THE NATURE OF THE HOT COMPANION OF THE G8 IV NUCLEUS OF ABELL 35

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The nucleus of the large, low surface brightness planetary nebula Abell 35 (Abell 1966) belongs to the small group of objects which are known to have a binary nucleus. From his photometric and spectroscopic study of the object, Jacoby (1981, Astrophys. J. 244,903) found the star SAO 181201, a G8 IV star, to be located near the apex of the parabolic region of enhanced [O III] emision which is completelely absent in Hα. The G8 IV star can clearly not be the ionising source for this nebulosity nor the larger scale nebulosity of the PN proper. Jacoby concluded that the central object must be a binary and suggested a hot subdwarf as the second component, which is masked in the optical by the bright SAO star. This interpretation is supported by the analysis of the DDO and UBVRI photometry, which shows that the observed colour indices can be fitted if one assumes a 50.000 K blackbody companion.

We have observed the nucleus of Abell 35 with the IUE-satellite on February 24th, 1987. Both the short-and the long-wavelength cameras were exposed in the low-resolution mode. While in the long wavelength range the continuum and the spectral features are dominated by the G8 IV star, at shorter wavelengths we clearly see the emission from a much hotter object.

The temperature of this hotter component can directly be determined from the observed and absolutely calibrated UV intensity distribution as Jacoby has shown the interstellar extinction to be effectively zero along the line of sight towards SAO 181201, a result confirmed by the absence of any significant depression in the spectrum near 2200 Å.

Fitting the short-wavelength part of the observed spectral distribution by a blackbody distribution, we find T > 120.000 K. A temperature in this range is independently found from the equivalent width of the He II 1640 Å absorption line (W_λ=1.99 Å). Using the theoretical results from Sion et al. (1982), who calculated equivalent widths for a number of absorption lines seen in the spectra of white dwarfs, we find for log g=6 T=50.000 K, a solution which is definitely ruled out by the slope of the UV continuum. For log g=8, we find (by extrapolation) a fit for the He II line for T=135.000 K. The possible range of temperatures is therefore within the uncertainty limits completely consistent with the above result.

We feel indeed justified to apply the Sion et al. white dwarf models, because from the blackbody fit to the absolutely calibrated IUE flux and taking into account the distance to SAO 181201 of d=360 $\pm$80 pc as determined by Jacoby (1981), it follows that the star's radius must be R < 17.700 km for T > 120.000 K.

S. Torres-Peimbert (ed.), Planetary Nebulae, 314.

https://doi.org/10.1017/S0074180900138628 Published online by Cambridge University Press