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THE UNIVERSITY of WISCONSIN MADISON

Department of Physics Colloquium

Friday, March 5, 2010 • 4:00 P.M. • 2241 Chamberlin Hall

cookies & coffee served at 3:30 p.m

Uncovering the Nature of Dark Matter with Direct Detection Experiments

Status and Prospects from a XENON Perspective

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More than 80% of the matter in the universe is in the form of non-baryonic Dark Matter. “Regular” matter makes up less than 5% of the matter and energy content of the universe. Understanding the nature of Dark Matter ranks therefore among the outstanding questions in physics today. The rapid formation of structure in the early universe from small density variations as observed in the Cosmic Microwave Background supports the idea of Dark Matter being a thermal relic of Weakly Interacting Massive Particles (WIMPs).

WIMPs can be detected in principle by their interactions with regular matter. The XENON Dark Matter program pursues the goal of directly detecting nuclear recoils resulting from scattering with Weakly Interacting Massive Particles (WIMPs), using increasingly more sensitive experiments. The detector concept consists of a dual-phase liquid/gas xenon time projection chamber with a low energy threshold. It discriminates against background using simultaneous measurements of the primary scintillation light and the charge signal, resulting from interactions in the noble liquid. Following the successful XENON10, the current experiment XENON100 features 10 times greater sensitive mass and 100 times lower background. XENON100 aims at improving sensitivity by a factor of 20 over current limits.

I will provide an overview of the field, describe the status of XENON100, and discuss its physics reach along with future prospects of detectors at the ton scale.