W33a Evolution of hot white dwarf binaries

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The Laser-Interferometer-Space-Antenna (LISA) will be capable of detecting 10's of thousands of Galactic double white dwarf binaries with orbital periods <20 minutes. The current catalogue of detached white dwarf binaries detected by Zwicky Transient Facility (ZTF) suggests that short-period binary components are hot (surface temperatures > 15,000 K), and that their radii are up to a factor of two larger than the cold mass-radius relation for completely degenerate white dwarfs (Eggleton 1983). This is also the case for the recent, first ever temperature measurement of a mass transferring donor white dwarf in a binary (Burdge et al. 2023). Taken together, these observations are in conflict with the theoretical picture typically assumed in Galactic population modelling. Namely, that white dwarfs cool before the onset of mass transfer, so that the stability criteria for white dwarf binary mergers is determined by the cold mass-radius relation. Using a temperature-dependent mass radius relation, we show that a larger fraction of Galactic white dwarf binaries should merge, compared to using the cold relation. Next, we consider tidal heating as a possible explanation for the temperature evolution suggested by these observations. Finally I will put these results into context regarding preparing for the unprecedented data set of Galactic white dwarf binaries from LISA in the 2030s.