

Dynamical Dark Matter: A New Framework for Dark-Matter Physics

Prof. Keith R. Dienes

University of Arizona / University of Maryland

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In this talk, I will provide an introduction to an alternate framework for dark-matter physics which we call "Dynamical Dark Matter" (DDM). Within this framework, the requirement of dark-matter stability is replaced by a balancing of lifetimes against cosmological abundances across an ensemble of individual dark-matter components with different masses, lifetimes, and abundances. It is this DDM ensemble which collectively serves as the dark-matter "candidate" within the DDM framework, and which collectively carries the observed dark-matter abundance Ω_{CDM} . Likewise, it is the balancing between lifetimes and abundances across the ensemble as a whole which ensures the phenomenological viability of the DDM framework--indeed, the usual notion of dark-matter stability is no longer required. As we shall discuss, this leads to a highly dynamical cosmology in which quantities such as Ω_{CDM} experience non-trivial time-dependences beyond those normally associated with the expansion of the universe. DDM ensembles arise naturally in many extensions to the Standard Model, including string theory and theories with large extra spacetime dimensions. Moreover, the DDM framework can lead to many striking signatures at colliders as well as at direct- and indirect-detection dark-matter experiments--signatures which transcend those usually associated with traditional dark-matter candidates. In this talk I shall give a theoretical overview of the DDM framework, and survey the research which has been done in this field thus far.