UNIVERSITY OF WARSAW

Astronomical Observatory of the University of Warsaw
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White Dwarf Binaries as Gravitational Wave sources

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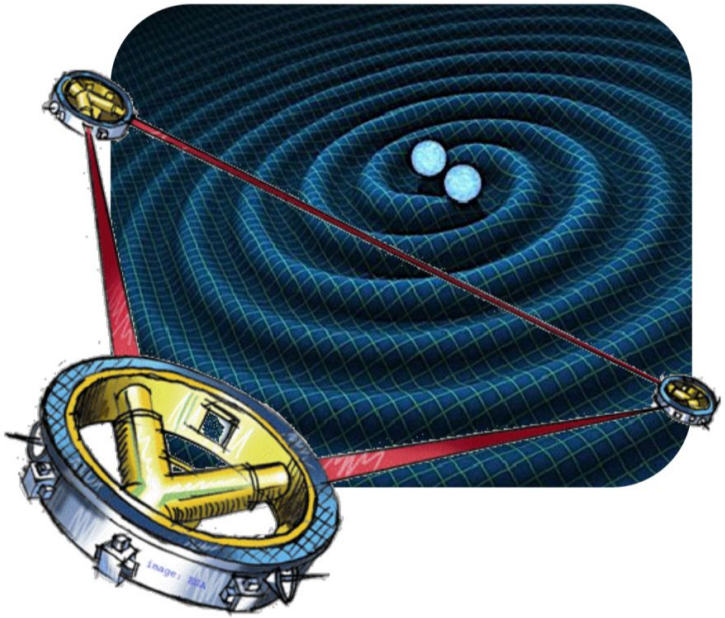
01

Motivation

Modelling the Gravitational Wave background from White Dwarf Binaries in the LISA sensitivity range and building a model of their population in the Milky Way.

- White Dwarfs are remnants of Sun like stars and their binaries make a significant portion of our galaxy.
- They emit gravitational waves in the range 0.1 to 100 mHz, matching LISA's sensitivity range.
- Excellent laboratories for studying binary stellar evolution.
- Detecting these binaries with LISA will help us to test gravitational wave astronomy in low-frequency regime.



02

Working

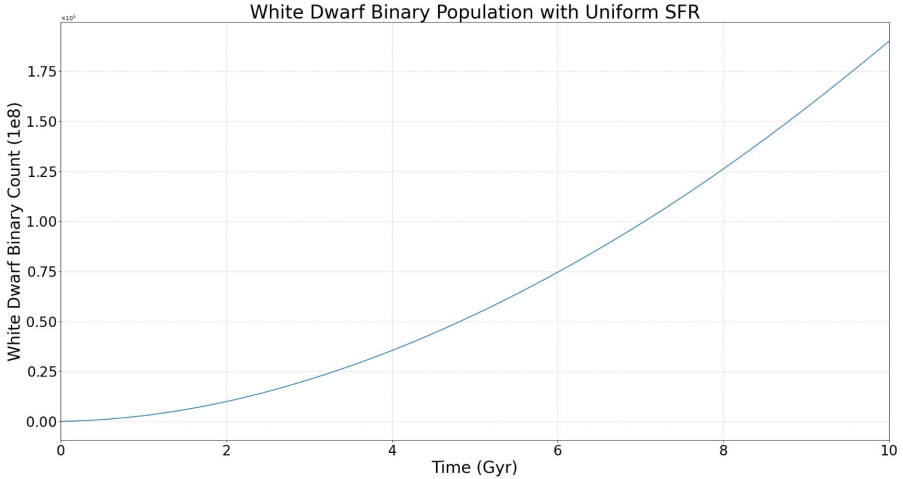
- COMPAS (https://compas.science/)is used for simulating the White Dwarf Binaries from their progenitors.
- Legwork (https://github.com/TeamLEGWORK/) for post processing.

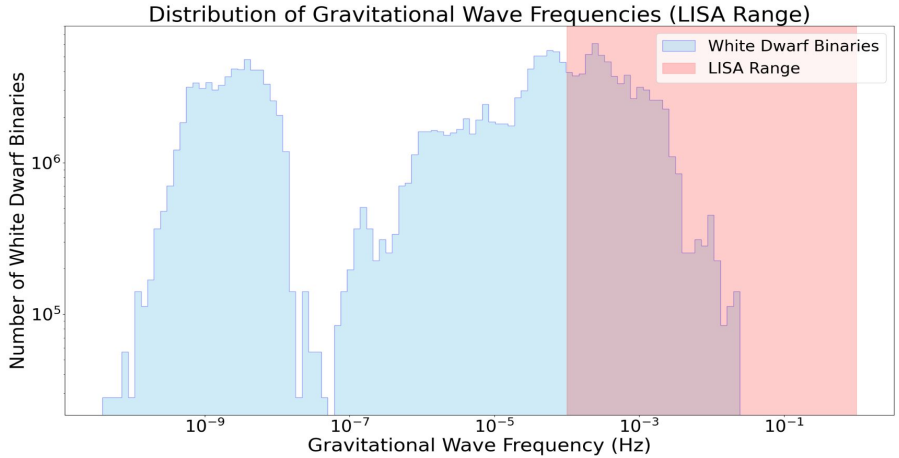
Initial parameters for COMPAS :

