



Contribution ID: 163

Type: Talk

Dark matter and black holes at the centers of galaxies: from gravitational dynamics to particle phenomenology

Monday, 2 September 2019 14:30 (19 minutes)

Regardless of the precise nature of dark matter (DM), its distribution in the central regions of galaxies remains poorly constrained at present. In particular, DM halos may be significantly affected by the presence of central supermassive black holes, leading to the possible formation of high density spikes. Two objects are of particular interest in this context: *Sgr A* at the center of the Milky Way, where precision astrometry and spectroscopy provide a direct probe of the gravitational potential, and *M87* at the center of the M87, which is a prime target of the Event Horizon Telescope, being the first ever black hole observed directly.

I will discuss different avenues that can shed light on the characteristics of the DM distribution in the cores of galaxies and the underlying properties of DM candidates. I will focus in particular on the kinematics of the *S2* star at the Galactic center—which constrains the amount of dark mass around *Sgr A*—and electromagnetic signatures of DM annihilation on the shadow of *M87*.

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Session Classification: Parallel Sessions: Dark Matter and Astroparticle (C.A.R.L., H08)

Track Classification: Dark Matter and Astroparticle Physics