Dipartimento di Fisica
Università di Cagliari
INFN, Sezione di Cagliari

High Energy Physics Colloquia

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Compact Objects as Dark-Matter Probes

Abstract

Compact objects are unique probes of beyond-Standard Model physics. I will discuss two representative examples in which compact-object observations can be used to constrain dark matter. During the motion of a binary pulsar around the Galactic center, the pulsar and its companion experience a wind of dark-matter particles that can affect the orbital motion through dynamical friction. This effect produces a characteristic seasonal modulation of the orbit and causes a secular change of the orbital period whose magnitude can be well within the astonishing precision of various binary-pulsar observations. Furthermore, if ultralight bosonic fields exist in nature, black holes may undergo superradiant instabilities. This effect, together with precision measurements of the mass and spin of astrophysical black holes, has been used to constrain axion-like particles, to derive bounds on light vector fields and on the mass of the graviton, as well as to constrain the fraction of primordial black holes in dark matter. The theoretical potential of these phenomena as almost-model-independent smoking guns for physics beyond the Standard Model are presented.

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