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Application of NuGraph to Proton Decay for Event Classification & Explorations of Nuclear Effects in the Deep Underground Neutrino Experiment

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The Deep Underground Neutrino Experiment (DUNE) is an international collaboration of 1000+ researchers which will study neutrinos and search for phenomena predicted by theories Beyond the Standard Model (BSM). DUNE will use liquid argon time projection chambers (LArTPCs) containing 70 ktons of LAr, 40 ktons of which are active, located more than a kilometer underground. The high spatial resolution imaging capabilities of the LArTPC technology, in addition to the large size and underground location, allow the experiment to probe many types of rare processes while preventing cosmogenic background. One of these processes is nucleon decay with $p \rightarrow K^+ \bar{\nu}$. In this talk, I will discuss the implementation of NuGraph, a state-of-the-art graph neural network (GNN) operating natively on detector hits, as an event classifier for proton decay events. In addition to such new analysis approaches, I will discuss our current understanding of selection effects due to potential modeling choices of the intranuclear environment for this rare process.

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