APR18-2018-020090

Abstract for an Invited Paper
for the APR18 Meeting of
the American Physical Society

The Long-Term Outcomes of Double White Dwarf Mergers

JOSIAH SCHWAB, Univ of California-Santa Cruz

Binary star systems composed of two white dwarfs are a natural outcome of stellar evolution. Angular momentum losses from gravitational wave radiation cause the binary system's orbit to shrink until the two white dwarfs merge. The final outcome of the merger depends primarily on the masses of the white dwarfs. Some potential outcomes, such as supernova explosions, may occur during or soon after the merger. Other outcomes, which I will refer to as "long-term" outcomes, occur as the merger remnant cools and its structure adjusts to the new state created during the energetic merger. In this talk, I will focus on the merger of two carbon-oxygen WDs. I will present simulations of the short-lived viscous disk initially present in these remnants and then show calculations that use the state-of-the-art MESA stellar evolution code to follow their thermal evolution. I will discuss the observational properties of these merger remnants and outline the interesting evolutionary process that leads to their final fate, which is likely collapse to a neutron star. The anticipated formation of a degenerate oxygen-neon core during this evolution necessitates an accurate treatment of the weak reactions that can drive its thermal and compositional evolution. I will discuss a series of calculations that use the MESA stellar evolution code to study degenerate oxygen-neon cores. These include previously neglected effects such as Urca-process cooling and are able to reach length-scales that directly connect full-star simulations to past studies of the onset of the collapse process.