



The nature of the Na I D-lines in the Red Rectangle

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In this paper we examine the profiles of the complex Na I D-lines in the Red Rectangle. The spectra were acquired with the ARCES $\{e\}$ chelle spectrograph $R = 38,000$ on the 3.5-m telescope at the Apache Point Observatory. Additional spectra taken with STIS were acquired from the Hubble Legacy Archive (HLA) and were used to independently confirm the spatial origin of the spectral features. The profile of a single D-line consists of double-peaked emission, red-shifted absorption and blue-shifted absorption. We find that the double-peaked emission originates from the bipolar outflow, the red-shifted absorption feature is due to the photospheric line, and the blue-shifted absorption arises from the bipolar outflow as seen against the photosphere of the luminous post-AGB component in HD 44179. In order to better understand the Na I D-line profile, we examined the periodically variable asymmetric photospheric absorption lines. The asymmetric lines are interpreted as a signature of slow self-accretion following enhanced mass-loss around periastron. An empirical model was constructed to remove the photospheric component from the Na I D-line profile in order to study the nebular emission and absorption of sodium along the line-of-sight to the primary. This paper also discusses the different origins of the single-peaked emission, the double-peaked emission and the blue-shifted and red-shifted absorption components.

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