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The DireXeno Experiment - Measuring the Temporal and Directional Structure of Scintillation from Liquid Xenon

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The scintillation process from Liquid Xenon (LXe) plays a major role in particle detectors. Features of it are used to estimate the energy and the type of the detected particle. An accurate model of the particle energy deposition in the LXe medium and the scintillation following it is crucial for the detector's background discrimination power and its sensitivity. DireXeno is an experiment that aims at studying the temporal and directional pattern of scintillation from LXe. The heart of the apparatus is a 1cm radius LXe target which is observed by 20 PMTs that surround it. The target is irradiated by gamma and neutron sources. We present here a process that we developed which utilizes a trained neural network to estimate the times of the photon emissions in a scintillation event based on the signals acquired by the PMTs. We show the average temporal structure of scintillation events with an emphasis on its variation with the interaction energy and type. This enables us to study a model of the temporal structure which incorporates the exponential components of the two excited states of LXe with the non-exponential recombination response, which is energy dependent.

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