**Abstract for THEORY CANADA 9, Wilfrid Laurier University, June 12-15, 2014**

# Dark Forces and Two Dark Matter Models: DDM and DDDM

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## Abstract

The majority of Dark Matter candidates being considered today are electrically neutral (dark), non-relativistic (cold) Beyond Standard Model (BSM) theoretical proposals that result in single particles or a small set of particles with predicted lifetimes usually exceeding the age of the universe (i.e., 'hyper-stable' particles). **Dynamical Dark Matter** (DDM) [1], however, is a recently hypothesized form in which this last requirement is relaxed, by conjecturing instead a very large ensemble of particle species which might decay with finite lifetimes, but where the lifetimes are in a fine balance with their abundances, hypothesized as individually small. Any decays thus manage to preserve the overall dark matter density in the universe. Another Dark Matter Model, **Double-Disk Dark Matter** (DDDM) [2] similarly relaxes the minimality inherent in most Dark Matter models by hypothesizing a dark matter world that is just as rich and complex in particle species, their masses and their interactions, as the visible one. Separately, it has been suggested that Dark Matter could conceivably consist of particles that interact with each other via hypothesized Dark Forces [e.g., 3]. We consider the Sommerfeld enhancement of interaction cross sections in these contexts; astrophysical & cosmological consequences of these ideas, and their potential implications for detector experiments.

## References

1. K. R. Dienes and B. Thomas, "Dynamical Dark Matter: I. Theoretical Overview," arXiv:1106.4546.
2. J. J. Fan, A. Katz, L. Randall, and M. Reece, "Double-Disk Dark Matter", arXiv:1303.1521
3. Nima Arkani-Hamed et al. "A Theory of Dark Matter". arXiv:0810.0713