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Analysis on the black hole formations inside old neutron stars by isospin-violating dark matter with self-interaction

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Fermionic dark matter (DM) with attractive self-interaction is possible to form black holes (BH) inside the Gyr-old neutron stars (NS). Therefore by observing such NS corresponding to their adjacent DM environments can place bounds on DM properties, eg. DM-baryon cross section $\sigma_{\chi b}$, DM mass m_χ, dark coupling α_χ and mediator mass m_ϕ. In case of isospin violation, DM couples to neutron and proton in different strengths. Even NS is composed of protons roughly one to two percent of the total baryons, the contribution from protons to the DM capture rate could be drastically changed in the presence of isospin violation. We demonstrate that this effect can be important in certain cases. On the other hand, DM-forming BH inside the star is subject to many criteria and the underlying dynamics is rich with interesting features. We also systematically review the relevant physics based on the virial equation.

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Secondary track (number)

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