Dark photon search with positron

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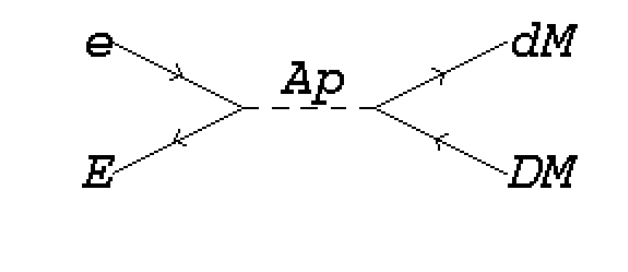
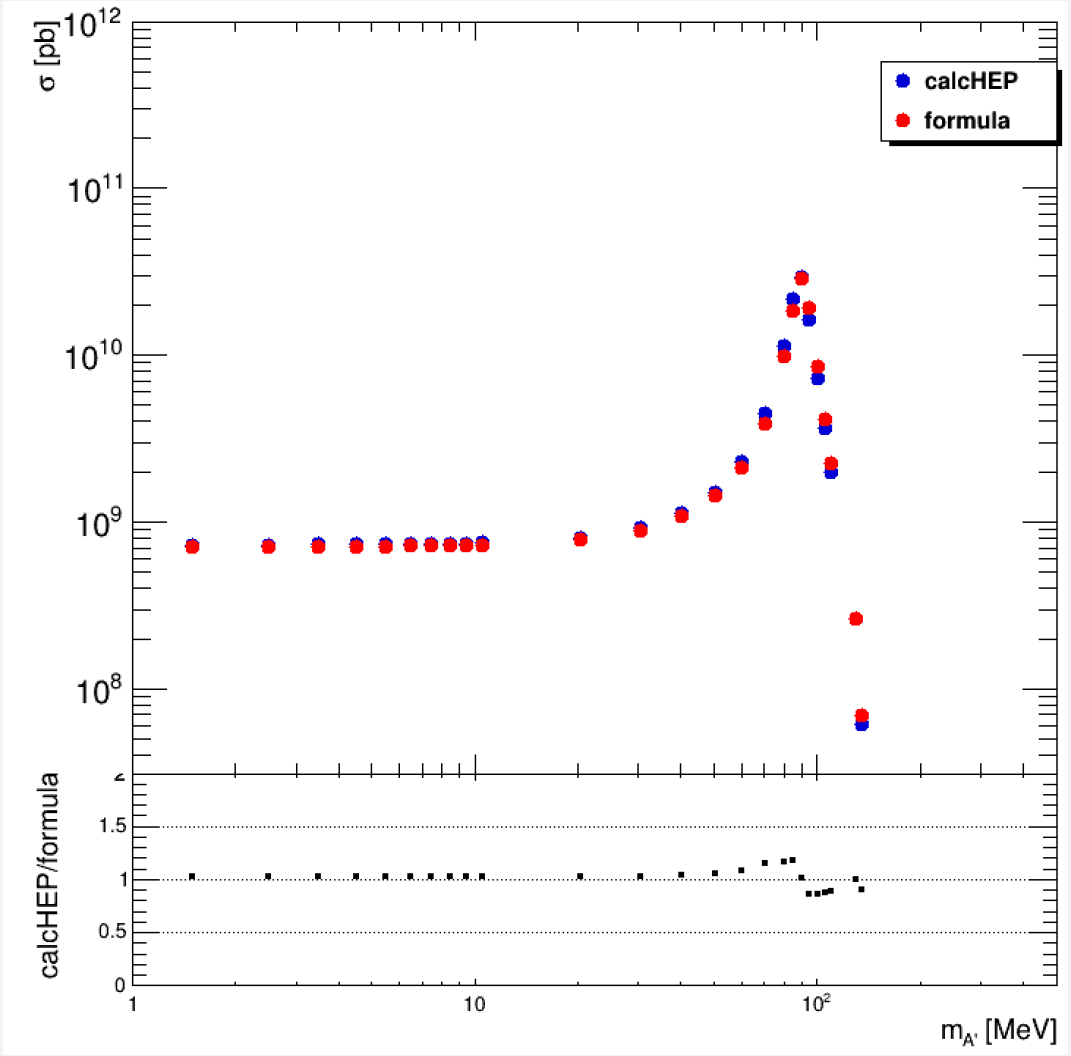
Cross section of s-channel



