

DLC-coated guides for the TUCAN EDM experiment

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The neutron electric dipole moment (nEDM) is an important property that can reveal additional breaking of fundamental symmetries, such as charge-parity symmetry, which may help explain why the universe is dominated by matter. The TUCAN collaboration is commissioning a next-generation ultracold neutron (UCN) source to deliver higher UCN density to experiments, aiming to improve the statistical precision of future nEDM measurements to a sensitivity of 10^{-27} e·cm. Ultracold neutrons, with energies in the nano-electronvolt range, can be stored for long periods, enabling precise studies of neutron properties.

Reaching these scientific goals requires transporting UCNs from the source to the experiment with minimal losses, which places strict demands on the surface quality of the UCN guides. To meet this need, a dedicated coating facility has been established at the University of Winnipeg to produce diamond-like carbon (DLC) coatings for the aluminum guides used in the TUCAN nEDM experiment. The system uses a high-power excimer laser and a custom vacuum-deposition chamber to apply low-loss, stable DLC films to the inner surfaces of the guide tubes. This talk will highlight the progress in facility setup, coating procedures, and preliminary surface science results, showing how DLC-coated guides contribute to improving UCN transport and enabling precise nEDM measurements.

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