



The Beginnings and Ends of Double White Dwarfs

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The Origin of Standard Thermonuclear Supernovae from Hybrid White Dwarf Mergers

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Type-Ia supernovae (SNe) are thought to originate from the thermonuclear explosions of carbon-oxygen (CO) white-dwarf (WD) stars. The proposed progenitors of standard type Ia-SNe can be generally divided between explosions of CO-WDs accreting material from stellar non-degenerate companions (single-degenerate; SD models), and those arising from the mergers of two CO-WDs (double-degenerate; DD models). However, the suggested models for the progenitors of such SNe fail to reproduce the diverse properties of the observed explosions, and they do not explain the inferred rates and the characteristics of the observed populations of type Ia-SNe. Here we use detailed thermonuclear-hydro dynamical and radiative-transfer models to show that mergers of CO-WDs with hybrid CO-He WDs provide a viable model for standard-candle Ia-SNe. We find that such mergers give rise to explosions that recreate the detailed light-curves and spectra of Ia-SNe, and in particular reproduce the full range of the width-luminosity Phillips relation observed for standard-candle SNe. Moreover, our population synthesis models show that the rate and delay-time distribution of such mergers are consistent with observations of standard candle type-Ia SNe. Such successful models for type Ia-SNe can, therefore, serve to study the detailed composition yields from SNe, and the systematics involved in Ia-SNe measurements of the cosmological parameters of the universe

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