Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3629** Type: **Invited Speaker / Conférencier(ère) invité(e)**

(I) Neutrino helicity and time-reversal breaking with TRIUMF's neutral atom trap for beta decay

Tuesday 20 June 2023 13:15 (30 minutes)

Building on our accurate measurement of the β direction's asymmetry with respect to decaying polarized ^{37}K [B. Fenker PRL 120 062502], we plan further measurements of the momenta of the recoiling progeny nucleus in coincidence. ^{37}K's decay to its isobaric analog state has similar sensitivity to unknown physics compared to neutron decay, while a nuclear structure feature where the $d_{3/2}$ unpaired proton naturally produces a tiny nuclear magnetic moment keeps known higher-order corrections small. The angular distribution of the outgoing leptons is predicted from their helicity combined with angular momentum conservation, and we've realized one of our experiments would be the most direct measurement of the ν helicity since the Brookhaven 1958 measurement. Adding γ-ray detection with high-Z GAGG scintillators enables our search for a time reversal-breaking correlation of β, ν, and γ momenta in radiative β decay, sensitive to a hypothetical dark strongly interacting sector. Time reversal-breaking interactions in the final nucleus in isospin-hindered β decay compete with the Coulomb interaction instead of the strong interaction, potentially enhancing sensitivity by 1000x to make it complementary to neutron EDM and neutron resonance time reversal tests. We are beginning a program to measure isospin breaking in isospin-hindered ^{47}K and ^{45}K decay to determine our sensitivity. ^{47}K decay, since parent and progeny are near closed shells so there are few final states, may exhaust the expected matrix element size in analog-antianalog isospin mixing.

Keyword-1

time reversal

Keyword-2

neutrino helicity

Keyword-3

beta decay

Primary author: BEHR, John (TRIUMF)

Presenter: BEHR, John (TRIUMF)

Session Classification: (DNP) T3-6 Precision Physics and Tests of Fundamental Symmetries | Physique de précision et tests des symétries fondamentales (DPN)

Track Classification: Symposia Day (Tues. June 20) / Journée de symposiums (mardi, le 20 juin): Symposia Day (DNP - DPN) - Precision Physics and Tests of Fundamental Symmetries | Physique de précision et tests des symétries fondamentales