Light dark matter candidates in intense laser pulses

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and

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EXTREME HIGH INTENSITY LASER PHYSICS ExHILP CONFERENCE

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- Summary.

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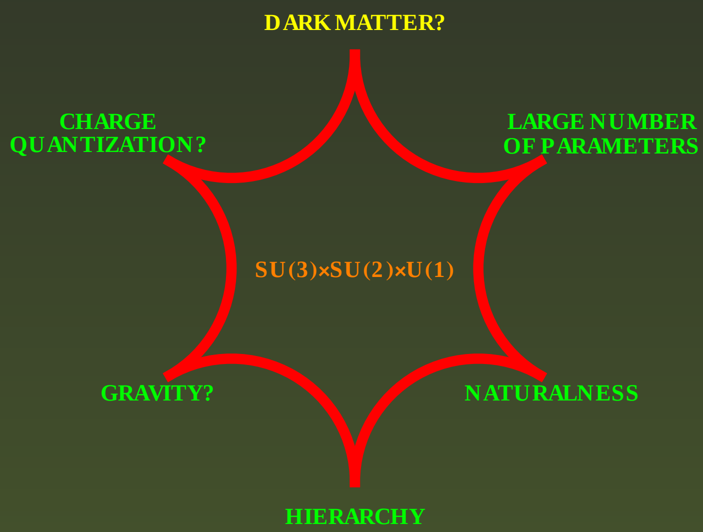

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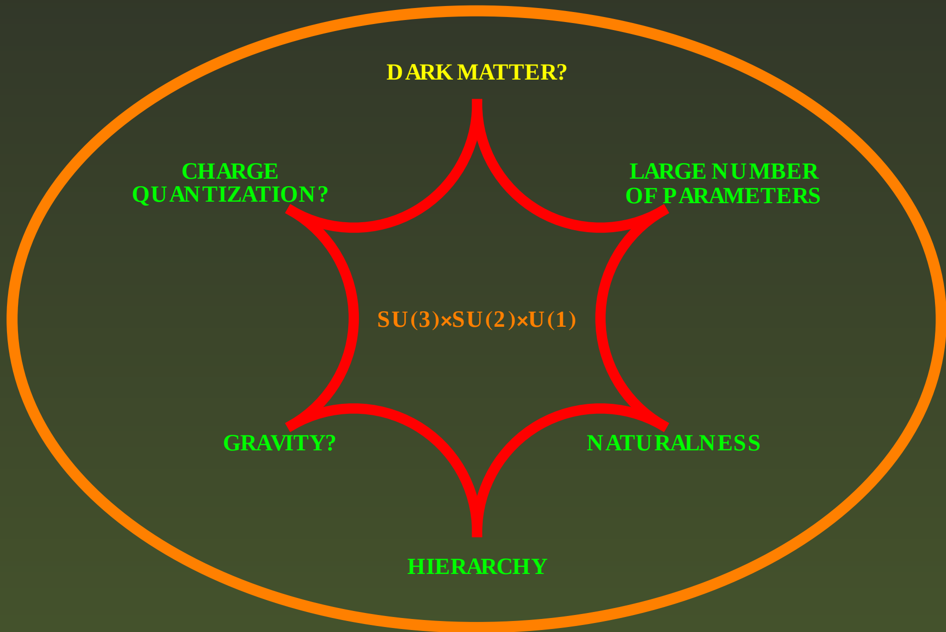

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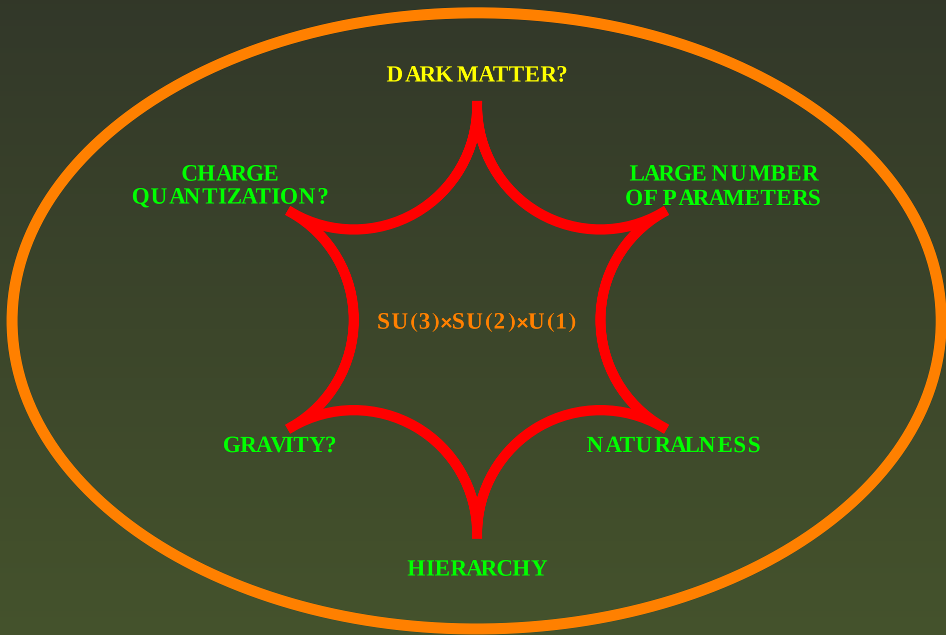

