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Development of next generation ultra cold neutron detectors to measure electric dipole moment of neutrons by TUCAN

Sunday, 15 February 2026 09:15 (15 minutes)

This presentation will show ongoing R&D of the new ultra cold neutron detectors. These detectors, filled with He3 at 15 mbar and CF4 to atmospheric pressure, detects neutrons via capture on He3. The resulting proton and triton deposit energy in the CF4, producing scintillation light. These detectors will be used to measure the neutron electric dipole moment (nEDM) by TRIUMF Ultracold Advanced Neutron (TUCAN) Collaboration to measure nEDM with a target sensitivity of up to 10^{−27} e.cm, an order of magnitude better than the current best limit. Measurement of nEDM higher than predicted by standard model will indicate another source of charge-parity violation in the universe and may improve our understanding of why the universe is matter dominated.
This presentation will detail the detector's construction, the working mechanism of the detector and the data acquisition methods. To calibrate the detector before its first commissioning test, it was used to measure the background rate of the TUCAN experimental hall at TRIUMF. The data was taken in different filling configurations vacuum, CF4 and CF4 + He3. The detector was also calibrated with gamma (Cs-137) and neutron (CF-252, AmBe-241) sources and the neutron background in TRIUMF Neutron Irradiation Facility (NIF). Results will be presented for measured
timing resolution, the efficiency of the detector to distinguish neutrons from background, and the characteristics of the neutrons signals detected.

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