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The origin and characteristics of massive white dwarfs

Our understanding of the mass distribution of white dwarfs remains elusive, yet it stands as a fundamental aspect of these stellar remnants that mark the final stage of the majority of stars' lifecycles. Unravelling this distribution requires untangling the influences of the initial mass function, star formation history, and stellar evolution. The latter can be significantly altered by the presence of a close companion star, leading to complex phases of interaction, mass loss, and merging. Coalescing white dwarfs give rise to some of the most energetic and spectacular phenomena observed in the universe.

Increasing evidence suggests that a significant portion of massive white dwarfs originates from binary mergers rather than single-star evolution. The population of massive white dwarfs is generally old and with kinematic properties consistent with those of stars belonging to the Galactic thick disc and halo. The merger scenario is also strongly supported by the presence of strong magnetic fields and rapid rotation rates.

White dwarfs in close binaries are also sources of low- frequency gravitational waves. Therefore, some of the progenitors of these merging binaries will be detectable with the space-based gravitational wave observatory LISA, which will 'hear' thousands of them millions of years before they merge.

In this presentation, I will provide an overview of our current understanding of massive white dwarfs and their characteristics (e.g., mass, atmospheric composition, magnetic field, age) and I will emphasise the critical role that massive white dwarfs play in numerous exotic and powerful astrophysical phenomena.

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