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ULTRAVIOLET SPECTROSCOPY OF SELECTED ASTRONOMICAL SOURCES

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by

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Drilling and Schönberner have used the distances, luminosities, and effective temperatures given by Schönberner and Drilling (Ap. J. 278, 702) for a complete sample of very hot O-type subdwarfs to estimate the birth rates of the various kinds of white dwarf progenitors. The relative birth rates are: central stars of planetary nebulae - 70%, other post-AGB objects - 30%, and post-HB objects not massive enough to climb the AGB = 0.3%. The combined birthrate for all of these objects (2-3 x 10^{-12} pc^{-3} yr^{-1}) is in satisfactory agreement with the death rate of main sequence stars and the birth rate of white dwarfs. The evolutionary tracks of Schönberner (Ap. J. 272, 708) and of Pacynski (Acta Astr. 21, 1) were used in these calculations.

Drilling, Holberg, and Schönberner (Ap.J. 283, L67) published low-resolution (25 Å) Voyager I spectrophotometry of two very hot O-type subdwarfs (LSE 21 and LSIV+10°9) covering the wavelength range 500 to 1700 Å. LSE 21 shows the HI Lyman series in absorption, and LSIV+10°9 appears to have the HeII 2 → ∞ series in absorption. Combination of the Voyager I data with published IUE spectrophotometry and UBV photometry, and comparison with the model atmospheres described by Schönberner and Drilling (Ap. J. 278, 702), indicates an effective temperature of 65,000 K for LSIV+10°9, and an effective temperature in excess of 100,000 K for LSE 21, making it one of the hottest known stars.

Schönberner and Drilling have detected numerous lines of FeV, FeVI, and FeVII in high-resolution spectra of two central stars (NGC 7293 and LSS 1362) and a number of very hot O-type subdwarfs (LSE 21, LSE 234, and LSII+18°9). The strengths of these lines vary widely from star to star, suggesting that the abundance of iron in the atmospheres of the immediate progenitors of white dwarfs is strongly variable. A possible explanation is elemental separation by gravity and radiation pressure.

Drilling has found that LSS 2018, the central star of the planetary nebula DS1, is a double-lined spectroscopic binary (P = 8.571 hours) showing an extremely large reflection effect (ΔV = $0^{m}.5$). High-resolution optical spectroscopy, UBV photometry, and low-resolution IUE spectrophotometry have been used to establish the radial velocity curves and the light curves at a number of different wavelengths. Analysis of these observations shows that the system consists of a very hot O-type subdwarf of mass 0.5 - 0.7 M_{O} and radius 0.2 - 0.3 R_{O}, which illuminates the nebula and the facing hemisphere of the secondary, and a red dwarf with a mass of 0.2 - 0.3 M_{O} and radius 0.3 - 0.4 R_{O}, from which we receive only "reflected" light from the primary. The orbits are circular, with a separation of 0.008 - 0.010 AU, and the radius of the nebula is 0.3 pc.

Heber and Drilling have discovered a planetary nebula surrounding the very hot subdwarf LSS 1362. High-resolution optical spectra of LSS 1362 have been analyzed by means of detailed NLTE model atmospheres, yielding the following results: T_{eff} = 100,000 ± 20,000, log g = 5.2 ± 0.3, and n(He)/n(H) = 0.1 ± 0.03. These results are in agreement with the effective temperature of 110,000 K derived by Schönberner and Drilling (Ap. J. 278, 702) using low-resolution IUE observations.