Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **4350** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Searching for neutrino absorption in 40Ar using the DEAP-3600 dark matter detector

Monday 27 May 2024 11:45 (15 minutes)

The highest energy range (~MeV) of the solar neutrino spectrum are dominated by 8B neutrinos produced in the pp-chain in the Sun and hep neutrinos. Previous work by R.S. Raghavan, K. Bhattacharya, and others predicted the neutrinos above 3.9 MeV can be absorbed by 40Ar producing an excited state of 40K. These neutrinos can be identified by the detection of the gamma rays produced as the excited 40K state from the neutrino absorption deexcites. A search for this process relies on a detailed understanding of the background namely the radiogenic background from neutron capture and the cosmogenic background from muons interacting with material surrounding the detector. Above around 10 MeV, just past the end of the neutron capture spectrum, the expected neutrino signal dominates the background so the search for this process relies on a highly accurate background model to identify excess events that can be attributed to neutrino absorption.

We propose to search for this process using 3 years of data from the DEAP-3600, a liquid argon (LAr) direct dark matter detection experiment designed to detect WIMP-nucleon scattering in argon. DEAP-3600's ultra-low background and high sensitivity could make it possible to make the first observation of this neutrino absorption process in
LAr.

Keyword-1

neutrino absorption

Keyword-2

DEAP-3600

Keyword-3

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Session Classification: (PPD) M1-1 Neutrinos and Dark Matter 1 | Neutrinos et matière noire 1 (PPD)

Track Classification: Technical Sessions / Sessions techniques: Particle Physics / Physique des particules (PPD)