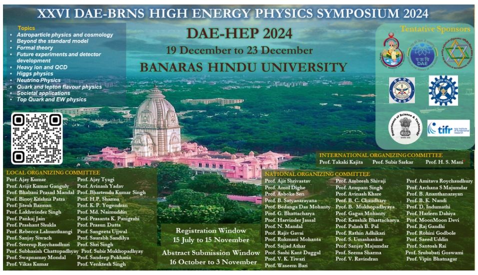

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Study of the background Xe-137 for the neutrinoless double-beta decay search in a liquid xenon

Neutrinos true nature is yet to be known, i.e., Dirac or Majorana. The most practical way to probe Majorana neutrino is by observing the neutrinoless double-beta ($0\nu\beta\beta$) decay. The observation not only confirms the Majorana nature but also constraints the effective Majorana neutrino mass ($m_{\beta\beta}$) and shows the total lepton number is not a conserved quantity. Several experiments are planned to observe the $0\nu\beta\beta$ decay. However, the detection of $0\nu\beta\beta$ decay is extremely challenging as the region of interest is largely populated by various backgrounds. ^{136}Xe is an attractive candidate for $0\nu\beta\beta$ decay search with a $Q_{\beta\beta} = 2457.83 \pm 0.37$ keV. Liquid xenon experiments— LUX-ZEPLIN, nEXO, KamLAND2-Zen, XENONnT, etc., are sensitive for $0\nu\beta\beta$ decay search of ^{136}Xe. The KamLAND2-Zen experiment sets the most stringent lower limit on the half-life of $0\nu\beta\beta$ decay: $T^{0\nu}_{1/2} > 3.8\times10^{26}$ yr at 90% C.L. and upper limit on $m_{\beta\beta}$ are in the range 28-122 meV. Neutron-capture with ^{136}Xe induces the radioactive ^{137}Xe, which could cause a background for the signal region. In this work, we simulate the production of ^{137}Xe in a cryostat filled with liquid xenon. Different neutrons of various resonance energies are confined in a cryostat and determine the production of ^{137}Xe.

Field of contribution

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