NWS19-2019-000082
E

Abstract for an Invited Paper
for the NWS19 Meeting of
the American Physical Society

The Quest to Observe Matter Creation: Searching for Neutrinoless Double-Beta Decay

JASON DETWILER, University of Washington

The Standard Model of particle physics is arguably the most successful theory in human history, but it fails to account for our own existence. It predicts that matter and antimatter would have been created in equal amounts in the Big Bang, but if that were the case we should have experienced a Great Annihilation, and none of us would be here to ponder what just happened. So there must exist processes in which matter and antimatter are generated asymmetrically. However, no such process has yet been observed. Efforts are underway to search for such a matter creation process in the form of neutrinoless double-beta decay, an ultra-rare nuclear process in which two electrons are generated with no accompanying antiparticles. This hypothetical process could occur if the neutrino and the antineutrino are actually one in the same. I will describe the theoretical motivation for the neutrino to have this so-called "Majorana" nature, and it's possible connection to the matter dominance of the universe, to Grand Unification Theories, and to the lightness of the neutrino itself. I will then provide an overview of the broad, international campaign to observe this process, highlighting the excellent chances for discovery in current and next-generation experiments.