

Cosmic-ray boosted dark matter confronted by constraints on new light mediators

Tuesday, 2 July 2024 12:40 (5 minutes)

Direct detection experiments lose sensitivity to light dark matter because of the small energy deposition in nuclear recoil events. Scenarios where dark matter is boosted to relativistic velocities thus provide a promising means to constrain sub-GeV dark matter particles. Cosmic-ray upscattering is a particularly appealing boosting mechanism as it does not require any assumptions beyond dark matter coupling to nucleons or electrons. However, observable signals are restricted to large cross sections which can only be realized with large couplings, light mediators or composite dark matter. Considering a general set of light mediators that couple dark matter to hadrons, we use data from Borexino, XENON1T, LZ and Super-K to show that existing constraints on such mediators exclude appreciable cosmic ray upscattering. This finding highlights the limited applicability of cosmic-ray upscattering and the importance of considering model dependence.

Title of the Poster/Talk

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<https://arxiv.org/abs/2309.11003>

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Session Classification: Young Scientist Forum