Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3002** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Searching for Minicharged Particles at the LHC's Run-3 with the Phase-I MoEDAL-MAPP Detector

Monday, 6 June 2022 10:45 (15 minutes)

The MoEDAL Apparatus for Penetrating Particles (MAPP) Experiment is designed to extend the searches for new physics at the LHC carried out by the baseline Monopole and Exotics Detector at the LHC (MoEDAL) Experiment. The recently approved Phase-I MAPP detector (MAPP-mCP) is on schedule for deployment this year and set to begin data taking in spring 2023. This independent detector system, located in the UA83 gallery adjacent to the MoEDAL detector region at IP8, is separate from the baseline MoEDAL detector and will enable searches for new feebly-interacting particles (FIPs) — avatars of new physics with small couplings $<< 1$ abound in various BSM theories, such as minicharged particles (mCPs) — produced in the high energy pp collisions at the LHC. The ground-breaking physics program of the MAPP Experiment covers numerous scenarios that yield potentially revolutionary insights into several foundational questions: what is the nature of dark matter? is there a hidden/dark sector? and what is the mechanism of electric charge quantization? This presentation begins with an overview of the MAPP Experiment and the design of the Phase-I MAPP detector, followed by a simple model of mCPs arising from kinetic mixing of a massless dark photon gauge field with the SM hypercharge gauge field. Thereafter, we focus on several dominant production mechanisms of mCPs (χ) at the LHC across the mass-mixing parameter space of interest to MAPP: Drell-Yan pair-production ($q\bar{q} \to \chi\bar{\chi}$), heavy quarkonia decays (e.g. $J/\psi \to \chi\bar{\chi}$), and direct decays of light vector mesons (e.g. $\rho \to \chi\bar{\chi}$). We modelled these processes computationally using MadGraph5, Pythia 8, and EPOS-LHC, respectively. Finally, we present the physics reach of the Phase-I MAPP detector for mCPs potentially produced at the LHC's Run-3 through such mechanisms.

Primary author: Dr STAELENS, Michael (University of Alberta)

Presenter: Dr STAELENS, Michael (University of Alberta)

Session Classification: M1-9 Exploring the Energy and Precision Frontier I (PPD) | (PPD)

Track Classification: Technical Sessions / Sessions techniques: Particle Physics / Physique des particules (PPD)