Contribution ID: **219** Type: **Invited**

The Heavy Photon Search experiment at Jefferson Lab

Thursday, June 8, 2023 2:40 PM (25 minutes)

Evidence for electroweak-scale Dark Matter (DM) particles arising from direct searches has proven to be extremely elusive so far. However, the existence of light (sub-GeV) particles could also be investigated searching for rare events at accelerators. A simple possibility for light DM is that its constituents belong to some Hidden Sector, uncharged under the Standard Model (SM) forces and coupled to SM through the interaction with the ordinary particles of a new force carrier, in a kinetic equilibrium condition. To this respect, theoretically well-motivated models have proposed the existence of a new U(1) light gauge boson, the heavy (or dark) photon A'. In some versions of these models DM particles can self-interact strongly, providing a viable explanation to the observed DM abundance –these are generally identified as Strongly Interacting Massive Particles (SIMPs). SIMPs are expected to feature a QCD-like pattern, with light dark pions and excited states like dark vector mesons, that are coupling and/or mixing to heavy photons.
The Heavy Photon Search Experiment (HPS) at the Thomas Jefferson National Accelerator Facility (JLab, USA) has been primarily designed to search for heavy photons by exploiting their kinetic mixing with the Standard Model photons. Recent studies disclosed also its potentialities for the investigation of SIMPs through their coupling to the heavy photons and following decays.
Heavy photons could be created in HPS via the interaction of an electron beam on a tungsten target, and could be detected through their subsequent decays to charged lepton (namely, e+e-) pairs. Experimental signatures for detection in HPS are either a resonance peak in the electron-positron invariant mass distribution or the detection of displaced decay vertices; their occurrence would depend on the heavy photon mass and the strength of its coupling.
In this presentation, the design and performance of the HPS detector will be described, together with the results of the analysis of data collected in the first 2016 engineering run and recently submitted for publication. Moreover, the status of and prospects for the ongoing analysis of two larger datasets collected in 2019 and 2021 will be shown, with reference on the expected reach for possible SIMPs observation.

Presenter: CELENTANO, Andrea (Istituto Nazionale di Fisica Nucleare)

Session Classification: Hadrons and physics beyond the standard model

Track Classification: Hadrons and physics beyond the standard model