Abstract Submitted
for the APR20 Meeting of
The American Physical Society

Demonstration of Single Barium Ion Detection in High Pressure Environments for Neutrinoless Double Beta Decay Using On-Off Barium Chemosensors[1] NICHOLAS BYRNES, University of Texas at Arlington, NEXT COLLABORATION — In the search for neutrinoless double beta decay, the ability to identify and reduce backgrounds is absolutely necessary, given that double beta decay is one nature's slowest decay processes. An advance that would allow us to reject our backgrounds almost entirely would be the ability to efficiently detect the barium daughter of 136-Xe to 136-Ba double beta decay in coincidence with conventional topological and energy cuts to detected electrons, since no conventional radioactive process can produce barium ions or atoms in xenon. The approach under development by the NEXT collaboration involves transporting the barium ion from the active medium onto a glass plane coated with a barium sensitive fluorescent molecule self-assembling monolayer, monitored via fluorescence microscopy. Our previous results have shown that single barium ions can be observed using both commercial and custom designed fluorescent dyes in solution through a technique called Single Molecule Fluorescent Imaging (SMFI). We show here that the new GodXilla pressure microscope system, a novel microscope operating at up to ten bar of xenon gas, can observe single fluorescent barium-chelated molecules at pressure, in the dry phase, using our custom molecules, a crucial step in getting the technique to operate in situ. This talk discusses this major step and the other developments being made for barium tagging in the NEXT collaboration.

[1]DOE Office of Nuclear Physics

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Date submitted: 10 Jan 2020 Electronic form version 1.4