Spectral analysis of the binary nucleus of the planetary nebula Hen 2-428

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Abstract

Binary systems provide us with an excellent laboratory for studying stellar evolution. In particular, systems with two evolved stars are rare and intriguing, as they have to undergo multiple mass transfer events to form. As well as this, double degenerate systems with short enough orbits and high enough system masses are candidates for type Ia supernovae, via the proposed double degenerate merger channel. There are _˜100 double white dwarf binaries with orbital periods less than 1 day, as well as _˜50 known white dwarf-hot sub dwarf binaries; however, there are only a few double hot sub dwarf systems. Of these double degenerates, only a handful are of sufficient mass to be considered type Ia candidate systems. We provide the first quantitative spectroscopic analysis of the binary central stars of the planetary nebula Hen 2-428, whose spectra are similar to that of hot sub dwarfs. The mass of these central stars is still open to debate; Santander-Garcia et al. (2015) conclude masses totalling greater than the Chandrasekhar Limit, making it a candidate type Ia progenitor system. However, Garcia-Berro et al. (2016) find a lower mass solution that fits the observations as well. We attempt to resolve this debate by using synthetic spectra from state-of-the-art non-LTE models to constrain the radial velocities, and thus calculate dynamical masses. Our synthetic spectra also provide us with the atmospheric parameters of the central stars. Based on these results, we discuss the implications of the supernova Ia progenitor status of Hen 2-428.

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