

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

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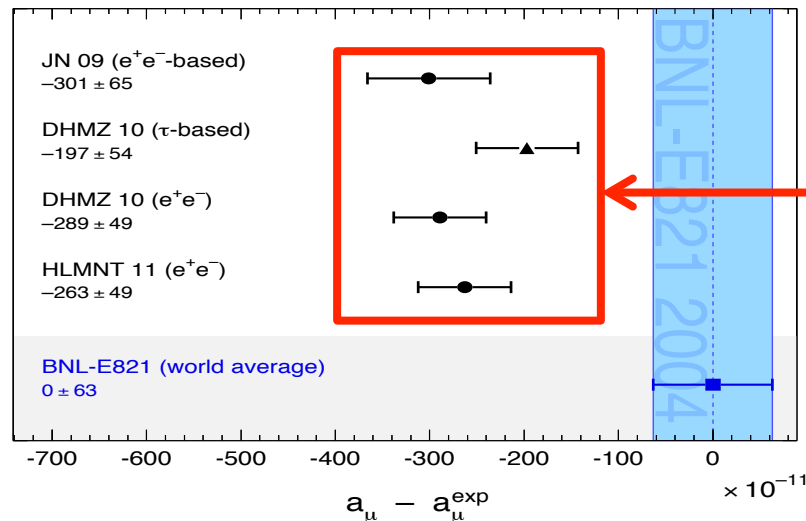


Dark photon, U

- Additional $U(1)$ gauge field for dark matter
- Mixes in ordinary photons with a small mixing strength, ϵ^2

Motivation - BSM phenomena

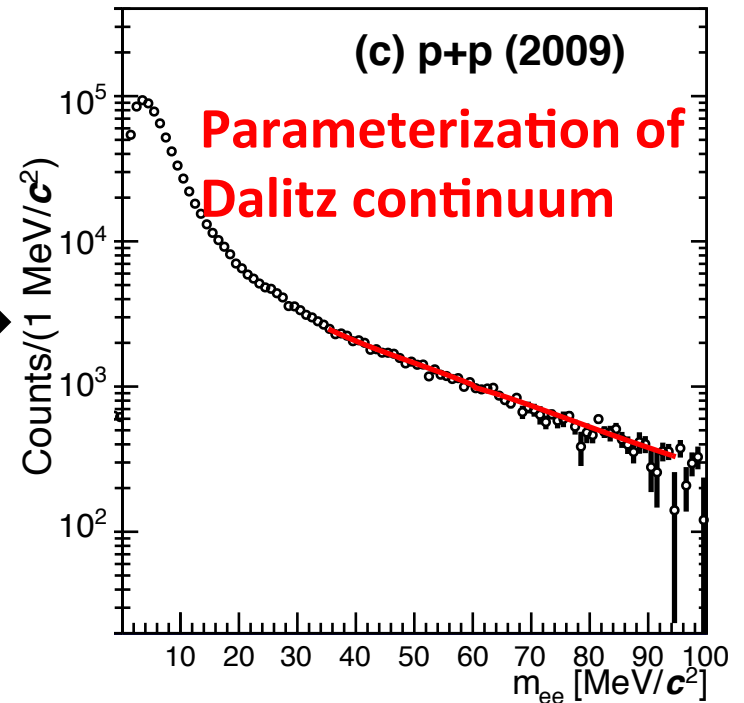
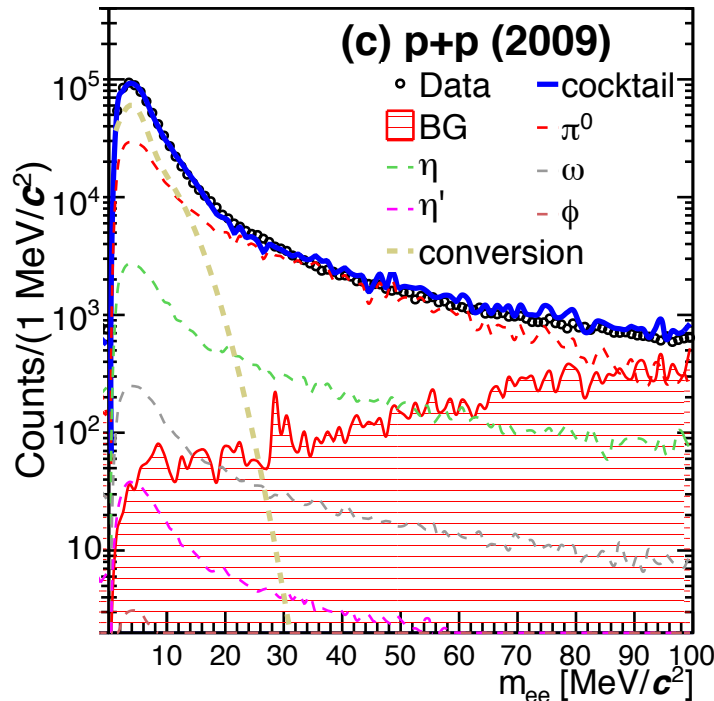
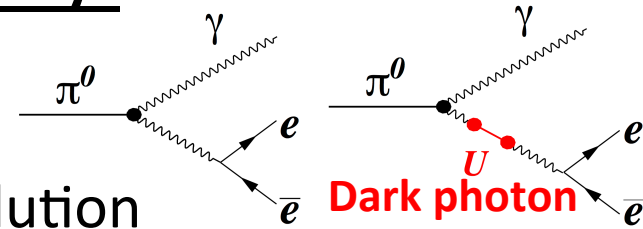
- Muon anomalous magnetic moment, $a_\mu = (g_\mu - 2)/2$
 - ✓ 3σ deviation from the SM calculations
- Dark photon \rightarrow most attractive candidate of the cause



