Contribution ID: **28** Type: **not specified**

Investigating the effect of dark matter component on neutron star equation of state using the gravitational wave observation from binary neutron star merger GW170817

Friday, 14 January 2022 12:35 (10 minutes)

We investigate the effect of a dark matter component inside a neutron star using gravitational wave constraints coming from binary neutron star merger. We consider the nuclear matter using the relativistic mean-field model including $\sigma - \omega - \rho$ meson interaction. We study fermionic dark matter interacting with nucleonic matter via the Yukawa interaction inside the neutron star. We show that admixture of dark matter inside the neutron star softens the equation state which gives rise to a lower value of the tidal deformability. Gravitational-wave observation GW170817 puts a constraint on the upper bound on the tidal deformability of a binary neutron star. Such gravitational wave observation puts a stringent constraint on the nuclear equation of state. We investigate any physical implication of such an observational constraint coming from the gravitational wave observation on the dark matter admixed neutron stars. We argue that in the presence of a dark matter component even the stiff equation of state, e.g. the Walecka model with NL3 parameterization satisfy the tidal deformability bound coming from the gravitational wave observation.

Reference: This abstract is based on our works, Phys. Rev. D 99, 043016 (2019) and arXiv:2011.01318

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Session Classification: Young Scientists' Session: Dark matter and astrophysical neutrinos