750 GeV diphoton w.o. new Physics

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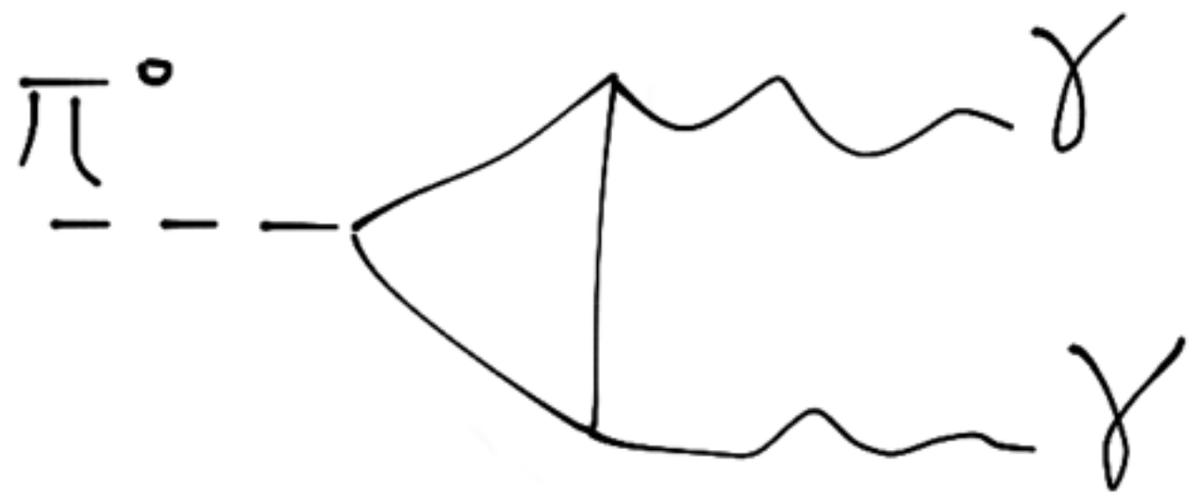
