviolet observations were obtained 1987 Sept. 28 by Stencel and Pesce [IUE program MLJRS]: SWP 31915 (30 minute exposure) and LWP 11744 (159 minute exposure). Only Mg II emission and a photospheric continuum longward of about 2700$\AA$ were detected. The Mg II emission suggests that a chromosphere is present.

Doggett obtained blue–visual spectra of HR 3126 on 1987 September 25th and 26th at CTIO. They appear to be typical red giant spectra. The Ba II feature at 4554$\AA$ is present and is possibly enhanced compared to other M giants. In addition, a 5640-7040$\AA$ region spectrum was obtained by Walter at Cerro Tololo (1987 April 4) showing an overly strong Li I line at 6707$\AA$. High lithium abundances in evolved stars have been taken as evidence that the stars have undergone helium shell flashes and are second ascent giants.

Whitelock observed HR 3126 on 1987 September 15/16 and comparison of (J-H), (H-K) and (K-L) colors with a standard star show longwave excesses. A low resolution ($\Delta\lambda/\lambda \sim 0.01$) spectrum from 1.2 - 4.0 μm obtained in December 1981 at South Africa is typical of an M giant, the CO strength indicates a type of M3 and there is no sign of Mira-like H_2O absorption. In addition, lack of large amplitude variability indicates that the star probably is not a Mira.

Finally, IRAS observed this object as well, detecting it in all four bands, 12 to 100 μm and with the Low Resolution Spectrograph (LRS). The infrared colors suggest a far infrared excess remains after a 3250K blackbody is subtracted. Further analysis suggest the source was spatially resolved by the IRAS detectors at all frequencies.

We surmise that HR 3126 passed through a red giant phase several million years ago and experienced comparatively high mass loss and dust production. The expansion of that dust shell is the present day IC 2220 nebula. The star subsequently may have undergone a blueward excursion in the HR diagram, onto the horizontal branch. At present, it appears to be evolving redward again and may soon begin its ascent of the asymptotic giant branch (while helium shell burning) on its way to carbon core ignition. The multiwavelength data appears to offer the possibility to test atmospheric response to evolutionary changes.

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