The diverse outcomes of massive white dwarf binary mergers



Many uncertainties affect the predicted white dwarf binary population

- Common envelope evolution
 - critical mass ratio for unstable mass transfer
 - envelope ejection efficiency
- Metallicity-dependent binary fraction
- Initial binary properties (separations, eccentricity, mass ratios)
- Milky Way star formation history
- White dwarf tides



The (currently uncertain) shape of this foreground affects *all* LISA science!

1. LISA verification binariese.g. ZTF (*Burdge+2020*), ELM survey (*Brown+2020*)

2. LISA progenitors (white dwarf+star binaries) e.g. SDSS (*Zorotovic+2010*), Gaia (*Yamaguchi+2024*)



Final outcomes for different white dwarf merger masses



Marsh+2004, Dan+2014, Shen 2015, Kremer+2022, Ferrario 2025



Breivik+2018, Tauris+2018)

Marsh+2004, Dan+2014, Shen 2015, Kremer+2022, Ferrario 2025





Marsh+2004, Dan+2014, Shen 2015, Kremer+2022, Ferrario 2025



- Dessart+2006
- Fast blue optical transient powered by magnetar? (*Lyutikov & Toonen* 2019)
- Fast radio bursts? (*Margalit+2019*)

Example Galactic population model



Evidence from globular cluster pulsars



Evidence from globular cluster pulsars



Evidence from globular cluster pulsars



All six young pulsars found in *core-collapsed* clusters, consistent with white dwarf merger origin

Fast Radio Bursts in Globular Cluster from White Dwarf Merger Collapse?



- Distance ~ 3.6 Mpc (closest extragalactic FRB known)
- A second globular cluster FRB candidate announced by CHIME in February 2025! Shah+2025, Eftekhari+2025,

