Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **41** Type: **Invited Speaker / Conférencier(ère) invité(e)**

Measuring the Schiff Moment with 227ThF+

Wednesday 11 June 2025 17:15 (30 minutes)

The Standard Model of particle physics is one of the most successful models of the universe, yet it is known to be incomplete. Substantial efforts on the theoretical front introduce new physics through extensions of the Standard Model. Advances in quantum control of molecules have resulted in some of the most stringent constraints on physics beyond the Standard Model [1,2]. Extensive molecular spectroscopy of $^{232}ThF^{+}$ [3-5] has been motivated by the immense sensitivity of the molecule to the electron's electric dipole moment and promised long coherence time in the molecular science state [4-7]. Building upon this work, we propose the measurement of the Schiff moment, a physical quantity that could hint at new physics, on the isotopologue $^{227}ThF^{+}$. Herein, we discuss the complications of working with radioactive ^{227}Th and provide a teaser of the status of the experiment.

[1] L. Caldwell, et al. Systematic and statistical uncertainty evaluation of the HfF+ electron electric dipole moment experiment. Physical Review A 108, 012804 (2023).
[2] T. S. Roussy, et al. A new bound on the electron's electric dipole moment. Science 381, 46-50 (2023).
[3] Y. Zhou, et al., Visible and ultraviolet laser spectroscopy of ThF, Journal of Molecular Spectroscopy 358, 1 (2019).
[4] K. B. Ng, et al., Spectroscopy on the electron-electric-dipole-moment–sensitive states of ThF+, Physical Review A 105, 022823 (2022).
[5] D. N. Gresh, et al., Broadband velocity modulation spectroscopy of ThF+ for use in a measurement of the electron electric dipole moment, Journal of Molecular Spectroscopy 319, 1 (2016).
[6] Skripnikov, L. V., and A. V. Titov. Theoretical study of ThF+ in the search for T, P-violation effects: Effective state of a Th atom in ThF+ and ThO compounds. Physical Review A 91, 042504 (2015).
[7] Denis et al., Theoretical study on ThF+, a prospective system in search of time-reversal violation. New Journal of Physics 17, 043005 (2015).

Keyword-1

Precision measurement

Keyword-2

Schiff moment

Keyword-3

Radioactive molecules

Author: NG, Kia Boon (TRIUMF)

Co-authors: Mr RILEY, Ed (TRIUMF); Mr SIMPSON, Rane (TRIUMF); Dr SHU, Kenji (RIKEN-Harvard); Dr FAN, Xing (Harvard); Dr MALBRUNOT-ETTENAUER, Stephan (TRIUMF)

Presenter: NG, Kia Boon (TRIUMF)

Session Classification: (DAMOPC) W3-3 Current Trends/Hot Topics | Tendances actuelles/sujets d'actualité (DPAMPC)

Track Classification: Symposia Day (Wed June 11) / Journée de symposiums (Mercredi 11 juin): Symposia Day (DAMOPC - DPAMPC) - Current Trends/Hot Topics / Tendances actuelles/sujets d'actualité