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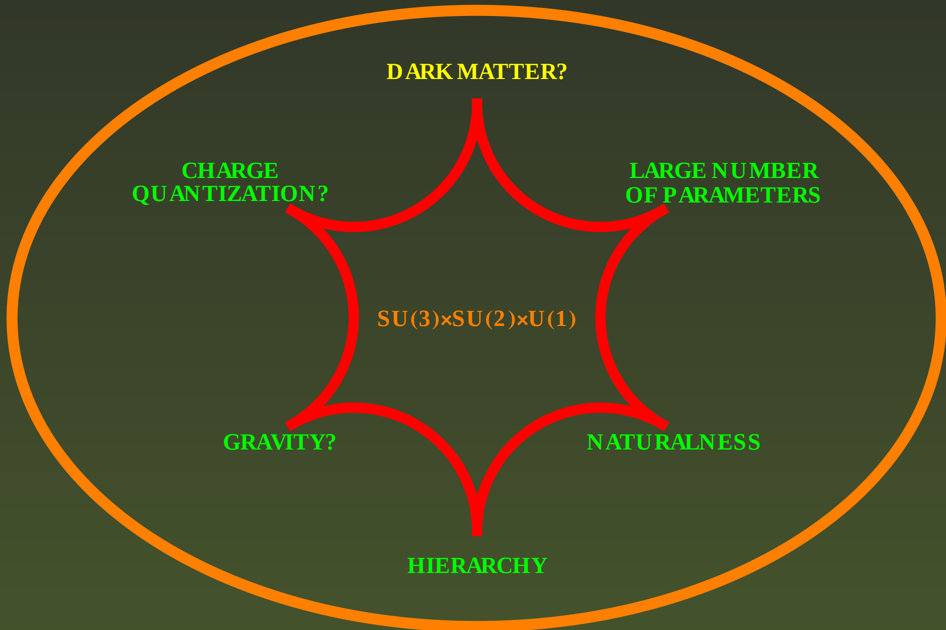

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- Extra local abelian gauge symmetry in the hidden sector: paraphotons $h^{\mu\nu}$ and ALPs ϕ.
- Interaction with the visible sector occurs via: $\mathcal{L} \sim -\frac{\chi}{2} f_{\mu\nu} h^{\mu\nu}$ or $\mathcal{L} \sim -\frac{g}{2} \phi \tilde{f}_{\mu\nu} f^{\mu\nu}$.

Minicharged particles

- We will deal with a parity-preserving Lagrangian, invariant under $\mathrm{U}(1) \times \mathrm{U}(1)-$gauge group:

$$\mathcal{L} = -\frac{1}{16\pi} f_{\mu\nu} f^{\mu\nu} - \frac{1}{16\pi} h_{\mu\nu} h^{\mu\nu} - \frac{\chi}{8\pi} f_{\mu\nu} h^{\mu\nu} + e j^{\mu} a_{\mu} + g_H j_H^{\mu} w_{\mu} .$$

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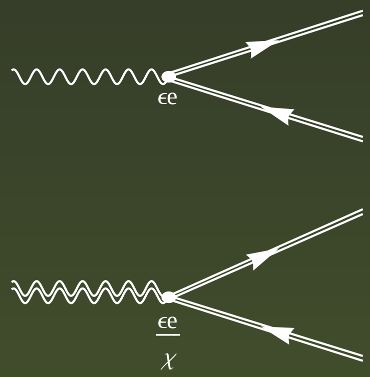

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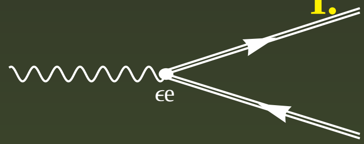

