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Compatibility of the dark matter condensation inside the neutron stars and their observed properties

We study a compatibility of the dark matter condensation inside the neutron stars with the observational constraints on the properties of these astrophysical objects. Effects of the baryon-lepton matter are taken under control based on the well tested novel equation of state of nuclear matter, which is able to fulfil a rich collection of constraints from nuclear physics and heavy ion collision experiments. Considering the dark matter as a free Fermi gas coupled to usual matter only by gravity we explicitly introduce mass and quantum mechanical degeneracy of these particles to the problem. Integration of the Tolman-Oppenheimer-Volkoff equation allows us to obtain the mass-radius diagram of neutron stars for different concentrations of dark matter particles and their masses from 100 MeV to 1 TeV. We argue, that concentrations of the dark matter typical for the Milky Way galaxy do not allow its particles to be heavier than several hundreds of GeV. This result can serve as a constraint for beyond the Standard Model theories aiming to explain the dark matter nature in terms of WIMPs.

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