Remnants Of Binary White Dwarf Mergers

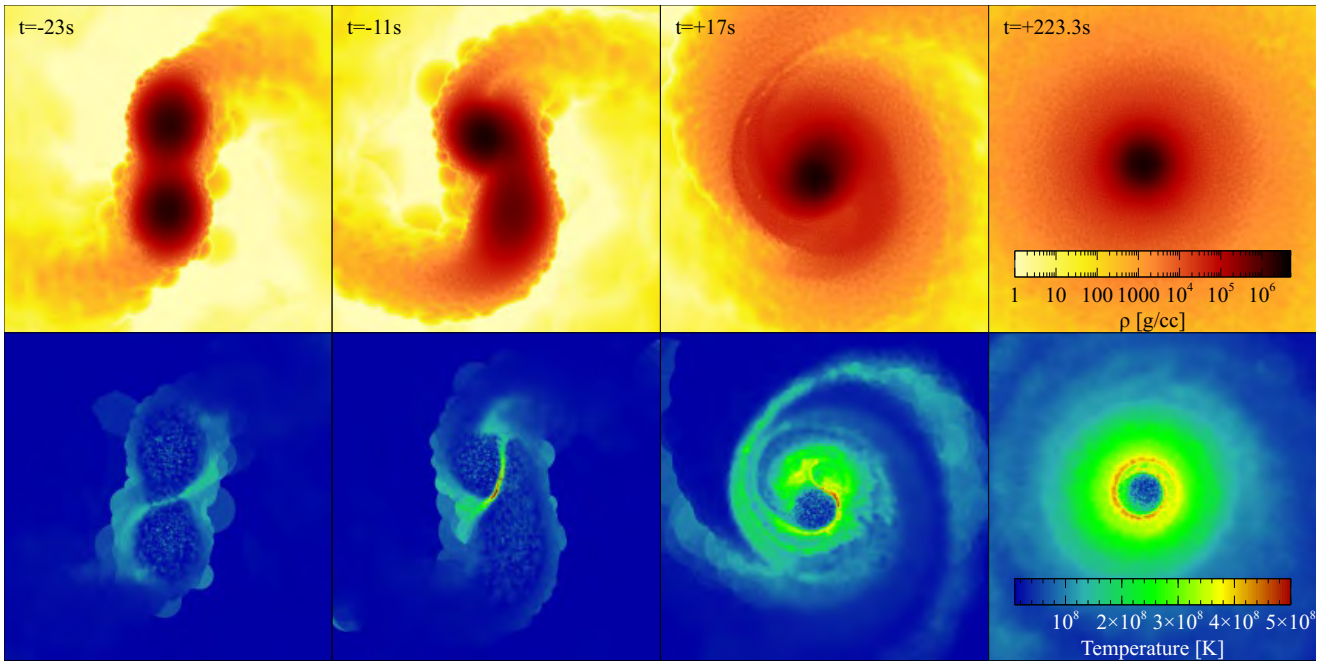

Fig 1 - Snapshots in time of a 0.8 $M_\odot$ × 2, merger with the time coordinate centered on the moment of complete destruction of the secondary star. The top four images are density maps of slices in the x–y plane, while the bottom four images are temperature maps of the same slice.

We carry out a comprehensive smooth particle hydrodynamics simulation survey of double-degenerate white dwarf binary mergers of varying mass combinations in order to establish correspondence between initial conditions and remnant configurations. We find that all but one of our simulation remnants share general properties such as a cold, degenerate core surrounded by a hot disk, while our least massive pair of stars forms only a hot disk. We characterize our remnant configurations by the core mass, the rotational velocity of the core, and the half-mass radius of the disk. We also find that some of our simulations with very massive constituent stars exhibit helium detonations on the surface of the primary star before complete disruption of the secondary. However, these helium detonations are insufficiently energetic to ignite carbon, and so do not lead to prompt carbon detonations.

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Published: Raskin et al., Astrophysical Journal, 746, 62, 2012

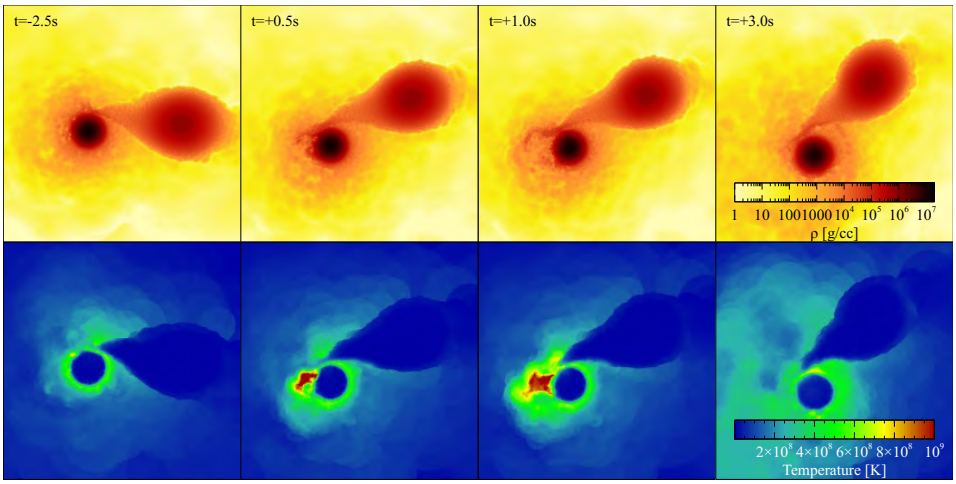

Fig. 2 - Same as above, but for 0.64 $M_\odot$ + 1.06 $M_\odot$, with the time coordinate centered on the moment of the helium detonation. A detonation shock propagates to the right, through the 1.0 $M_\odot$ primary, expanding its outer layers.