Probing fundamental interactions by an Electrostatic Ion Beam Trap
An "in house" experiment

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The study of fundamental interactions and their underlying symmetries in ultra-high energy accelerator can be complemented via precision measurements of the parameters of the β 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, atom or ion traps are mandatory since the sub-keV energies of the recoiling nuclei, subsequent to the β decay, require a "matter free" environment.

We have embarked on a novel experimental scheme of trapping a radioactive ion beam inside an Electrostatic Ion Beam Trap. Such traps have been instrumental in many atomic, molecular and cluster physics experiments but have not been used before in the context of β-neutrino correlation measurements. This method exhibits several advantages compared to other trapping schemes in terms of concept, efficiency, applicability to other radio isotopes and ease of operation. The first nuclide under study is ^{6}He, to be produced using the neutron-induced ^{9}Be(n,α)^{6}He reaction and subsequent ionization in an electron ion beam source/trap (EBIT) for. The entire apparatus has been constructed at the Weizmann Institute and is presently undergoing acceptance tests using beams of stable ^{4}He. It is important to note that the necessary neutrons will be available at the Weizmann Institute laboratory via the use of a commercial d+t neutron generator but also using the 3 MV Van de Graaff accelerator with an intense deuteron beam impinging on a LiF target. At a later stage, such a setup will be made available at the newly constructed high flux, SARAF accelerator at the Soreq center, Israel.
The method, the present status of the setup and future plans will be discussed, with an emphasis on the "in-house" nature of this project, with the continuity aspects and un-interrupted operation. Work at the 3 MV Van de Graaff accelerator on nuclear astrophysics will be also outlined.