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Better Mass Measurements Using Many-body Phase Space in Cascade Decay

Monday 5 May 2014 15:45 (15 minutes)

I will talk about the mass measurements for dark matter and its mother particles appearing in decay chains can be improved by determining the boundary of the available phase space in its full dimensionality rather than by using one-dimensional kinematic features for each stage of the cascade decay. This is demonstrated for the case of one particle decaying to three visible and one invisible particles in a two-stage cascade, but our methods also apply to a more general set of decay topologies. We show that not only mass differences, but also the overall scale of masses can be determined with high precision without having to rely on cross section information. The improvement arises from the properties of the higher dimensional phase space itself, independent of the matrix element for the decay, and it is not weakened by the presence of intermediate on-shell particles in the cascade. Our results are particularly significant for the case of low signal statistics, a distinct possibility for new physics searches in the near future.

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