Abstract Submitted
for the DNP17 Meeting of
The American Physical Society

Prospects for Searching for Time-Reversal Violation In Pa-229
JAIDEEP SINGH, Michigan State University — Certain pear-shaped nuclei are expected to have enhanced sensitivity to time-reversal and parity-violating interactions originating within the nuclear medium. In particular, Pa-229 is thought to be about 100,000 times more sensitive than Hg-199 which currently sets some of the most stringent limits for these types of interactions. Several challenges would first have to be addressed in order to take advantage of this discovery potential. First, there is not currently a significant source of Pa-229; however, there are plans to harvest Pa-229 from the FRIB beam dump. Second, the spin-5/2 nucleus of Pa-229 limits its coherence time while also making it sensitive to systematic effects related to local field gradients. On the other hand, this also gives Pa-229 an additional source of signal in the form of a magnetic quadrupole moment (MQM) which violates the same symmetries as an EDM but is not observable in spin-1/2 systems. Third, in order to compensate for the small atom numbers and short coherence times, the Pa-229 atoms would have to be probed with exceptionally large electric magnetic fields that are only possible if Pa-229 is a part of a polar molecule or embedded inside of an optical crystal. I will present an our plans to test some of these concepts using stable Pr-141.

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Date submitted: 30 Jun 2017 Electronic form version 1.4