

Global Analysis and Dark Photons

Nicholas Hunt-Smith

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Supervisors: Tony Thomas and Martin White

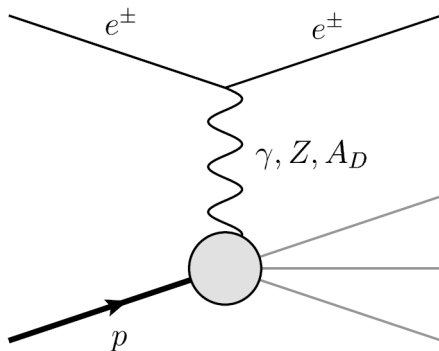
Collaborators: Wally Melnitchouk, Nobuo Sato and Xuan-Gong Wang

University of Adelaide

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Dark Photon in DIS



$$\mathcal{L} \supset -\frac{1}{4}F'_{\mu\nu}F'^{\mu\nu} + \frac{m_{A'}^2}{2}A'_\mu A'^\mu + \frac{\epsilon}{2\cos\theta_W}F'_{\mu\nu}B^{\mu\nu}$$

Dark Photon in DIS

$$C_Z^v = (\cos \alpha - \epsilon_W \sin \alpha) \bar{C}_Z^v + \epsilon_W \sin \alpha \cot \theta_W C_\gamma^v,$$

$$C_Z^a = (\cos \alpha - \epsilon_W \sin \alpha) \bar{C}_Z^a,$$

$$C_{A_D}^v = -(\sin \alpha + \epsilon_W \cos \alpha) \bar{C}_Z^v + \epsilon_W \cos \alpha \cot \theta_W C_\gamma^v$$

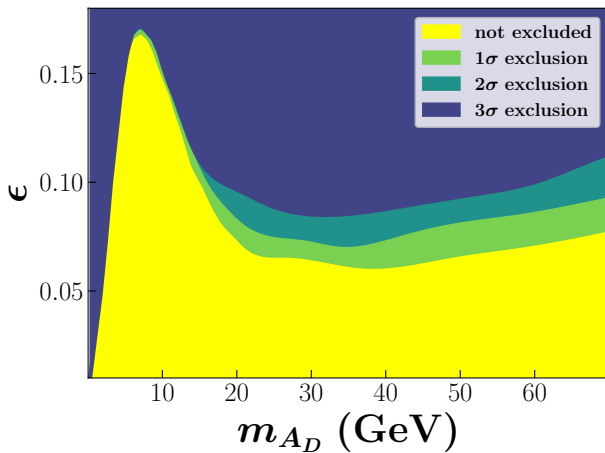
$$C_{A_D}^a = -(\sin \alpha + \epsilon_W \cos \alpha) \bar{C}_Z^a$$

Modified couplings depend on two dark parameters, ϵ and m_{A_D} .

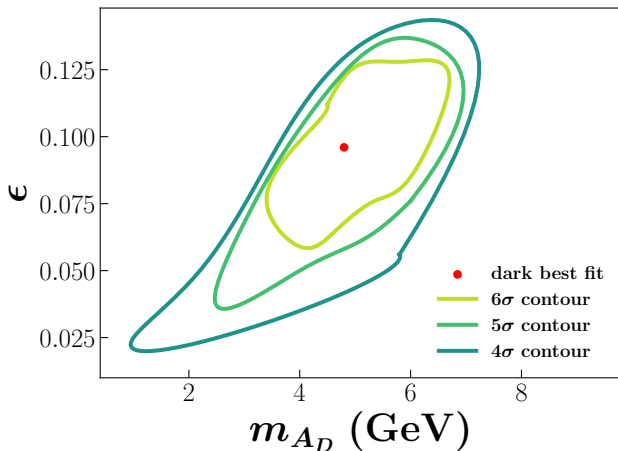
JAM framework

- We used the JAM global analysis framework at NLO.
- DIS data taken from SLAC, BCDMS, NMC and HERA.
- Q^2 cut of 1.69 GeV^2 and a W^2 cut of 10 GeV^2 for the DIS data.
- Drell-Yan, Z-rapidity, W-asymmetry and jet production also included.
- Agreement between fitted results and theory is assessed through the χ^2 .
- Extra χ^2 contribution from $g - 2$ of the muon.

