The importance of quantum loops for astrophysical ALPs

Eike Müller, Poster #41
August 2022 @ Patras Mainz

Based on

- *Do Direct Detection Experiments Constrain Axionlike Particles Coupled to Electrons?,* Ricardo Z. Ferreira, M. C. David Marsh, and **EM,** Phys. Rev. Lett. 128, 221302
- *Strong supernovae bounds on ALPs from quantum loops,* Ricardo Z. Ferreira, M.C. David Marsh, and **EM**, arXiv:2205.07896 (submitted to JCAP)

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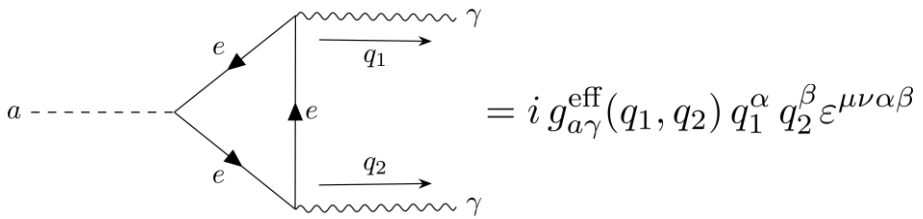
Poster #41; Ricardo Ferreira, M.C.David Marsh, **Eike Müller**: 2202.08858 & 2205.07896

