



High Energy Physics - Phenomenology

# Dynamical Dark Matter: II. An Explicit Model

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In a recent paper ([arXiv:1106.4546](#)), we introduced "dynamical dark matter," a new framework for dark-matter physics, and outlined its underlying theoretical principles and phenomenological possibilities. Unlike most traditional approaches to the dark-matter problem which hypothesize the existence of one or more stable dark-matter particles, our dynamical dark-matter framework is characterized by the fact that the requirement of stability is replaced by a delicate balancing between cosmological abundances and lifetimes across a vast ensemble of individual dark-matter components. This setup therefore collectively produces a time-varying cosmological dark-matter abundance, and the different dark-matter components can interact and decay throughout the current epoch. While the goal of our previous paper was to introduce the broad theoretical aspects of this framework, the purpose of the current paper is to provide an explicit model of dynamical dark matter and demonstrate that this model satisfies all collider, astrophysical, and cosmological constraints. The results of this paper therefore constitute an "existence proof" of the phenomenological viability of our overall dynamical dark-matter framework, and demonstrate that dynamical dark matter is indeed a viable alternative to the traditional paradigm of dark-matter physics. Dynamical dark matter must therefore be considered alongside other approaches to the dark-matter problem, particularly in scenarios involving large extra dimensions or string theory in which there exist large numbers of particles which are neutral under Standard-Model symmetries.

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