$$\sigma_{res} = \frac{4\pi\alpha_{EM}\alpha_D\varepsilon^2}{\sqrt{s}} \frac{q\mathcal{K}}{(s - m_{A'}^2)^2 + \Gamma_{A'}^2 m_{A'}^2 \eta}$$

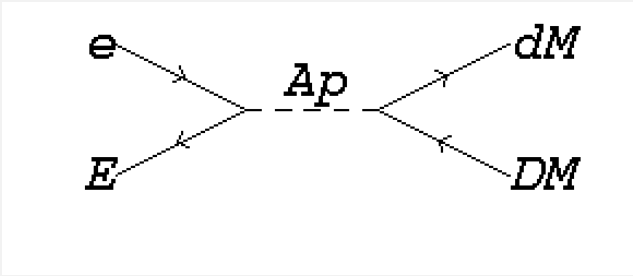
Incident energy: 8 GeV



$\varepsilon^2 = 1$ $\alpha_D = 0.5$

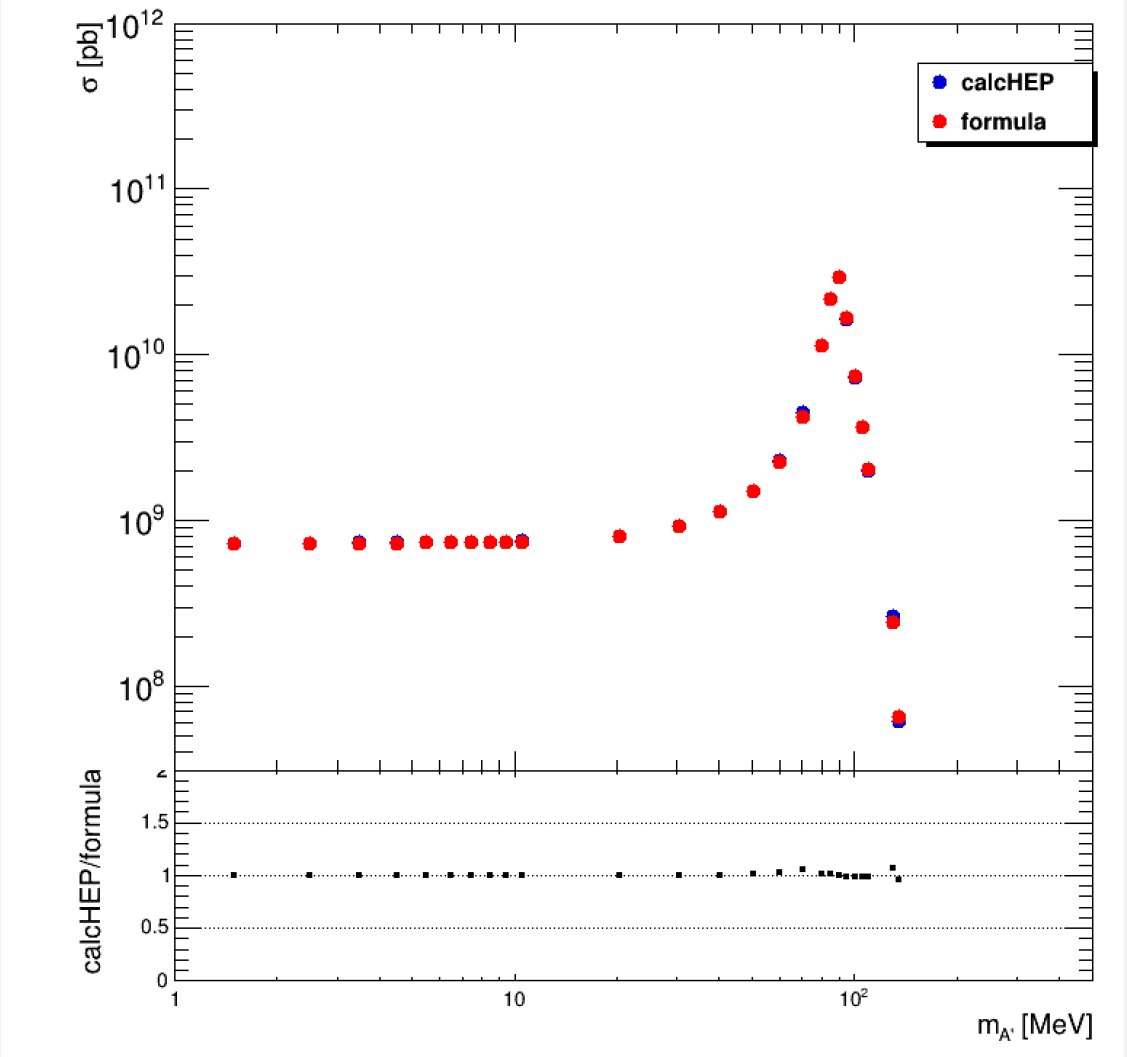
$\alpha_{EM} = 1/137$

Cross section of s-channel



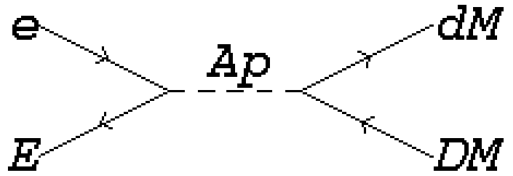
$$\sigma_{res} = \frac{4\pi\alpha_{EM}\alpha_D\varepsilon^2}{\sqrt{s}} \frac{qK}{(s - m_{A'}^2)^2 + \Gamma_{A'}^2 m_{A'}^2}$$

Incident energy: 8 GeV



$\varepsilon^2 = 1$ $\alpha_D = 0.5$ $\alpha_{EM} = 1/137$

Cross section of s-channel



$$\sigma_{res} = \frac{4\pi\alpha_{EM}\alpha_D\varepsilon^2}{\sqrt{s}} \frac{q\mathcal{K}}{(s - m_{A'}^2)^2 + \Gamma_{A'}^2 m_{A'}^2 \eta}$$

