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Nucleon Decay Searches in 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 China, with a 650-meter rock overburden (1800 m.w.e.) for shielding against cosmic rays. 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 JUNO LS target consists of about 88% 12C and 12% 1H. The large LS detector of JUNO has a distinct advantage in detecting nucleon decay, with high energy resolution 3% and an excellent energy threshold of 0.7 MeV. For proton decay, the mode $p \longrightarrow \nu K$ is one of two dominant decay
modes predicted by a majority of GUTs, with expected sensitivity at $\tau /B(p \longrightarrow \nu K^{-}$
$+) > 9.6 \times 1033$ yr after 10 years of data taking. Meanwhile, neutron invisible decay has two modes, $n \longrightarrow$ inv and $nn \longrightarrow$ inv, prevalent in some new physics models. After 10 years of data taking, the JUNO expected sensitivities at a 90% confidence level are $\tau /B(n \longrightarrow inv) > 5.0 \times 1031$ yr and $\tau /B(nn \longrightarrow inv) > 1.4 \times 1032$ yr. Both decays will exceed the corresponding current best limits.

Presenter: JIANG, Cailian (Nanjing University)

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