Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **248** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Muon-induced backgrounds in a new dark matter experiment: the Scintillating Bubble Chamber

Thursday 10 June 2021 12:45 (10 minutes)

Searching for low mass WIMPS has many challenges, the largest one being the discrimination between electron recoils and nuclear recoils within a given detector, the latter being a potential dark mater signal while the former is not. Many detectors cannot make this distinction and thus can only look so far in the low mass dark matter regime, but a new dark matter detector called the Scintillating Bubble Chamber (SBC) has a clever design to overcome this barrier. By having a target fluid of liquid argon that is both a bubble chamber and scintillator, scintillation from an electron recoil will distinguish the event from a lightless nuclear recoil allowing the detector to reach a 100 eV energy threshold. In addition to introducing the SBC, this talk will go over my personal contribution to the experiment, namely the study of another important background: neutrons from muon-induced spallation. Since it is impossible to know what caused a nuclear recoil just from the bubble it produces within the SBC, it is crucial to know how many neutron nuclear recoils we expect to see and their range of energies. Additionally, these events can potentially be vetoed by surrounding the SBC with a water shield. The surrounding water would cause an incoming muon to produce Cerenkov light detected by photomultiplier tubes within the shield, giving a signal that any nuclear recoils seen within the detector at that moment might be from a spallated neutron. Exactly how to build an effective water shield for SBC is the second focus of my talk. This work, studied through Monte Carlo simulations, will inform the data analysis and the water shield design of the SBC when it begins its data taking at SNOLAB in 2022.

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Session Classification: R2-8 Backgrounds and modelling for rare event searches (PPD) / Bruit et modélisation pour la recherche d'événements rares (PPD)

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