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Neutrinos as signal and background in the search for dark matter with INO

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Annihilation of Weakly Interacting Massive Particles (WIMPs) in the center of the sun($\odot$), earth($\oplus$) and the galaxy can give rise to neutrino-antineutrino pairs as their final products. We look at the prospects of detecting such neutrinos at the proposed 50-kt Iron Calorimeter (ICAL) detector, to be housed at the upcoming India-Based Neutrino Observatory (INO), wherein the interaction of neutrinos ($\nu_\mu/\bar{\nu}_\mu$) with detector iron layers will produce μ^-/μ^+. The atmospheric neutrinos in GeV range will pose a serious background to such signal neutrinos, which fortunately, can be suppressed considerably by exploiting the excellent angular resolution of the ICAL detector. The expected sensitivity limits for 500 kt-years of ICAL exposure are quite competitive to other neutrino experiments for the WIMP masses m_χ) $<$ 100 GeV. The expected 90 % C.L. exclusion sensitivity limits for 500 kt-years exposure for $\tau^+\tau^-$ channel (100 % branching ratio) for WIMP-nucleon Spin Dependent (σ_{SD}) and Spin Independent σ_{SI}) cross-section are found to be $\sigma_{SD,\odot} < 6.87 \times 10^{-41}$ cm^2 and $\sigma_{SI,\odot} < 7.75 \times 10^{-43}$ cm^2 for the WIMP mass (m_χ) = 25 GeV, and $\sigma_{SI,\oplus} = 1.02 \times 10^{-44}$ cm^2 for m_χ =52.14 GeV. For galactic centre searches, the expected 90 % C.L. sensitivity limits on velocity averaged annihilation cross-section $\langle\sigma_A v\rangle$ for a 30 GeV WIMP, assuming NFW WIMP profile and 100\% branching ratio for each channel are: $\langle\sigma_A v\rangle \leq 1.19 \times 10^{-22}$ cm^{3}s^{-1} for the $\mu^+\mu^-$ channel and \langle\sigma_{A}v\rangle \leq 6.35\times 10^{-23} \mathrm{cm}^3 \mathrm{s}^{-1}$forthe\nu ~\bar{\nu}$ channel.

Collaboration name

INO

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