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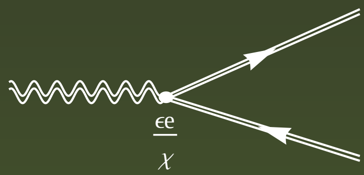
$$j_H^\mu = \bar{\psi}_\epsilon \gamma^\mu \psi_\epsilon ,$$



or a current built up from hidden scalar fields

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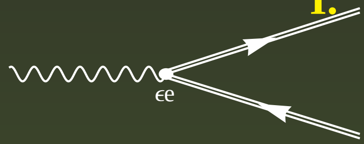

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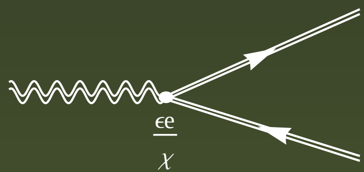

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$$\mathscr{A}^\mu(x) = a_1^\mu \cos(\varkappa x) + a_2^\mu \sin(\varkappa x).$$

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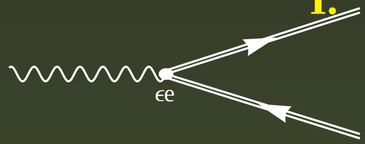

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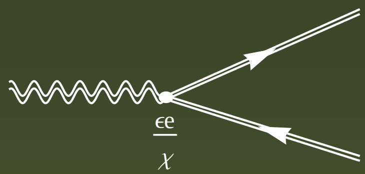

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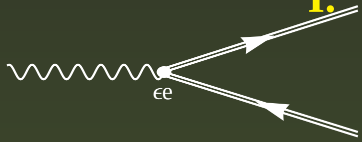

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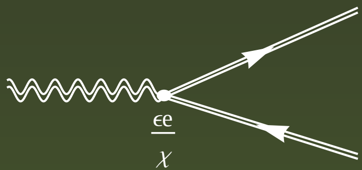

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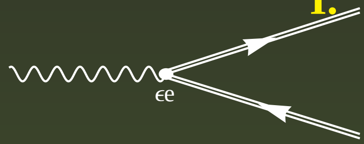

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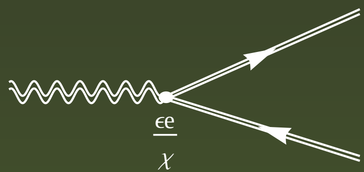

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$$a_1^2 = a_2^2 \quad \textbf{CIRCULAR POLARIZATION!}$$

- To analyze the vacuum properties including Minicharged Particles and Paraphotons effects.

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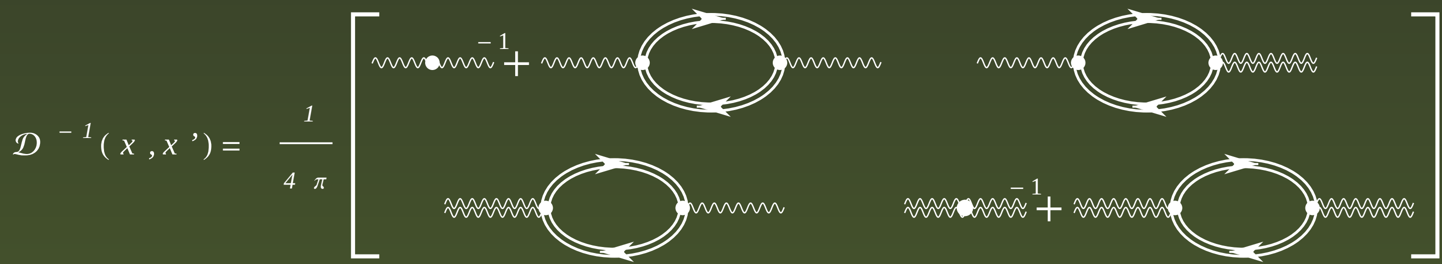

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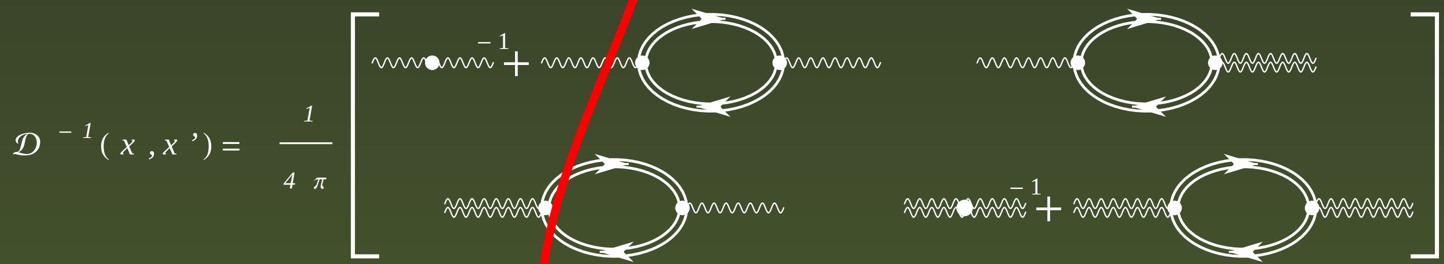