and $\Gamma_{A'}$ is the A' width, given by

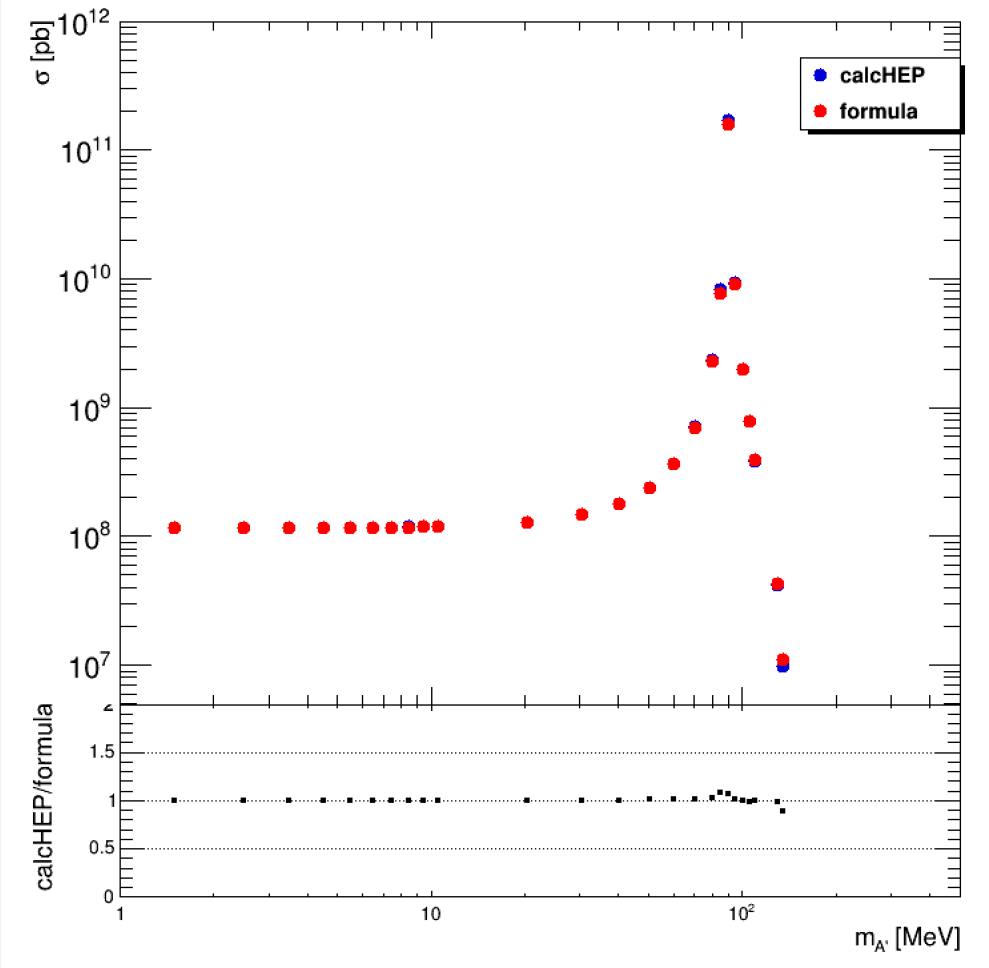
$$\Gamma_{A'} = \alpha_D \frac{m_{A'}}{3}(1 + 2r^2)\sqrt{1 - 4r^2} \text{ (fermionic LDM)}$$
$$\Gamma_{A'} = \alpha_D \frac{m_{A'}}{12}(1 - 4r^2)^{3/2} \text{ (scalar LDM)}, \quad (4)$$

where $r \equiv m_\chi/m_{A'}$, and we neglected the ε^2-suppressed A' visible decay channel. Finally, $\mathcal{K}$ is a kinematic factor equal to $s - 4/3q^2$ $(2/3q^2)$ for the fermionic (scalar) case, while $\eta = (s/m_{A'}^2)^2$ is a correction term introduced for the fermionic LDM case ($\alpha_D = 0.5$) to consider the energy dependence of $\Gamma_{A'}$ when this is non-negligible with respect to $m_{A'}$.

arXiv:2108.04195v2 [hep-ex] 25 Oct 2021

Cross section of s-channel

Incident energy: 8 GeV

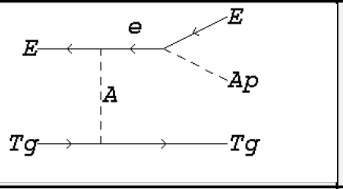
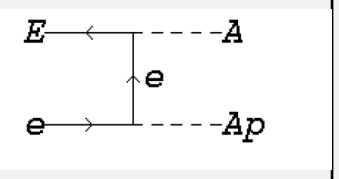
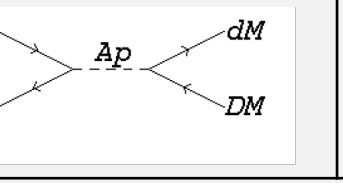


$\varepsilon^2 = 1$

$\alpha_D = 0.0795775$

$\alpha_{EM} = 1/137$

e^+-target on DarkSHINE

	Signal	Rec-Target	ECAL	HCAL	Background
	e+ , Ap	1	Big missE/P	nothing	Similar to e- on Taget
	A, Ap	0	missE	nothing	$e^+e^- \to \gamma\gamma / \gamma\gamma\gamma$ bremsstrahlung
	X,X	0	~8GeV missE	nothing	$e^+e^- \to \mu^+\mu^-$

Next to do

- sensitivity with combined three channels
- Investigate the characteristics of each channel in the detector

谢谢！