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## Axion searches using the European X-ray Free Electron Laser (EuXFEL)

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The axion was initially posed as a solution to the CP problem of QCD, but axion-like particles (ALPs) also arise in string theory and are a dark matter (DM) candidate. Most laboratory axion searches concentrate on the 0.001-0.1 meV mass range, however there is growing interest in heavier (DFSZ) axions (above 10 meV) which avoid the cosmological domain wall catastrophe[1] and may explain stellar energy losses beyond those accounted for by neutrino emission[2].

Here we describe new laboratory searches for axions performed at EuXFEL. These are sensitive to an axion/ALP mass range including 1 meV-1 eV, which is unconstrained by astrophysical arguments if axions constitute DM. Similar searches were previously performed on a 3rd generation synchrotron[3]; however limited flux prevented those experiments probing down to DM relevant couplings. This work is the first step in developing a platform with improved sensitivity due to an increase in brightness by  $\sim 10^{10}$  when using EuXFEL. Initial work has confirmed previous bounds on the axion-photon coupling[3] and considered a previously unexplored axion mass range. In future we expect to probe down to the coupling in the keV mass range for which QCD axions can be DM.

[1]K.Beyer & S.Sarkar arXiv:2211.14635v5. (2023)

[2]M.Giannotti+ JCAP 2017.10 (2017)

[3]T.Yamaji+ Phys.Lett.B 782, 523–527 (2018)

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### Submitted on behalf of a Collaboration?

No

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