Contribution ID: **76** Type: **Poster**

Measurement and Simulation of the Ambient Gamma Background in the QUEST-DMC Experiment

Monday 7 April 2025 19:40 (20 minutes)

The Quantum Enhanced Superfluid Technologies for Dark Matter and Cosmology (QUEST-DMC) experiment aims to search for sub-GeV dark matter with a quantum-amplified superfluid 3He calorimeter. Cosmic rays and radiogenic backgrounds are expected to be dominant backgrounds in the region of interest, between eV to keV scale recoil energies, for a dark matter search. Characterising these backgrounds in an ultra-low temperature cryostat is not only imperative for dark matter searches but is also of increasing interest for quantum sensor and qubit development. Ambient gammas are part of the radiogenic background and are usually produced from the surrounding environment (natural radioactive isotopes in the soil, rocks, and building materials etc), as well as cosmic ray interactions with the atmosphere. This poster shows the measurement of the ambient gamma spectra in and around the QUEST-DMC cryostats using a sodium iodide (NaI) detector and simulations of expected energy deposition in the bolometer using this data.

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Session Classification: Poster session

Track Classification: Terrestrial Dark Matter Searches