Measurement of $\pi^0/\eta \rightarrow \gamma U \rightarrow \gamma e^+e^-$ in Dalitz decays

Ref. PLB 726, 187 (2013)

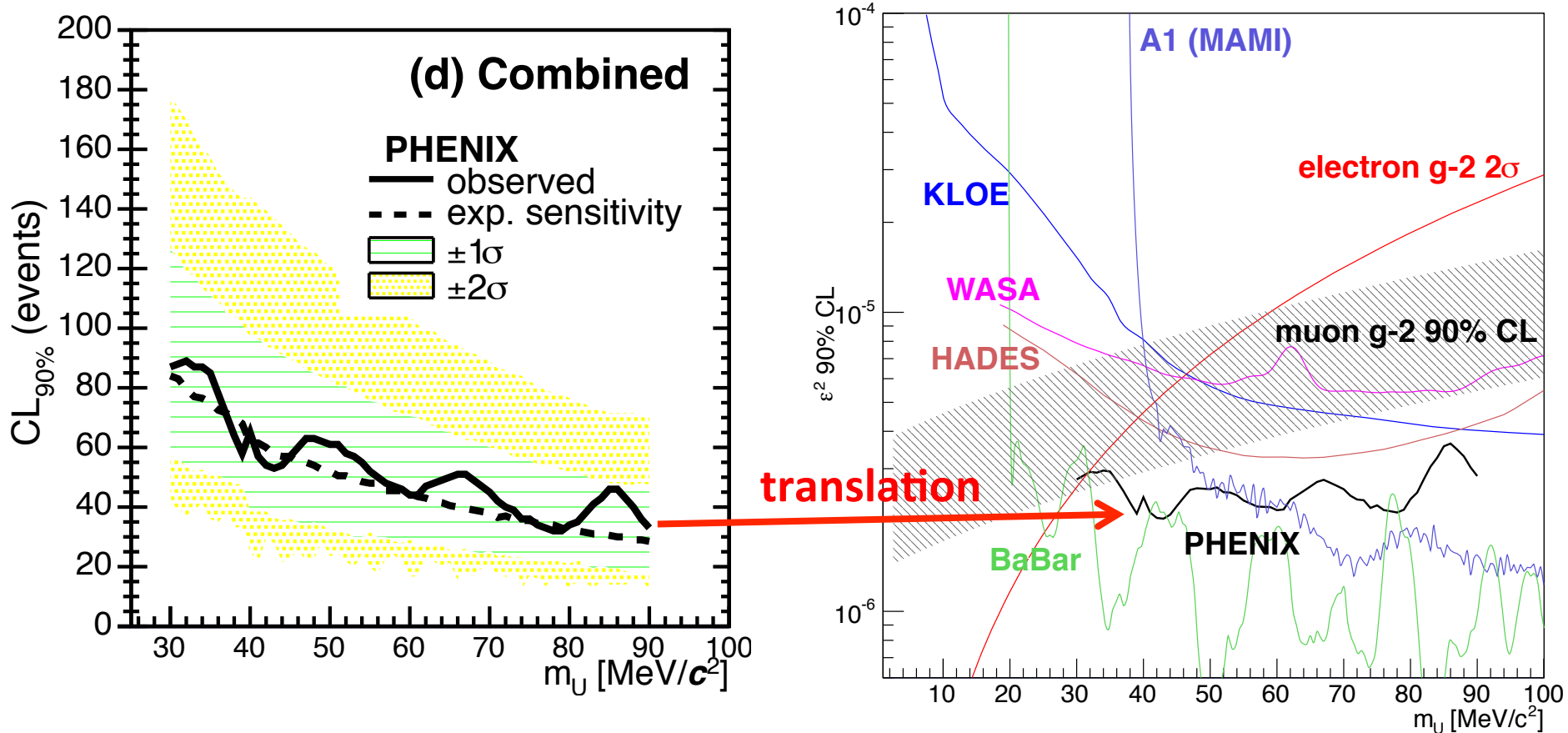
- Exclusively decays into e^+e^-
- Very narrow natural width
 - ✓ Expected peak with detector mass resolution
- 700k (p+p)+1M (d+Au) = **1.7M** e^+e^- pairs in total for $m_{ee} < 100 \text{ MeV}/c^2$



Statistical test for a small signal finding – CL_s approach

- Calculated relative likelihoods of how well the data is described by:
 - ✓ Only Dalitz continuum & Dalitz + dark photon signal
 - ✓ Peak width = 3.1 MeV dominated by detector resolution

Upper limits on dark photon parameter space for $30 < m_{ee} < 90 \text{ MeV}/c^2$



- Consistent within 2σ fluctuation of our experimental sensitivity
→ No dark photon signal
- Muon g-2 favored band is almost **ruled out** with our & BaBar results
 - ✓ More detail: PRC 91, 031901 (2015)
 - ✓ Completely excluded by NA48/2 result: PLB 746, 178 (2015)