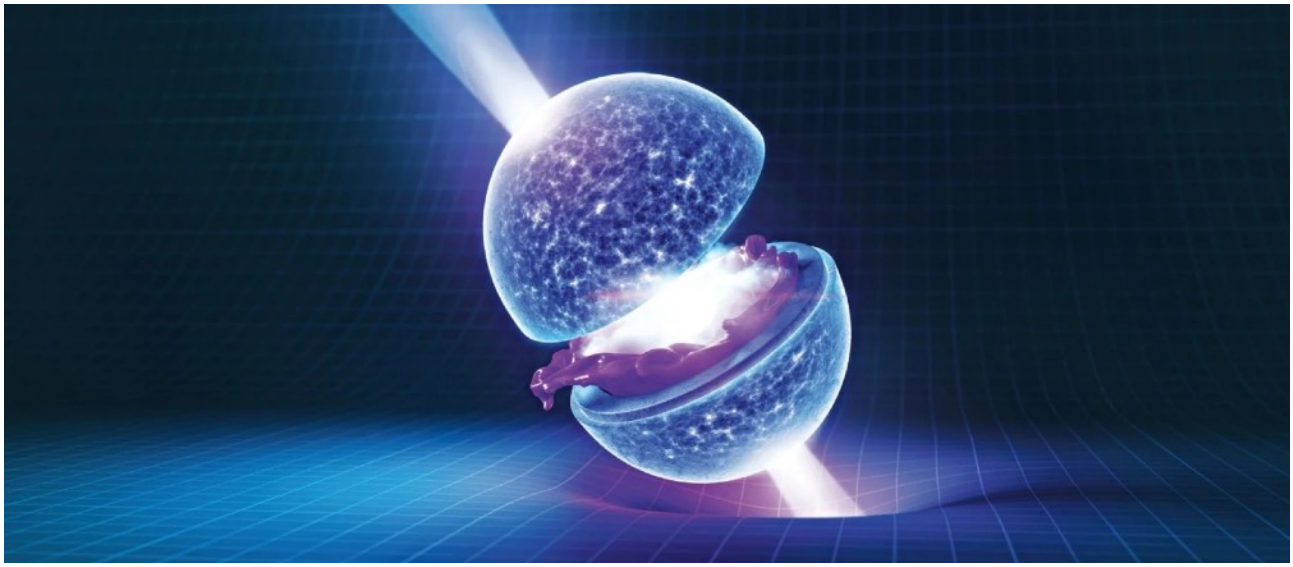
Probing dark matter with compact stars

E. Giangrandi[1]

V. Sagun[1], C. Providência[1], T. Dietrich[2,3], O. Ivanytskyi[4]

[1] CFisUC, Department of Physics, University of Coimbra, Rua Larga P-3004-516, Coimbra, Portugal
[2] Institut für Physik und Astronomie, Universität Potsdam, Karl-Liebknecht-Str. 24/25, Potsdam, Germany
[3] Max Planck Institute for Gravitational Physics, Am Mühlenberg 1, Potsdam, Germany
[4] Institute of Theoretical Physics, University of Wroclaw, 50-204 Wroclaw, Poland

9 November 2022



Compact stars due to their enormous gravitational field can accumulate a sizeable amount of dark matter in their interior. Depending on its nature, an accumulated dark matter may affect the properties of neutron stars in quite different ways. I will give an overview of the impact of dark matter on various observable properties of neutron stars, i.e. the mass-radius relation, tidal deformability, surface temperature, merger dynamics and gravitational wave waveform, etc. The conditions at which dark matter particles tend to condensate in the core of the star or create an extended halo will be presented. I will show how dark matter condensed in a core tends to decrease the total gravitational mass and tidal deformability compared to a pure baryonic star, which appears as an effective softening of the equation of state. On the other hand, the presence of a dark matter halo has an opposite effect, causing an increase of those observable quantities. Thus, observational data on compact stars could be affected by an accumulated dark matter and, consequently, constraints we put on the strongly interacting matter at high densities. I will discuss how the ongoing and future x-ray, radio and gravitational wave observations could shed light on dark matter admixed compact stars and put multi-messenger constraints on the corresponding effect.