

The Heavy Photon Search experiment: looking for Dark Matter at Jefferson Lab.

Recent cosmological observations have suggested that a mysterious excess in the flux of electrons and positrons in high-energy cosmic rays may be explained by the existence of a dark matter vector boson, called the dark or heavy photon, with a weak coupling to the electromagnetic field. Current constraints limit its mass to a region of $\sim 10 - 1000 \text{ MeV}/c^2$ and a coupling strength of $\sim 10^{-9} - 10^{-3}$. This small coupling to the EM field would allow the possible decay of the heavy photon into lepton pairs, notably e^+e^- . It also suggests a small cross-section for the production of a heavy photon by a process akin to Bremsstrahlung, when a high-energy electron is deflected in the EM field of a high-Z nucleus. This forms the premise for an experiment currently in preparation by the Heavy Photon Search (HPS) Collaboration, to be performed at Jefferson Lab in 2014-16, which will pass a high-luminosity 11 GeV electron beam through a tungsten target and look for a signature of the heavy photon in the invariant mass of the reconstructed e^+e^- pairs and in their displaced vertex from the target position.