Excluded parameter space

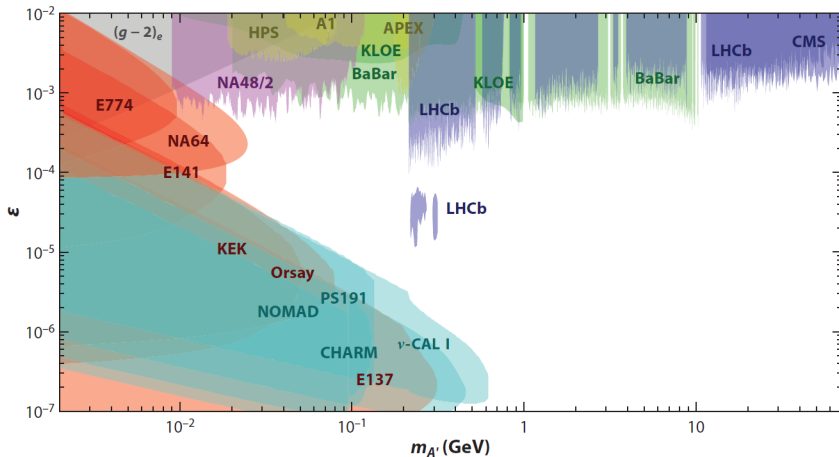


Potential dark photon signal?

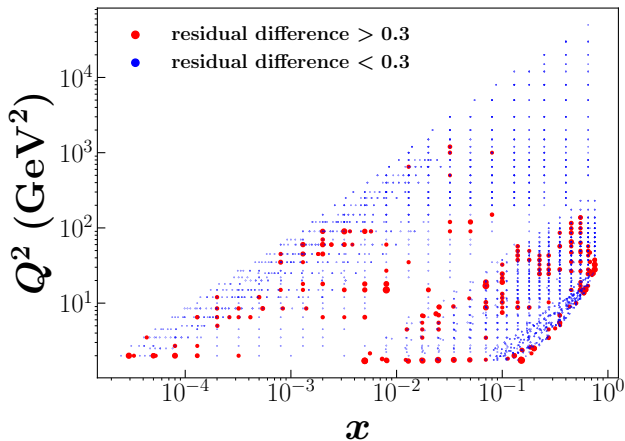


Difference in anomalous magnetic moment of $g - 2$ reduced from 4.2σ to 1.5σ for these parameter values.

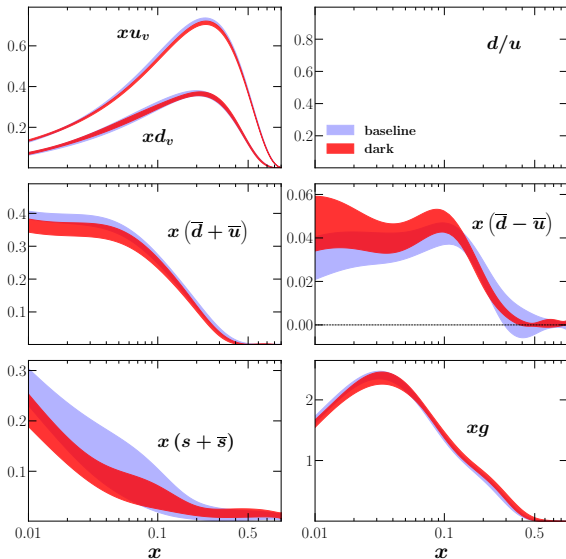
Potential dark photon signal?



Potential dark photon signal?



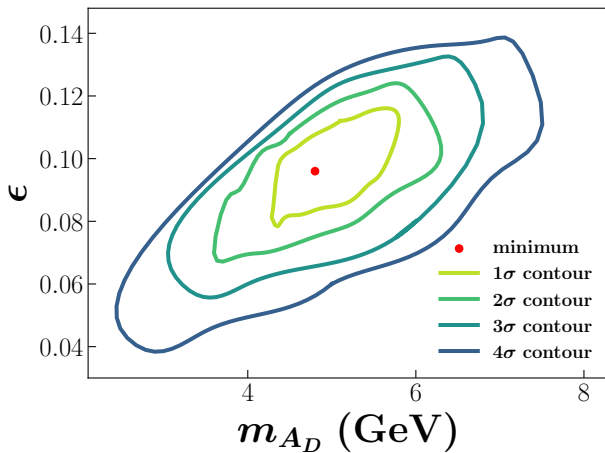
PDFs are stable



Cultural snippet



Profile Likelihood



χ^2 table

reaction	$\chi^2_{\text{dof}}(\text{dark})$	$\chi^2_{\text{dof}}(\text{base})$	N_{dof}
fixed target DIS	1.01	1.05	1495
HERA NC	1.02	1.03	1104
HERA CC	1.13	1.18	81
Drell-Yan	1.18	1.16	205
Z rapidity	1.08	1.05	56
W asymmetry	1.04	1.07	97
jets	1.16	1.15	200
total	1.03	1.05	3283