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(G*) Dark Sector Portals & New Anomalously Penetrating Particles at the LHC with the MoEDAL-MAPP Experiment

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The Large Hadron Collider (LHC) at CERN supports a plethora of experiments aimed at improving our understanding of the universe by attempting to solve the many unanswered questions in physics, such as: What is the nature of dark matter? Why is electric charge quantized? Why do the free parameters of the Standard Model (SM) have their particular values? To-date, the SM has been stringently tested at the LHC and completely validated by the recent discovery of the Higgs boson by the ATLAS and CMS experiments. However, no smoking-gun signal of new physics beyond the SM (BSM) has been detected at the LHC to-date. The Monopole and Exotics Detector at the LHC (MoEDAL) is specifically dedicated to investigating various BSM scenarios through searches for highly ionizing particles, such as magnetic monopoles and multiply electrically charged particles, as avatars of new physics. Currently, MoEDAL has taken data for pp collisions at center-of-mass energies of $\sqrt{s} = 8$ and $\sqrt{s} = 13$ TeV, providing the world's best laboratory constraints on magnetic monopoles with magnetic charges ranging from two to five times the Dirac charge. During the ongoing Long Shutdown 2, the MoEDAL collaboration has been preparing the MoEDAL Apparatus for Penetrating Particles (MAPP) detector upgrade. The aim of the MAPP detector is to expand MoEDAL's physics program by including searches for new mini-ionizing particles (mIPs) and long-lived neutral particles (LLPs). The proposed placement of the MAPP detector is ~ 50 m from the interaction point, in the UGC1 gallery; a generously sized cavern adjacent to the MoEDAL region at interaction point 8. This presentation provides a progress update on the new MoEDAL Apparatus for Penetrating Particles (MAPP) detector currently planned for deployment by run-3 and phased throughout. A brief overview of the two subdetectors, MAPP-mCP and MAPP-LLP is presented. Lastly, benchmark studies involving renormalizable portal interactions that couple a dark sector to the SM are presented for each subdetector to illustrate the performance capabilities of the MAPP detector in the upcoming Run-3.

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