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Sensitivity Ceilings for the QUEST-DMC Detector

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The QUEST-DMC experiment utilises surface-based superfluid helium-3 bolometers to search for sub-GeV dark matter with low energy thresholds. This talk outlines the impact of the dark matter stopping effect on QUEST-DMC's projected sensitivity for both spin-dependent and spin-independent interactions. Our analysis employs two complementary strategies: (i) a straight-line path for dark matter scattering, and (ii) a semi-analytic diffusion model that accounts for large-angle deviations, particularly relevant for lighter dark matter particles. By comparing these approaches, we highlight how the choice of scattering model influences sensitivity estimates. Given atmospheric overburden and complete Earth blocking from below, the QUEST surface run covers several orders of magnitude of unexplored dark matter parameter space at large scattering cross sections.

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