

The Heavy Photon Search Experiment at JLab

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The Heavy Photon Search (HPS) experiment at Jefferson Lab is searching for a new $U(1)$ vector boson ("heavy photon", "dark photon" or A') in the mass range of 20-500 MeV/ c^2 . An A' in this mass region is natural in hidden sector models of light, thermal dark matter. The A' couples to the ordinary photon through kinetic mixing, which induces its coupling to electric charge. Since heavy photons couple to electrons, they can be produced through a process analogous to bremsstrahlung, subsequently decaying to an e^+e^- pair, which can be observed as a narrow resonance above the dominant QED trident background. For suitably small couplings, heavy photons travel detectable distances before decaying, providing a second signature. HPS accesses unexplored regions in the mass-coupling parameter space.

The experiment uses the CEBAF electron beam located at Jefferson Lab to accelerate electrons which are then incident on a thin tungsten target. The outgoing e^+e^- pair is detected in a compact, large acceptance forward spectrometer consisting of a silicon vertex tracker and lead tungstate electromagnetic calorimeter.

HPS conducted successful engineering runs in the spring of 2015 using a 1.056 GeV, 50 nA beam and in the spring of 2016 using a 2.3 GeV, 200 nA beam, and is readying an upgraded detector for an extended physics run for summer 2019. This talk will present the results of the 2015 run, preliminary results of the 2016 run, and prospects for the 2019 run.