

Next Generation Axion Helioscope

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We present a proposal for a new generation axion helioscope, with a potential sensitivity to the axion photon coupling down to a few $10^{-12} \text{ GeV}^{-1}$, 1-1.5 orders of magnitude beyond the CERN Axion Solar Telescope (CAST), currently the most powerful implementation of the axion helioscope concept. We show that such improvement is conceivable by fully exploiting innovations already introduced by CAST, namely, x-ray focusing optics and low background x-ray detectors, as well as a new magnet with substantially enlarged magnetic volume. If axions also couple to electrons, the Sun produces a larger flux for the same value of the Peccei-Quinn scale, allowing one to probe a broader class of models. Except for the axion dark matter searches, this experiment will be the most sensitive axion search ever, reaching or surpassing the stringent bounds from SN1987A and possibly testing the axion interpretation of anomalous white-dwarf cooling that predicts an axion mass of a few meV. Beyond axions, this new instrument will probe entirely unexplored ranges of parameters for a large variety of axion-like particles (ALPs) and other novel excitations at the low-energy frontier of elementary particle physics.

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