Argonne NATIONAL LABORATORY

PHY Seminar

Physics Division Seminar

Yassid Ayyad Limonge

Michigan State University

Beta-Delayed Proton Decay in Neutron-Rich Nuclei

Host: Ben Kay

Monday, October 28, 2019 – 203, R150, 3:30 PM

Nuclei with more neutrons than protons tend to get rid of excess neutrons to reach the valley of stable nuclei through beta-minus (β-) decays. On the other side of the valley of stability, proton-rich nuclei follow the analogous process through beta-plus (β+) decays. Beta-delayed proton emission, observed more than 40 years ago, typically occurs in very proton-rich nuclei and not on the neutron-rich side of the stable nuclei. However, the emission of protons following β- decay is energetically allowed for neutron-rich nuclei with neutrons bound by less than 782 keV. This condition may be fulfilled in so-called halo nuclei where one or several neutrons are loosely bound and orbit far from the core. ^{11}Be is one of the most promising candidates, resulting in ^{10}Be following the beta decay to ^{11}B and the subsequent proton emission. A team of NSCL (National Superconducting Cyclotron Laboratory, Michigan State University, USA) and TRIUMF (Canada) researchers carried out the first direct observation of the beta-delayed proton decay of a neutron-rich nucleus by directly measuring the very low-energy protons emitted following the beta decay of ^{11}Be. This experiment was performed with the Active Target Time Projection Chamber (AT-TPC), a gas-filled detector capable of providing high efficiency and resolution for low-energy charged particles such as the emitted protons. In this seminar, I will discuss the technique and the results of such experiment, as well as different aspects of this decay, including a speculative dark matter decay.