

Searching a Dark Photon with HADES

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The existence of a photon-like massive particle, the gamma' or dark photon, is postulated in several extensions of the Standard Model. Such a particle could indeed help to understand the puzzling behavior of the observed cosmic positron fraction as well as to solve the so far unexplained deviation between the measured and calculated values of the muon $g-2$ anomaly. The dark photon, unlike its conventional counterpart, would have mass and would be detectable via its mixing with the latter. We present a search for the e^+e^- decay of such a hypothetical dark photon, also named U boson, in inclusive dielectron spectra measured with HADES in the $p(3.5 \text{ GeV})+p$, Nb reactions, as well as in the $Ar(1.756 \text{ GeV/u})+KCl$ reaction. A new upper limit on the kinetic mixing parameter squared (ϵ^2) at 90% CL has been obtained in the mass range $M(U) = 0.02 - 0.55 \text{ GeV}$ and is compared here with the present world data set. For masses $0.03 - 0.1 \text{ GeV}$, the limit has been lowered with respect to previous results, allowing to exclude a large part of the parameter space favored by the muon $g-2$ anomaly. From our data also an improved upper limit of 2.3×10^{-6} (90% CL) could be set on the branching ratio of the helicity-suppressed direct decay of the eta meson, i.e. $\eta \rightarrow e^+e^-$.

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