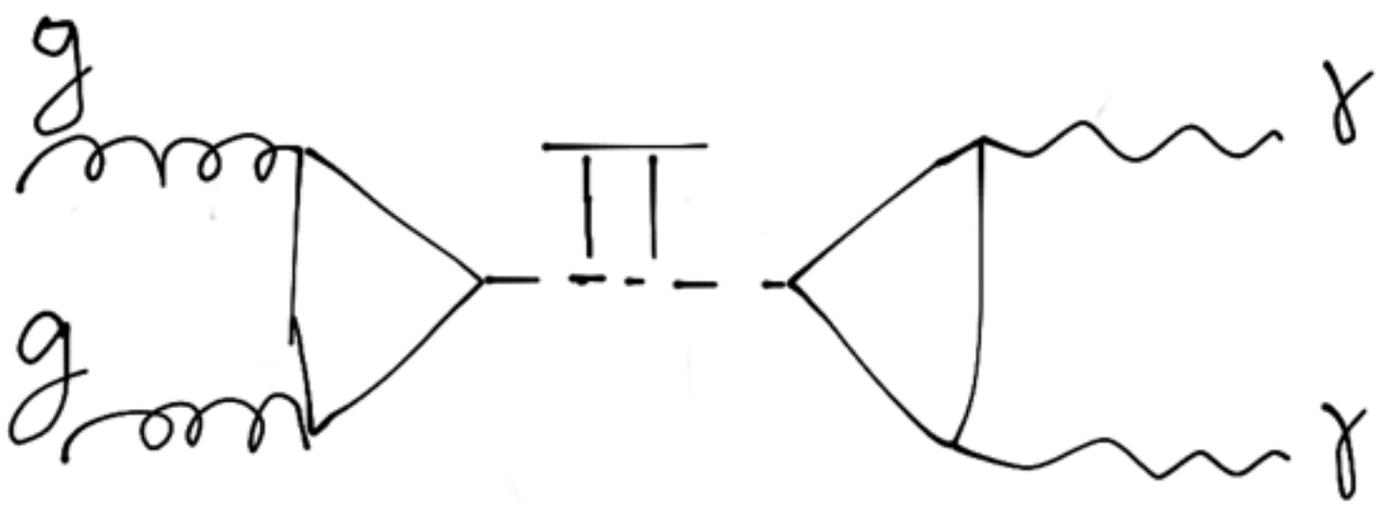
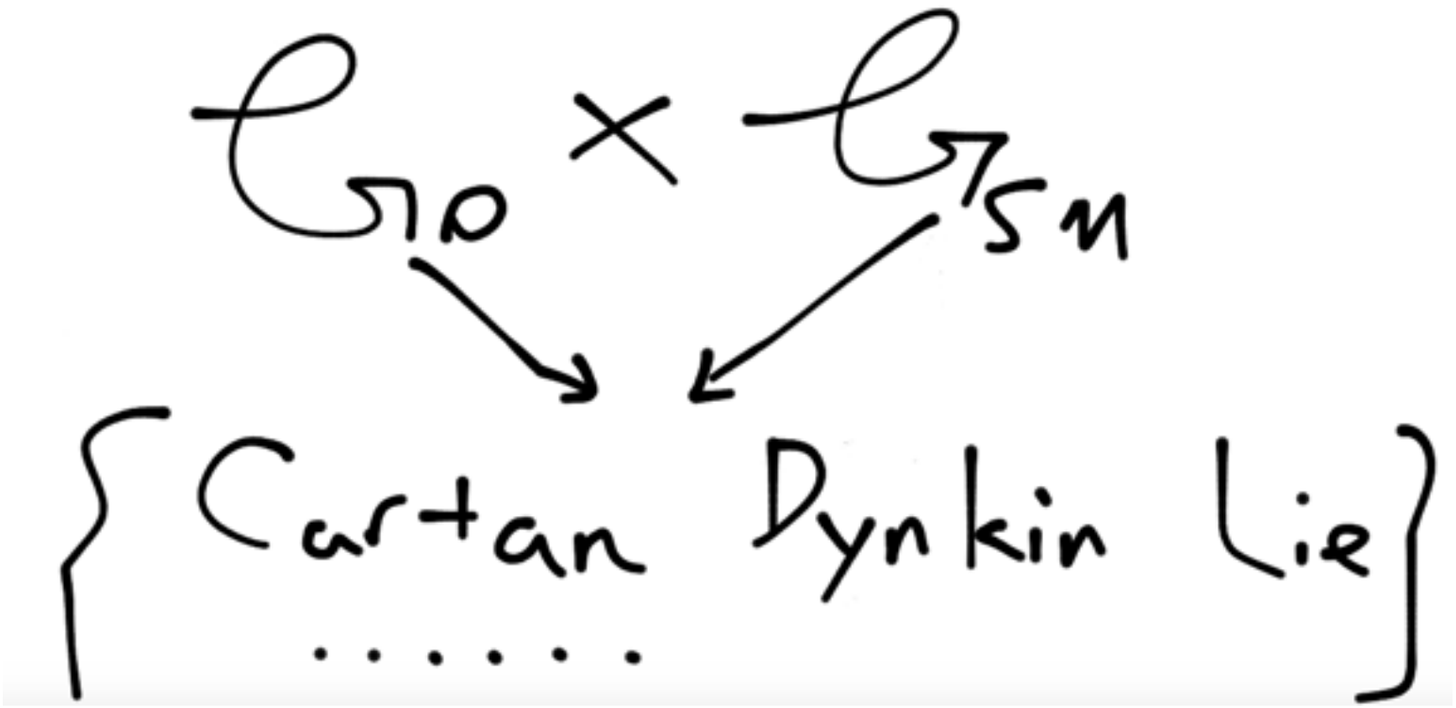
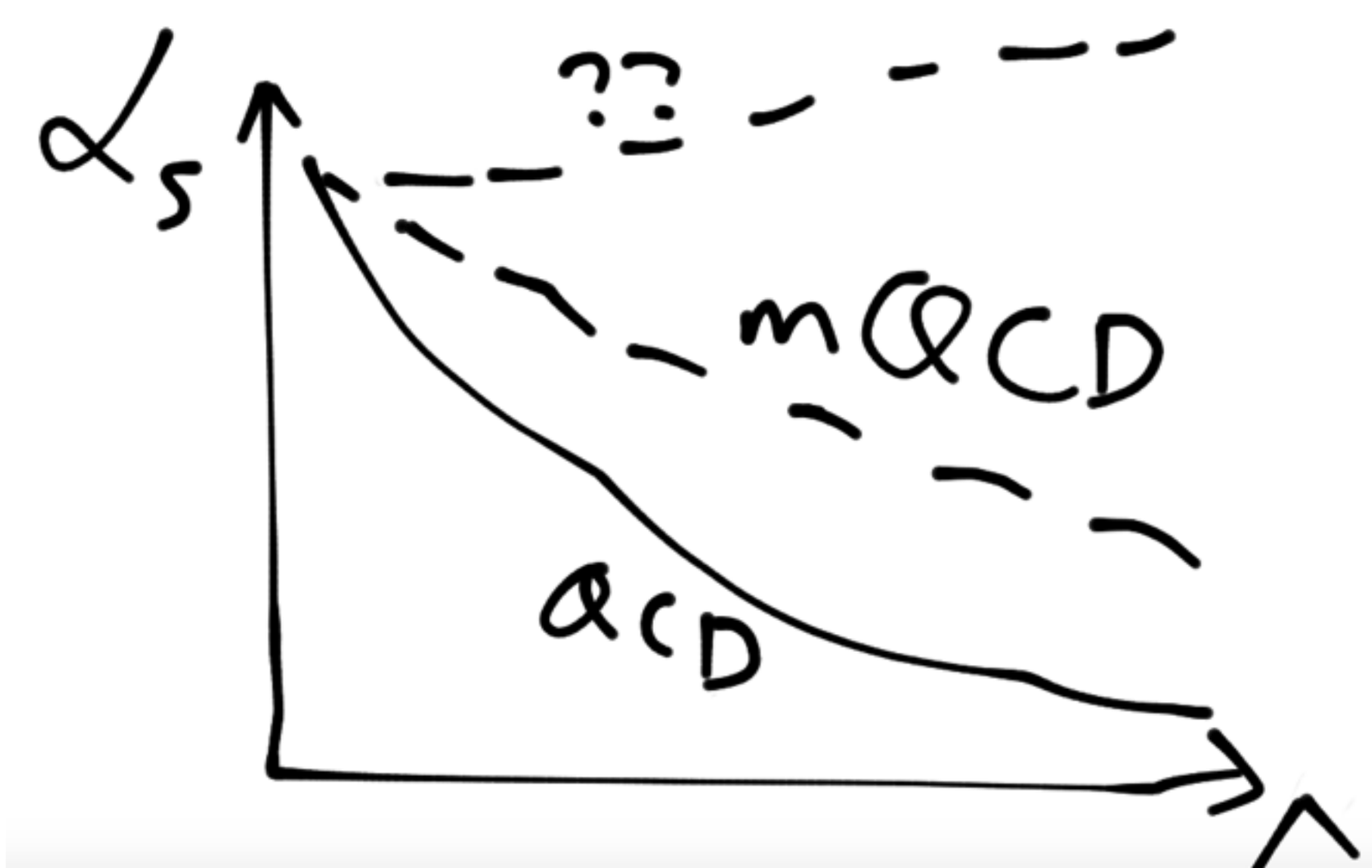

