

Optimizing the TUCAN Experiment for Precision Measurements of Ultracold Neutron (UCN) Properties

Tuesday, August 20, 2024 1:25 PM (10 minutes)

We investigate the experimental techniques necessary to optimize the measurement of the neutron electric dipole moment (nEDM) and free lifetime in the ultracold neutron (UCN) experiment at TRIUMF. The nEDM is measured using Ramsey's method of oscillating fields within a magnetically shielded room, and the lifetime is obtained by counting neutrons and their decay protons within a gravitomagnetic trap. We find that to optimize nEDM statistics, it is necessary to impose constraints on the production, filling, storage, and emptying phases of (22, 87, 162, 52) seconds, respectively, which correspond to a Ramsey cycle of 156s and 1.73×10^6 UCN detected per cycle. To increase sensitivity on the lifetime measurement, we find that it is necessary to minimize spin-flip probability through the implementation of secondary magnetic racetrack coils, a neutron absorber placed 10cm above $h \approx 60$ neV, and to keep the trap volume at a pressure of $\sim 1 \times 10^{-7}$ mbar.

What area of study best describes your talk?

Physics

If you answered 'Other', please provide the study area.

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