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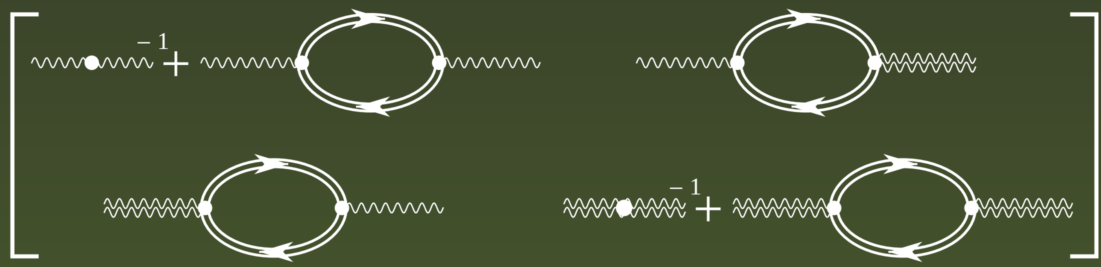

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- The equations of motion to be solved

$$k^2 a_\mu(k) - \int \frac{d^4k'}{(2\pi)^4}\Pi_{\mu\nu}(k,k')a^\nu(k') + \frac{1}{\chi}\int \frac{d^4k'}{(2\pi)^4}\Pi_{\mu\nu}(k,k')w^\nu(k') = 0,$$

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Vacuum polarization tensor

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$$\Pi^{\mu\nu}(k,k') = \delta_{k,k'}\Pi_0^{\mu\nu}(k') + \delta_{k,k'-2\varkappa}\Pi_-^{\mu\nu}(k') + \delta_{k,k'+2\varkappa}\Pi_+^{\mu\nu}(k'),$$

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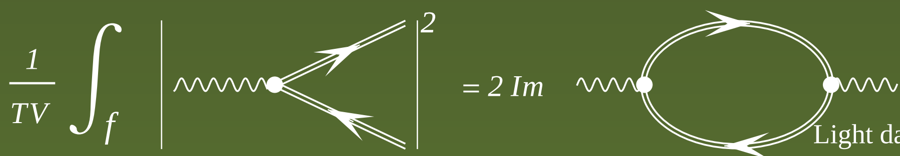
- The sum of the absorption coefficients coincides with the rate of the photo-production of a pair:



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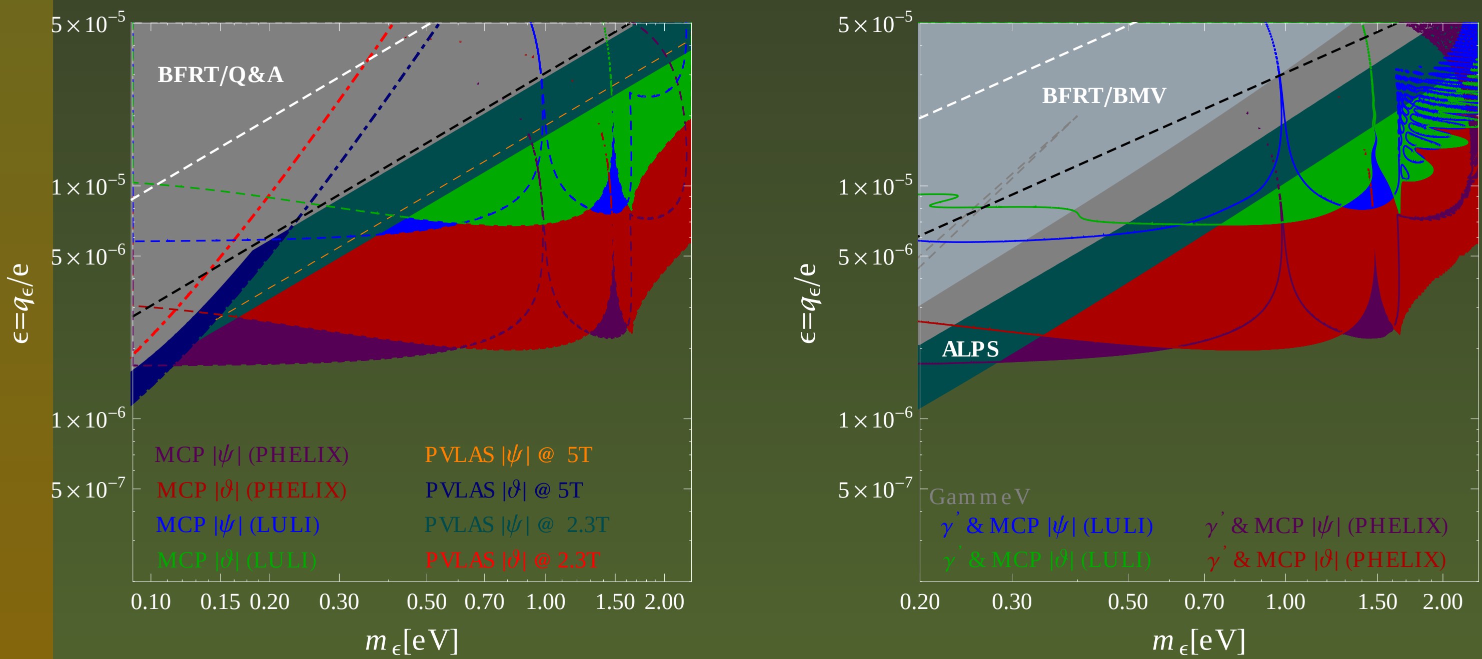

