



Contribution ID: 154

Type: **Presentation**

Co-annihilating dark matter and effective operator analysis

Friday, June 27, 2014 5:45 PM (15 minutes)

We study dark matter (DM) models in which there are two dark sector particles, χ_1 and χ_2 , of near mass. In such models, co-annihilation of χ_1 and χ_2 may be the dominant process controlling the DM relic density during freezeout in the early universe. In this scenario, there is no significant contribution to direct and indirect detection signals, unless there exists an extreme degeneracy in the masses of the lightest dark sector particles. Therefore, relic density constraints and collider searches provide the most relevant information about these models. We consider Dirac fermion dark matter which couples to standard model (SM) particles via an effective operator. For the collider phenomenology, where an effective field theory may not be valid, we adopt a simple Z' model to provide an appropriate UV completion. We explore the interesting LHC signals that arise from the dark matter production process $pp \rightarrow \bar{\chi}_1 + \chi_2 + \text{jet}$, followed by the decay $\chi_2 \rightarrow \chi_1 + SM$.

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Session Classification: Particle Physics

Track Classification: Particle Physics