Abstract

We investigate the prospects for indirect detection of fermion WIMPless dark matter at the neutrino telescopes IceCube and DeepCore. The dark matter annihilating in the Sun is a hidden sector Majorana fermion that couples through Yukawa couplings to a connector particle and a visible sector particle, and it exhibits only spin-dependent scattering with nuclei. We consider cases where the annihilation products are taus, staus, or sneutrinos of the three generations. To evaluate the muon fluxes incident at the detector, we propagate the neutrino spectra through the solar medium and to the Earth and account for the effects of neutrino oscillations, energy losses due to neutral- and charged-current interactions, and tau regeneration. We find that for the stau and sneutrino channels, a five-year 3σ-detection of dark matter lighter than about 300 GeV is possible at IceCube for large Yukawa couplings or for dark matter and connector particles with similar masses. The tau-channel offers far better detection prospects. However, due to its lower energy threshold and better muon background rejection capability, DeepCore is able to detect signals in all annihilation channels and for a wider range of dark matter masses.