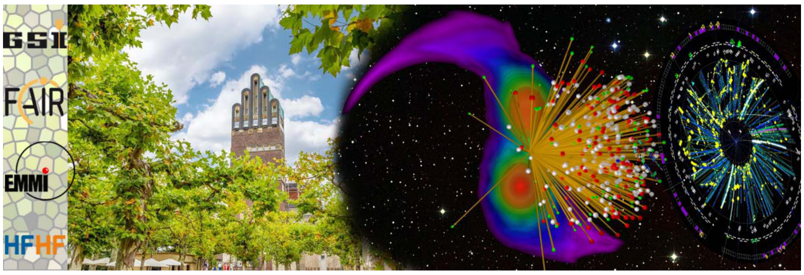

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Tidal heating as a direct probe of Strangeness inside Neutron stars

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The cores of neutron stars (NS) reach densities several times the nuclear saturation density and could contain strangeness containing exotic particles such as hyperons. During the binary inspiral, viscous processes inside the NS matter can damp out the tidal energy induced by the companion and convert this to thermal energy to heat up the star. We demonstrate that the bulk viscosity originating from the non-leptonic weak interactions involving hyperons is several orders of magnitude higher than the standard neutron matter shear viscosity in the relevant temperature range of $10^6 - 10^9$K and for heavier mass NSs ($M \geq 1.6 M_{\odot}$) that contain a significant fraction of hyperons in their core, the bulk viscosity can heat up the stars upto $0.1 - 1$ MeV before the final merger. This "tidal heating" process also introduces a net phase shift of $10^{-3} - 0.5$ rad, depending on the component mass, in the gravitational wave (GW) signal that can potentially be detected using current and future generation GW detectors. Such a detection would be the direct confirmation of the presence of hyperons inside the NS core, having a great significance for the study of dense matter under extreme condition.

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