Abstract

Neutrinos are some of the most fascinating particles that occur in nature. Over one billion times lighter than the proton, the neutrino was once thought to be massless and to travel at the speed of light. The Nobel-Prize winning discovery of neutrino oscillations told us that neutrinos have non-zero mass, which opens up the unique possibility of the neutrino being its own antiparticle, known as a Majorana fermion. This property could help explain the dominance of matter in our Universe. This talk will discuss the benefits of different experimental approaches for using light to observe neutrinos, and the physics thus enabled: from directional Cherenkov detectors like the Sudbury Neutrino Observatory, to its successor experiment, SNO+, which uses scintillation to probe low-energy interactions. We will then discuss technological advances that could enable a new kind of hybrid neutrino experiment: the THEIA detector would be capable of combining both signals to achieve unprecedented physics reach across low- and high-energy neutrino and rare-event physics.