Conceptual design of the International Axion Observatory (IAXO) - DTU Orbit (28/07/2019)

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The International Axion Observatory (IAXO) will be a forth generation axion helioscope. As its primary physics goal, IAXO will look for axions or axion-like particles (ALPs) originating in the Sun via the Primakoff conversion of the solar plasma photons. In terms of signal-to-noise ratio, IAXO will be about 4–5 orders of magnitude more sensitive than CAST, currently the most powerful axion helioscope, reaching sensitivity to axion-photon couplings down to a few $\times 10^{-12}$ GeV$^{-1}$ and thus probing a large fraction of the currently unexplored axion and ALP parameter space. IAXO will also be sensitive to solar axions produced by mechanisms mediated by the axion-electron coupling $g_{ae}$ with sensitivity — for the first time — to values of $g_{ae}$ not previously excluded by astrophysics. With several other possible physics cases, IAXO has the potential to serve as a multi-purpose facility for generic axion and ALP research in the next decade. In this paper we present the conceptual design of IAXO, which follows the layout of an enhanced axion helioscope, based on a purpose-built 20 m-long 8-coils toroidal superconducting magnet. All the eight 60cm-diameter magnet bores are equipped with focusing x-ray optics, able to focus the signal photons into ~ 0.2 cm$^2$ spots that are imaged by ultra-low-background Micromegas x-ray detectors. The magnet is built into a structure with elevation and azimuth drives that will allow for solar tracking for ~ 12 h each day.

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