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(I) The Current Status of the TUCAN Source and EDM Experiment

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The TRIUMF UltraCold Advanced Neutron (TUCAN) Collaboration is developing a new ultracold neutron (UCN) source for installation at TRIUMF. High energy neutrons will be produced by directing protons from the TRIUMF cyclotron onto a tungsten target. The neutrons will undergo moderation in two steps to reduce their energy, first in a heavy water then in a liquid deuterium moderator. The moderated neutrons then enter a superfluid helium volume where they will be converted into UCN through superthermal processes. The goal for the source is to produce the world's highest density UCN source surpassing current UCN source densities by at least one order of magnitude.

As UCN can be stored in material containers for hundreds of seconds they are ideal for experiments on the fundamental properties of neutrons. To take advantage of this the first experiment planned for this UCN source is a measurement of the neutron electric dipole moment (nEDM). For this experiment UCNs will be confined to a material bottle where they will precess at a rate that is proportional to their electric and magnetic dipole moments and the applied fields. By precisely measuring the difference in the precession frequency between parallel and anti-parallel field configurations the nEDM can be determined. According to current models we expect to have 1.43×10^6 UCN detected per measurement cycle which should allow us to reach our goal statistical accuracy of 1×10^{-27} e-cm in 400 measurement days. This is approximately 20 times more precise than the current world's best measurement that was done by the nEDM Collaboration at the Paul Scherrer Institut of 1.8×10^{-26} e-cm (90% CL) which had 1.5×10^4 UCN per cycle, and is competitive with their planned future experiment n2EDM that anticipates 1.21×10^5 UCN per measurement cycle.

I will describe the planned UCN source and nEDM experiment, as well as the current status of the efforts.

Keyword-1

nEDM

Keyword-2

UCN

Keyword-3

Primary author: Dr MCCREA, Mark (University of Winnipeg)

Co-author: TUCAN COLLABORATION

Presenter: Dr MCCREA, Mark (University of Winnipeg)

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