- Mass : 0.5 - 15 Msun
- Mass function : Salpeter
- Mass ratio distribution : Flat
- Semi-major axis : 0.01 - 10 AU
- Semi-major axis distribution : Flat in log
- Eccentricity distribution : Thermal
- Varied CE prescriptions

03 Result

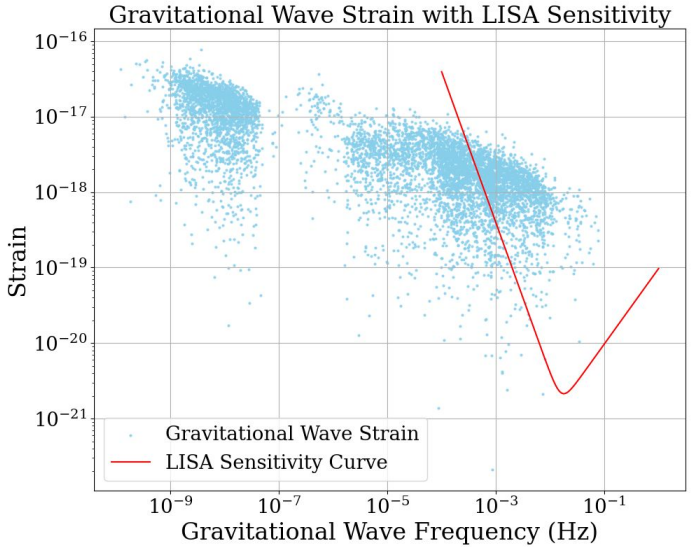
- The White Dwarf Binary population for Milky Way is calculated assuming a constant SFR.
- Gravitational Wave frequencies are calculated for these sources



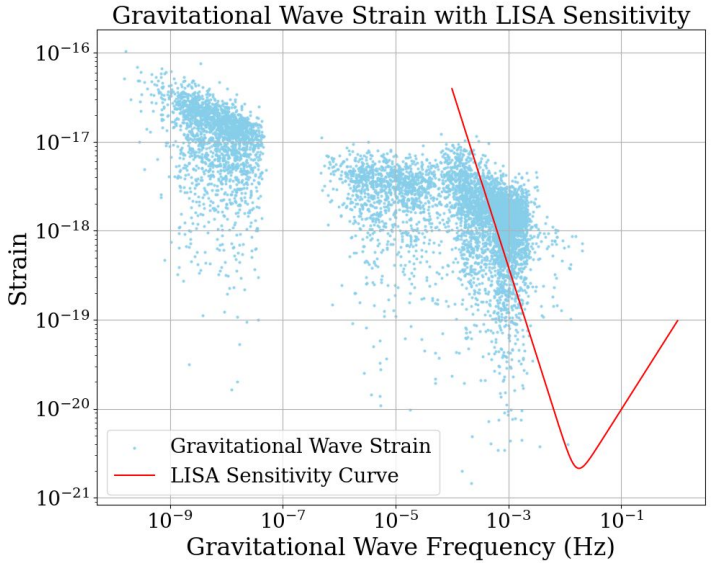


03 Result

The Gravitational Wave strain is calculated and plotted against the LISA sensitivity curve for models with different CE prescriptions.



CE Prescription : Lambda Nanjing (0.5-1)



CE Prescription : Lambda Kruckow (0.01-0.1)

04 Summary

- White Dwarf Binaries (WDBs) are important sources of gravitational waves for LISA.
- The current population of WDBs is calculated to be about 10^8 assuming constant SFR out of which 10^7 are in the LISA range.
- Higher lambda values correspond to efficient CE ejection compared to lower lambda values, which in turn affect the number of binaries in LISA range and their effective strain for gravitational wave calculations.
- Galactic WDBs contribute to the gravitational wave background in LISA sensitivity range and can help to understand the statistical properties of tight WDBs and constrain binary evolution.