The Beginnings and Ends of Double White Dwarfs

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The Fastest Stars in the Galaxy: Confirmation of the D6 Type Ia Supernova Scenario

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The binary companion and mechanism responsible for triggering the explosion of a white dwarf (WD) as a Type Ia supernova (SN Ia) have been the subject of intense research for decades. In the "dynamically driven double-degenerate double-detonation"(D6) scenario, the binary companion is another WD that begins to undergo unstable mass transfer. The violence of this dynamical accretion leads to a helium detonation on the primary WD's surface that then triggers a carbon core detonation and subsequent SN Ia. One possible outcome of the D6 model is that the secondary WD survives the explosion and flies away from the SN Ia site with its pre-explosion orbital velocity of > 1000 km/s. We performed a search for such hypervelocity runaway WDs in Gaia's second data release and found three very intriguing stars whose characteristics, derived from follow-up observations, match many of the predictions of the D6 model. These potential D6 survivors are the strongest evidence to date of a successful SN Ia progenitor scenario, and future work may confirm the hypothesis that the D6 model is responsible for the majority of all SNe Ia.

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