The Beginnings and Ends of Double White Dwarfs

Contribution ID: **21** Type: **Talk**

Characterizing the local double white dwarf population

Monday 1 July 2019 11:35 (20 minutes)

The characterization of the local double white dwarf (DWD) population is crucial to our understanding of multiple questions, from stellar evolution, through the progenitors of Type-Ia supernovae (SNe Ia), to gravitational wave sources. From a spectroscopic sample of 439 WDs from the SPY survey, we measure the maximal changes in radial-velocity (DRVmax) between epochs, and model the observed DRVmax statistics via Monte-Carlo simulations, to constrain the population characteristics of DWDs. We then combine the results with those of a complementary sample from the SDSS to obtain new and precise information on the DWD population and on its gravitational-wave-driven merger rate. We find that ~10% of WDs are in DWD systems in the separation range ~<4 AU within which the data are sensitive to binarity. The Galactic WD merger rate per WD is ~1e-11 per year. Integrated over the Galaxy lifetime, this implies that 8.5-11% of all WDs ever formed have merged with another WD. If most DWD mergers end as more-massive WDs, then some ~10% of WDs are DWD-merger products. The implied Galactic DWD merger rate is 4.5-7 times the Milky Way's specific SN Ia rate. If most SN Ia explosions come about from the mergers of some DWDs then ~15% of all WD mergers must lead to a SN Ia.

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Session Classification: Observed WD Populations 1