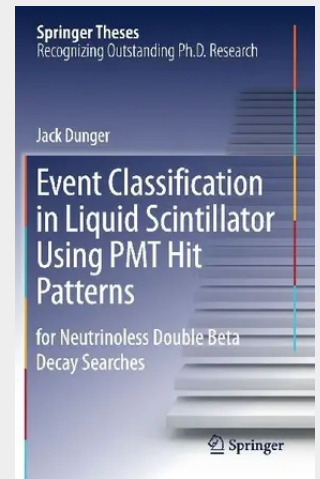


Event Classification in Liquid Scintillator Using PMT Hit Patterns

for Neutrinoless Double Beta Decay Searches

The search for neutrinoless double beta decay is one of the highest priority areas in particle physics today; it could provide insights to the nature of neutrino masses (currently not explained by the Standard Model) as well as how the universe survived its early stages. One promising experimental approach involves the use of large volumes of isotope-loaded liquid scintillator, but new techniques for background identification and suppression must be developed in order to reach the required sensitivity levels and clearly distinguish the signal. The results from this thesis constitute a significant advance in this area, laying the groundwork for several highly effective and novel approaches based on a detailed evaluation of state-of-the-art detector characteristics. This well written thesis includes a particularly clear and comprehensive description of the theoretical motivations as well as impressively demonstrating the effective use of diverse statistical techniques. The professionally constructed signal extraction framework contains clever algorithmic solutions to efficient error propagation in multi-dimensional space. In general, the techniques developed in this work will have a notable impact on the field.

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