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Pulsar-black hole binaries in the dynamical environment of star clusters

Over a third of all observed millisecond pulsars appear in Galactic globular clusters, which collectively account for less than 0.05% of the total number of stars in the Milky Way. Recently, there have been radio observations (with MeerKAT) of a possible millisecond pulsar-black hole (mass gap) eccentric binary in the globular cluster NGC 1851. On the other hand, the current generation of gravitational wave detectors (LIGO-Virgo-KAGRA, LVK) has been discovering neutron star-black hole binaries.

Using detailed pulsar evolution (through massive binary evolution) in massive globular clusters modeling (using the code PeTar), I will show the formation mechanism behind such pulsar-black hole binaries, aiming to decouple the contributions of angular momentum gain through mass transfer and tidal encounters in spinning up a neutron star. Accounting for radio selection effects, I will specifically highlight the MeerKAT-observed NGC 1851 millisecond pulsar binary and elaborate on the mass, mass ratio, spin, and eccentricity of such binaries. Furthermore, I will link such neutron star-black hole systems to those being observed by the LVK. I will also provide predictions for the near future, including ongoing high sensitivity radio telescopes like the SKA and MeerKAT, upcoming LVK observing runs, as well as future gravitational wave missions like the Laser Interferometer Space Antenna (LISA) and the Cosmic Explorer (CE).

Affliation

Cardiff University

Current Position

Postdoc

Primary author: CHATTOPADHYAY, Debatri (Cardiff University)

Co-authors: ANTONINI, Fabio (Cardiff University); WIKTOROWICZ, Grzegorz; BARBER, Jordan (Cardiff University); SPURZEM, Rainer (Astronomisches Rechen-Institut, Zentrum für Astronomie der Universität Heidelberg / National Astronomical Observatories and Key Laboratory of Computational Astrophysics, Chinese Academy of Sciences / Kavli Institute for Astronomy and Astrophysics, Peking University)

Presenter: CHATTOPADHYAY, Debatri (Cardiff University)

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