



Contribution ID: 284

Type: **Poster**

Search for light dark photon with neutral meson decays at the PHENIX experiment

Tuesday 29 September 2015 16:30 (2 hours)

A hypothetical $U(1)$ gauge field has been introduced to explain several experimental results that the Standard Model (SM) can not describe, such as the high energy positron excess in cosmic rays, the muon $g-2$ anomaly and so on. The hypothetical $U(1)$ field is considered to very weakly couple with SM, and its gauge boson called as a 'dark photon' mixes in ordinary photons as a result.

The PHENIX experiment has a good capability to measure low mass electron pairs with a good mass resolution. We have conducted a search for electron pairs possibly showing up from dark photons within Dalitz decays of π^0 and η . An upper limit of the dark photon mixing strength with ordinary photons has been obtained for $30 < m_{ee} < 90$ MeV/ c^2 . Combining with other experimental results, the possibility of explanation by the dark photon for the 3.6 sigma deviation of the measured muon $g-2$ value from the SM calculations was excluded.

We will present our latest result on the dark photon search and discuss a possibility for future light dark matter searches with heavy ion collisions as well.

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Session Classification: Poster Session

Track Classification: Electromagnetic Probes