$\beta$–$\nu$ Correlation Precision Measurements in an Electrostatic Trap

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One of the possibilities to study fundamental interactions and the underlying symmetries is via precision measurements of the parameters of beta decay of trapped radioactive atoms and ions. For example, determining the beta-neutrino angular correlation coefficient in a trap can probe the minute experimental signal that originates from possible tensor or scalar terms in the weak interaction, thus probing possible new physics of beyond-the-standard-model nature. For precision measurements of this correlation, traps are mandatory since the recoiling nuclei, subsequent to the beta decay, are at sub-keV energies.

We have embarked on an experimental scheme to establish a novel experimental set-up to study the beta-neutrino correlation by studying the decay of the trapping light radioactive ion beam inside an Electrostatic Ion Beam Trap. This method exhibits several advantages compared to other commonly used trapping schemes in terms of concept, efficiency and ease of operation. The first nuclide under study is $^6$He, to be produced using use neutron-induced reactions and subsequent ionization in an electron ion beam source/trap (EBIT) for ionization. The $^6$He$^*$ radioisotopes will be stored in an electrostatic ion beam trap (EIBT), commonly used in atomic and molecular physics. The entire apparatus has been built at the Weizmann Institute. The method, the results of commissioning runs and future plans will be discussed.