Contribution ID: **186** Type: **Parallel talk**

Strongly interacting dark sectors with light vector mesons

Tuesday, 9 July 2024 16:30 (20 minutes)

The dark pion, π_D, is generally the lightest meson of strongly interacting dark sectors, which makes it a popular dark matter candidate. However, it is facing the challenge of simultaneously reproducing the relic abundance and satisfying constraints on dark matter self-interaction from the Bullet Cluster. This challenge can be overcome by considering additional light mesons of the dark sector, such as the vector meson ρ_D. In such a set-up, the $3\pi_D \to \pi_D\rho_D$ annihilation channel dominates the freezeout of the π_D, allowing higher π_D masses and weaker self-interactions. Additionally, the ρ_D is forced to decay into standard model states, revealing the possibility of exciting novel signatures, such as displaced vertices and emerging and semi-visible jets.

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Session Classification: Parallel 2

Track Classification: Parallel session: Theory