π°
γ
γ


f
π
Q LD


g
g
γ
γ


f
π


SO × SU
{ Cartan Dynkin Lie
. . . . . }


??
mQCD
αCD

	$SU(N_n)$	$SU(3)_c$	$SU(2)_L$	$U(1)_Y$
Q	$\mathcal{R}_n$	3	1	Y_1
L	$\mathcal{R}_n$	1	1	Y_2
...				

$2 \leq N_n \leq 10$ and $Y_1 \neq Y_2$.

$$\Pi_A T^A = \Phi_8^a T^a + \Phi_3^i \hat{T}^i + (\Phi_3^i \hat{T}^i)^\dagger + \Phi_1 T^{15} .$$

$$\mathcal{L}_{\Phi_1} = -\frac{\dim(\mathcal{R}_n)\alpha_s}{8\sqrt{6}\pi f_\Pi} \Phi_1 G^a_{\mu\nu} \widetilde{G}^{a,\mu\nu}$$
$$-\sqrt{6}(Y_1^2 - Y_2^2) \frac{\dim(\mathcal{R}_n)\alpha}{8\pi f_\Pi} \Phi_1 (\widetilde{A}_{\mu\nu} A^{\mu\nu} - 2t_W \widetilde{Z}_{\mu\nu} A^{\mu\nu} + t_W^2 \widetilde{Z}_{\mu\nu} Z^{\mu\nu}) ,$$

$$\mathcal{L}_{\Phi_8} = -\frac{\dim(\mathcal{R}_n)\alpha_s}{8\pi f_\Pi} d^{abc} \Phi_8^a G^b_{\mu\nu} \widetilde{G}^c_{\mu\nu}$$
$$-\frac{Y_1 \dim(\mathcal{R}_n)\sqrt{\alpha\alpha_s}}{4\pi f_\Pi} \Phi_8^a G^a_{\mu\nu} (-t_W \widetilde{Z}^{\mu\nu} + \widetilde{A}^{\mu\nu}) .$$

NP out of Old Physics

- The hypercharges

$$\left|Y_1^2 - Y_2^2\right|^2 = \frac{2}{9}\left(\frac{\alpha_s}{\alpha}\right)^2 \frac{\Gamma[\Phi_1 \to \gamma\gamma]}{\Gamma[\Phi_1 \to gg]}\,, \qquad \propto \sigma[\text{ diphoton}]/\sigma[\text{ dijets}]$$

- Look for octet at ~ 1 TeV

$$Y_1^2 = \frac{5}{96}\frac{\alpha_s}{\alpha}\frac{\Gamma[\Phi_8 \to g\gamma]}{\Gamma[\Phi_8 \to gg]}$$

- **Long-lived scenario**, color triplets: triplet Φ_3, forming R-hadrons if they are long-lived. Displaced vertices or inner detector tracks for charged R-hadrons, exclusion to $M \sim 845 - 900$ GeV.

- Or **decays** through higher-dim effective operators

$$Y_1 - Y_2 = \frac{2}{3} \quad : \quad \frac{1}{\Lambda^2}(\bar{L}\gamma^\mu\gamma_5 Q)(\bar{d}_R\gamma_\mu e_R)\,,$$
$$Y_1 - Y_2 = \frac{5}{3} \quad : \quad \frac{1}{\Lambda^2}(\bar{L}\gamma^\mu\gamma_5 Q)(\bar{u}_R\gamma_\mu e_R)\,.$$

  Signals to look for: lepto-quark $jj\ell\ell$.

- For $Y_2 = 0$, $\mathrm{SU(N_n)}$ "neutron" of $(L)^{N_n} \sim 1$ TeV as DM candidate.

Concussion

没有大新闻