

*CAP undergraduate lecture tour*

## Searching for Physics Beyond the Standard Model at SNOLAB

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**ABSTRACT:** Particle Physics is currently at a crossroad – with the Discovery of the Higgs Boson in 2012, most of the predictions of the Standard Model of Particle Physics have been confirmed, leaving researchers wanting to further probe the nature of our Universe without a clear roadmap. Two long-standing questions, with possibly open-ended answers, are “what is the nature and absolute mass scale of the neutrino?” and “what is the dark matter that makes up most of our Universe ?” In this talk I’ll discuss the current status of those problems, and how they can be addressed by searching for rare interactions deep underground in the SNOLAB facility near Sudbury, Ontario. A leading explanation for the make-up of the dark matter is that there exists a never-before-observed particle contributing to the most of the matter density in the Universe, and there is currently intensive worldwide activity aimed at observing this particle directly. Starting in the 1980’s, direct searches for cosmological dark matter particles were performed with small-scale detectors, with active masses less than one kilogram, and began placing constraints on the allowed ranges of masses and interaction cross-sections of these new particles. During the past ten years, advances in the field have significantly extended experimental sensitivity to dark matter particles by instrumenting detectors with target masses of tens to hundreds of kilograms, with still no positive detection. A new experiment being pioneered in Canada (DEAP-3600) allows a further increase in sensitivity by instrumenting an even larger target mass of 3.6 tonnes of liquid argon, and has begun operation in 2016. The technique could in the future be scaled to extremely large target masses, on the order of hundreds of tonnes. I will present an overview of searches for new physics beyond the standard model at SNOLAB, a description and status of the experimental search for dark matter with DEAP-3600, and plans for a new detector facility at Carleton University that will be used to develop future large-scale noble liquid detectors and fully exploit the exciting science of SNOLAB.

ALL ARE WELCOME!