Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **180** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Applications of ab initio nuclear theory to tests of fundamental symmetries

Thursday, June 10, 2021 12:10 PM (10 minutes)

Ab initio approaches such as the no-core shell model with continuum (NCSMC) describe nuclei as systems of nucleons experiencing inter-nucleonic forces derived from the underlying Quantum Chromo-Dynamical (QCD) structure. This, along with the NCSMC's unified description of nuclear structure and reaction theory, provide a rigorous framework that can be applied to tests of fundamental symmetries of the standard model (SM) that involve nuclei. New global analysis of Fermi decays, and the corresponding V_{ud} determination, reveal a statistical discrepancy with the well-established SM expectation for Cabibbo-Kobayashi-Maskawa (CKM) matrix unitarity. Theoretical confirmation of the discrepancy would point to beyond SM physics. Necessary for extracting V_{ud} from experiment is calculation of corrections to Fermi transition matrix elements; computing the isospin symmetry breaking correction δ_C is the main effort of this work. By studying Fermi transitions in light-nuclei, such as the ^{10}C $\rightarrow$ ^{10}B beta transition, we may perform a precision calculation of δ_C within an *ab initio* framework. Further, there exists significant motivation from the nuclear physics community for understanding the structure of the aforementioned systems. In particular, ^{10}C is of great interest as little is known experimentally about its structure. We present nuclear structure results for the following systems (i) $^{10}\mathrm{C} \rightarrow p + {}^{9}\mathrm{B}$ (ii) $^{10}\mathrm{B} \rightarrow (n + {}^{9}\mathrm{B}) + (p + {}^{9}\mathrm{Be})$ (iii) $^{10}\mathrm{Be} \rightarrow n + {}^{9}\mathrm{Be}$. A high-quality description of the first two of these systems is necessary to guarantee the accuracy of δ_C, and the third system provides an additional check on the NCSMC. We present results for ^{10}C which indicate a good description of the 0^+ ground-state for calculation of δ_C. Importantly, we also present novel structure results for the ^{10}B system considered as two mass partitions, including the charge-exchange reaction. Lastly, we aim to present a preliminary result for the determination of δ_C in the NCSMC.

Author: GENNARI, Michael (TRIUMF)

Co-authors: Dr ATKINSON, Mack (TRIUMF); Dr NAVRATIL, Petr (TRIUMF)

Presenter: GENNARI, Michael (TRIUMF)

Session Classification: R1-5 Theory II (DNP) / Théorie II (DPN)

Track Classification: Nuclear Physics / Physique nucléaire (DNP-DPN)