Contribution ID: **1097** Type: **Oral (Student, In Competition) / Orale (Étudiant(e), inscrit à la compétition)**

Calibration of HALO for Long-Term Supernova Monitoring

Wednesday, 15 June 2016 13:45 (15 minutes)

Supernovae are the only location where the effects of neutrino-neutrino scattering could plausibly be observed, and they are also the favored location in the universe for certain processes necessary for the formation of heavy elements. This makes supernovae mechanics relevant to the fields of both particle physics and nuclear astrophysics.

A core collapse supernova can be detected by the immense burst of neutrinos it produces. For this reason, HALO (Helium And Lead Observatory) was built to detect supernova neutrinos by detecting neutrons released from lead nuclei when struck by neutrinos. The use of lead as a target material gives the detector a unique sensitivity to electron neutrinos, where as other detectors predominantly see electron anti-neutrinos. The comparison of the spectra of different neutrino flavours could provide more information about the structure and mechanics of the core-collapse and the resulting neutrino interactions.

HALO has been connected to SNEWS (SuperNova Early Warning System) since Oct 9, 2015. SNEWS is a network of neutrino detectors around the world that will send an alarm to the astronomy community when a galactic supernova is detected. The surface of a supernova progenitor star does not explode until the shock wave from the core collapse reaches it, allowing the neutrino pulse to lead the light by a few hours. Because of this delay, SNEWS can inform astronomers of a supernova before it is visible, which will hopefully allow for a supernova to be observed from its very beginning for the first time.

HALO is expected to run continuously for decades in order to detect a supernova. This is important because most other detectors in the SNEWS network are not primarily focused on supernovae, and as such may be shut down for refurbishments aimed at other physics goals when a supernova occurs. An "always on"detector removes the possibility that SNEWS misses a galactic supernova.

The calibration of HALO will be done during March 2016 with a Californium neutron source. Knowledge of the multiplicity of the neutrons emitted will be used to make measurements independent of the listed source strength and to mitigate statistical errors. The calibration will determine the neutron drift lengths, drift times, and capture efficiencies, which will be compared to simulations and to existing muon-induced spallation event data.

Primary author: Mr BRUULSEMA, Colin (Laurentian University)

Presenter: Mr BRUULSEMA, Colin (Laurentian University)

Session Classification: W2-4 Neutrino Physics (PPD-DNP-DTP) / Physique des neutrinos (PPD-DPN-DPT)

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