Contribution ID: **61** Type: **Talk**

Thermal Relaxation of Dark Matter Admixed Neutron Star

Thursday 15 December 2022 16:15 (15 minutes)

Motivated by the various theoretical studies regarding the efficient capturing of dark matter by neutron stars, we explore the possible indirect effects of captured dark matter on the cooling mechanism of a neutron star. The equation of states for different configurations of dark matter admixed star at finite temperature is obtained using the relativistic mean-field formalism with the IOPB-I parameter set. We show that the variation in the dark matter momentum vastly modifies the neutrino emissivity through specific neutrino generating processes of the star. The specific heat and the thermal conductivity of a dark matter admixed star have also been investigated to explore the propagation of cooling waves in the interior of the star. The dependence of theoretical surface temperature cooling curves on the equation of state and chemical composition of the stellar matter has also been discussed along with the observational data of thermal radiation from various sources. We observed that the dark matter admixed canonical stars with $k_f^{\rm DM} > 0.04$ comply with the fast cooling scenario. Further, the metric for internal thermal relaxation epoch has also been calculated with different dark matter momentum and we deduced that increment of dark matter segment amplify the cooling and internal relaxation rates of the star.

Session

Astroparticle Physics and Cosmology

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Session Classification: WG1-Astroparticle Physics and Cosmology