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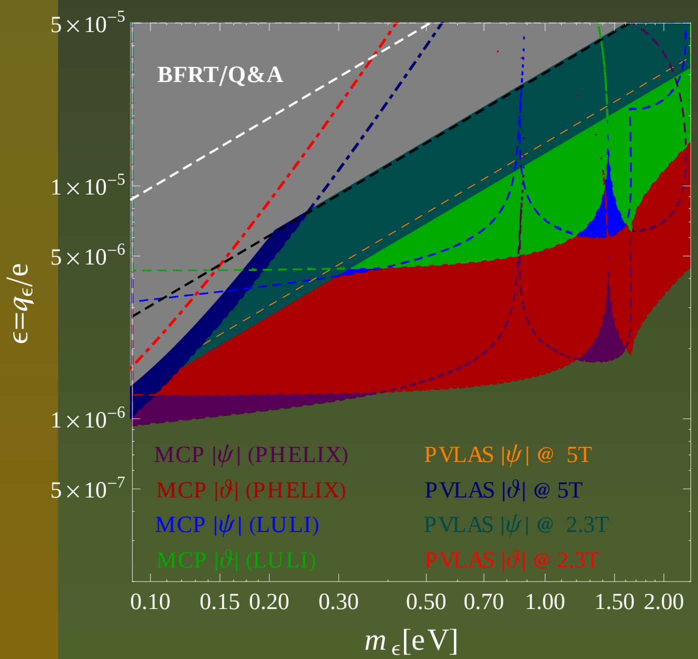

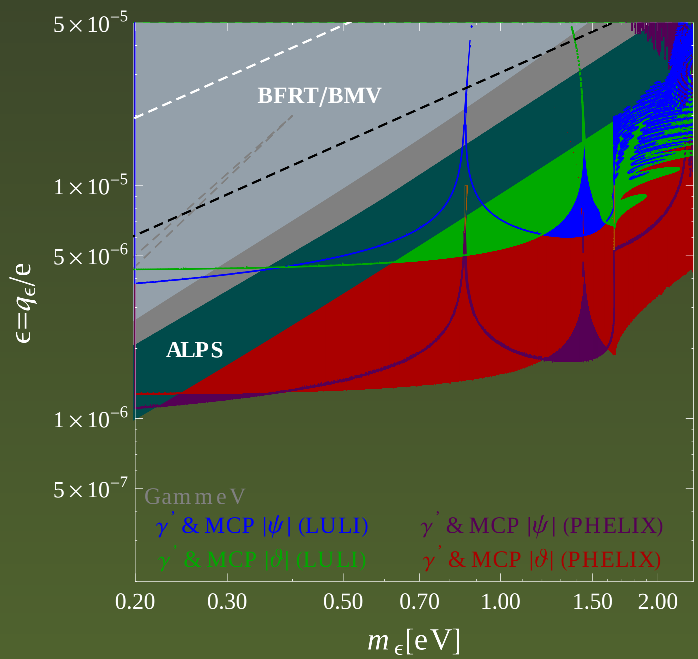

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4. Our outcomes complement the results obtained in previous investigations developed within the context of axionlike particles S. Villalba and A. Di Piazza, JHEP **1311**, 136, (2013) and S. Villalba, Nucl. Phys. B **881**, 391, (2014).

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