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Blazar-boosted dark matter: a cosmic accelerator for dark matter particle detection

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The search for dark matter (DM) remains one of the most pressing challenges in modern physics. Detecting sub-GeV DM particles poses significant challenges for traditional Earth-based detectors due to their low collision energies. This talk presents a novel approach to overcome these limitations: blazar-boosted dark matter (BBDM). I will explore how active galactic nuclei (AGN) with jets oriented towards Earth, known as blazars, can serve as cosmic particle accelerators for DM. Through interactions with hadronic matter in blazar jets, DM particles in the host galaxy's halo can be significantly accelerated, potentially reaching Earth with kinetic energies high enough for detection.

This presentation will cover the theoretical framework of BBDM, including blazar selection, modeling, and the upscattering mechanism in the DM halo. Additionally, I will present the first constraints on this framework using data from leading direct detection experiments, including XENON and LZ, demonstrating how these world-class detectors can probe this novel dark matter scenario. Notably, this is the first work that brings together experimental particle physicists, astrophysicists, and theoretical physicists, representing a cross-section of different disciplines. This approach allows us to explore the potential of BBDM, potentially opening new avenues for DM research.

Secondary track

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