

Fishing in a sea of Xe - Barium-ion tagging for ^{136}Xe double-beta decay studies with EXO

EXO-200 is a detector currently searching for the existence of $0\nu\beta\beta$ decays in ^{136}Xe . A positive observation of this decay would determine that the neutrino is a Majorana particle. Furthermore, one could extract the effective Majorana neutrino mass from the half-life of such a decay. In order to push the limit of sensitivity it is necessary to suppress the background (currently dominated by gamma rays) and increase the mass of the parent isotope under observation. EXO has started development on a multi-ton scale time-projection chamber (TPC) to continue the search. One option under development is using a TPC filled with high pressure gaseous xenon as source and detection material. This layout offers the possibility to extract the Ba-daughter ions and identify them (tag). This tagging possibility, combined with enough energy resolution to separate $0\nu\beta\beta$ and $2\nu\beta\beta$ decays, allows one to dramatically reduce the background of the measurement to virtually zero.

A test setup is being developed at Stanford to demonstrate the feasibility of Ba-ion extraction from 10 bar Xe into an UHV environment. A prototype nozzle-funnel system is currently being developed. Ions produced by a Gd-driven Ba source have been extracted from both Xe and Ar gas, and the development of m/q identification is ongoing. The status of Ba-ion extraction from a high pressure Xe gas environment, along with the latest results from EXO-200 will be presented.

