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A Novel Liquid Scintillator Setup for Beta-spectrum Measurements

The process of neutrinoless double beta decay ($0\nu\beta\beta$) plays a crucial role in nuclear and particle physics. While several feasible candidate isotopes are available and a multitude of experimental efforts are ongoing all over the world, the decay has eluded detection. The half life measured in $0\nu\beta\beta$ experiments is converted into effective neutrino mass, where one of the main sources of uncertainties is the understanding of nuclear matrix elements. The rate at which this rare decay occurs strongly correlates with the value of the effective weak axial vector coupling strength (g_A).

We propose a new small-scale measurement setup using a well proven Liquid Scintillator (LS) technique and supplementing it with gamma-tagging. Such a detection technique has an advantage, measuring the β^+ decay energy deposition practically without a threshold and in coincidence with the two 511 keV gammas emitted from e^+e^- annihilation. Precise coincidence gating by time and energy will allow for very efficient background suppression. The gamma-tagging can also be applied to gamma-cascades or singular gammas, extending the setup's reach to β^- domain as well.

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