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Sensitivity to invisible modes of neutron decay on JUNO

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The Jiangmen Underground Neutrino Observatory (JUNO) is a 20 kton multipurpose underground liquid scintillator (LS) detector currently under construction in southern China. One of the capabilities of JUNO detector is to search for the baryon number violation processes, which would be a crucial step towards testing the Grand Unified Theories and explaining the matter-antimatter asymmetry of the Universe. The nucleon decay provides a direct observation of baryon number violation and has been the focus of many experiments over the past several decades. The large LS detector of JUNO has a distinct advantage in detecting nucleon decay. The JUNO LS target consists of about 88% 12C and 12% 1H. The invisible decays of neutrons from the s-shell in 12C will result in a highly excited residual nucleus. It has been found that some de-excitation modes of the excited nucleus can produce time- and space-correlated triple signals. This poster reports the JUNO sensitivity to search for invisible decay modes of the neutron. Based on the Monte Carlo simulation, we comprehensively estimate all possible backgrounds, including from inverse beta decay events of the reactor antineutrino $\bar{\nu}_e$, natural radioactivity, cosmogenic isotopes and neutral current interactions of atmospheric neutrinos. Pulse shape discrimination and multivariate analysis, two machine learning techniques, are employed to further suppress backgrounds. Then a sensitivity to neutron invisible decays on JUNO will be presented.

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