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Stellar Constraints on Dark matter

Due to their extreme density and low temperature, neutron stars (NS) are efficient probes to unveil interactions between standard model and dark matter (DM) particles. From elastic scatterings on NS material, DM can get gravitationally trapped by the star.

The in-falling DM unavoidably transfers heat to the NS and can increase the temperature of old NS up to $\sim$ 1700 K. Moreover, if DM is symmetric, its annihilations inside the NS also heat up old NS to $\sim$ 2400 K, leading to an infrared blackbody spectrum that is in principle within range of future telescopes. In the first half of the talk I will discuss the implications for a model with DM charged under a local $U(1)_{L_\mu - L_\tau}$.

Furthermore, if DM is asymmetric, the thermal DM cloud formed inside the NS could collapse into a black hole, thus destroying the whole NS. From the observation of old NS, such a scenario leads to very stringent constraints on the parameter space of asymmetric DM. In the final part of the talk I will revisit this possibility in a model with asymmetric DM with significant attractive self interactions.

Summary

The talk will be based on arXiv:1906.10145, arXiv:1812.08773
and a work in preparation.

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