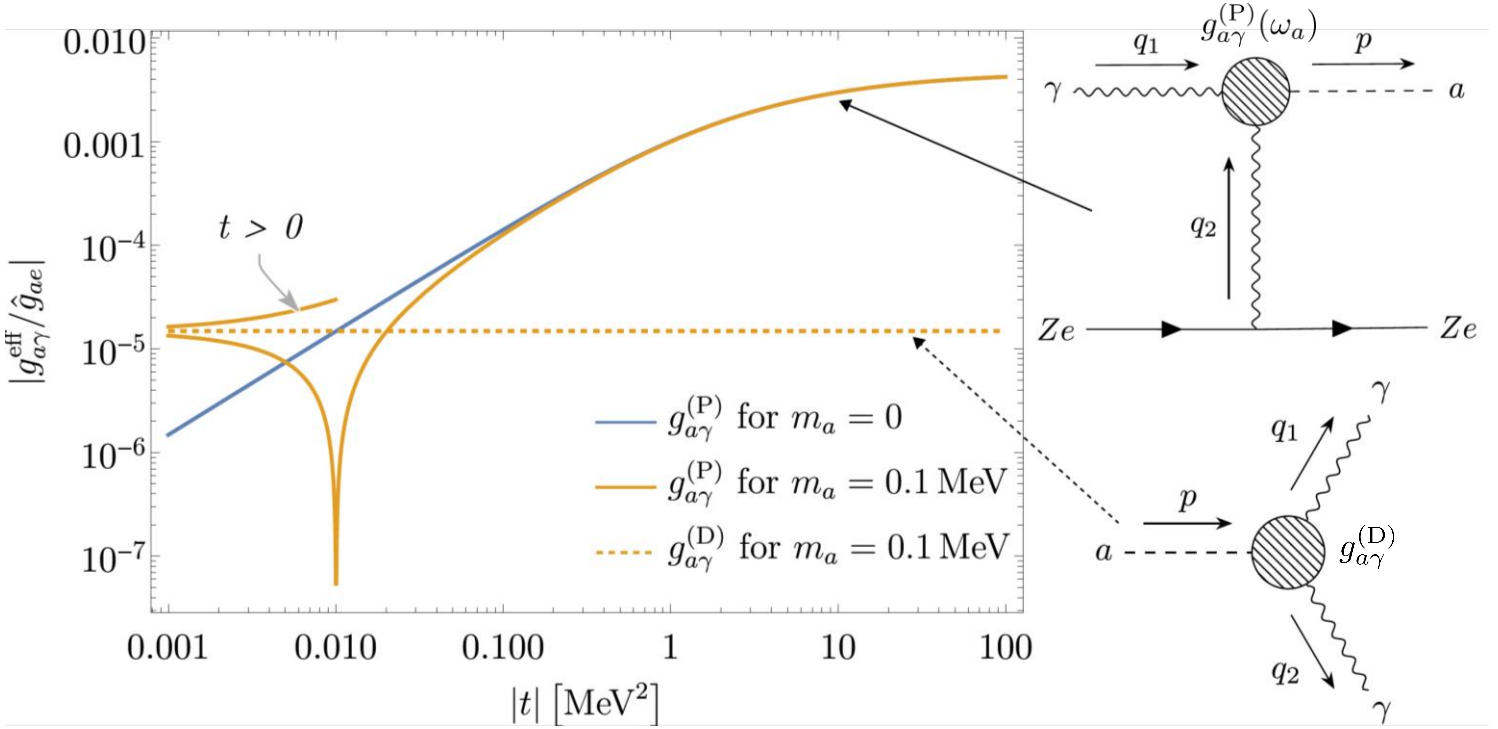
Stockholm University

ALPs dominantly coupled to electrons at tree-level…

$$\mathcal{L}_{\rm EFT} \supset \hat{g}_{ae}(\partial_\mu a)\,\bar{\psi}_e\gamma^\mu\gamma_5\psi_e + \frac{\hat{g}_{a\gamma}}{4}a\tilde{F}F$$



$$= i\,g^{\rm eff}_{a\gamma}(q_1,q_2)\,q_1^\alpha\,q_2^\beta\,\varepsilon^{\mu\nu\alpha\beta}$$



…acquire an effective off-shell photon coupling at one loop! This is an irreducible contribution.

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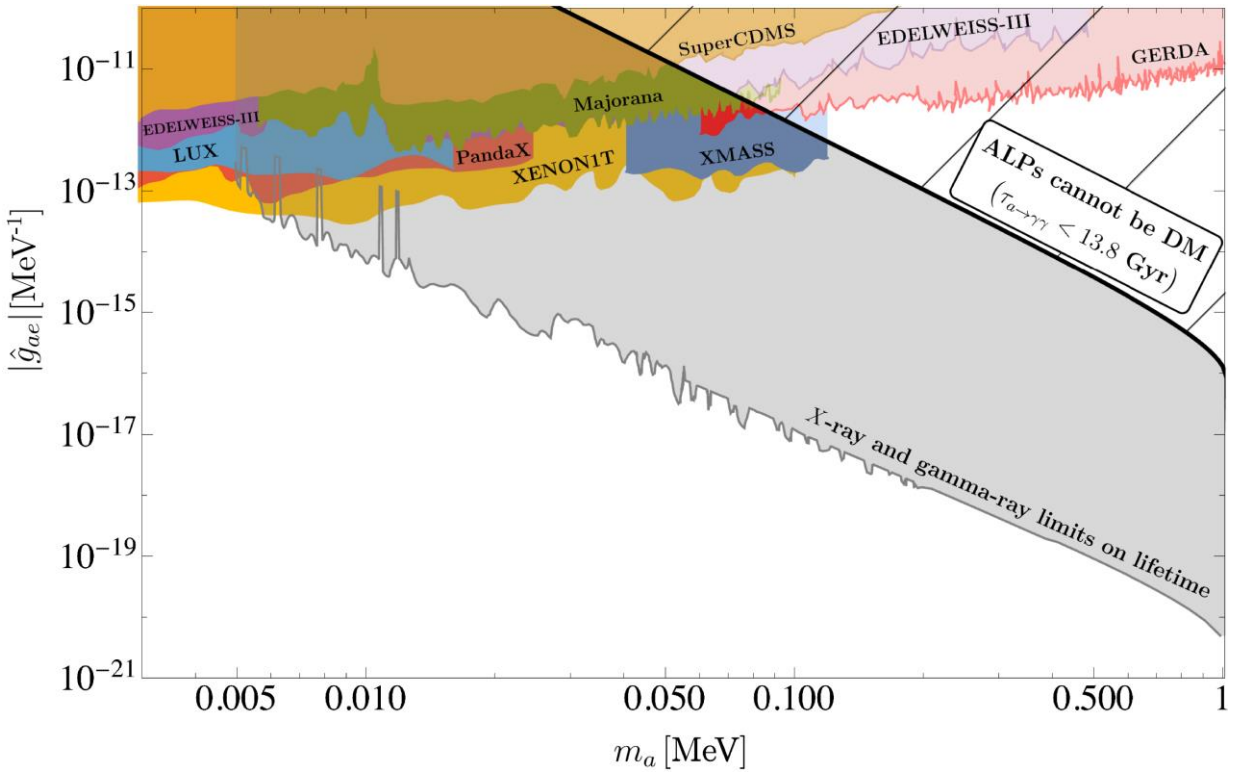
We looked at two phenomenological applications:

1-loop decay of dark matter ALPs



ALPs produced in SN1987A at tree-level & 1-loop