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Solar Axion Searches with the International Axion Observatory (IAXO) and BabyIAXO

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More than 80 years after the postulation of dark matter, its nature remains one of the fundamental questions in cosmology waiting to be answered. Axions have taken the spotlight in recent years and are currently one of the leading candidates for the hypothetical, non-baryonic dark matter expected to account for about 25% of the energy density of the Universe. Especially in the light of the Large Hadron Collider at CERN as well as other dedicated dark matter experiments slowly closing in on weakly-interacting massive particle (WIMP) searches, axions and axion-like particles (ALPs) provide a viable alternative approach to solving the dark matter problem. The fact that makes them especially appealing is that they were initially introduced to solve a long-standing problem in quantum chromodynamics and the Standard Model of particle physics, so they do not present an ad-hoc solution to dark matter alone.

Helioscopes are one of three major types of axion experiments and search for axions produced in the core of the Sun via the Primakoff effect. The International Axion Observatory (IAXO) is a next generation axion helioscope aiming at a sensitivity to the axion-photon coupling of 1 - 1.5 orders of magnitude beyond the current most sensitive axion helioscope which is the CERN Axion Solar Telescope (CAST). IAXO will be able to challenge the stringent bounds from supernova SN1987A and furthermore test the axion interpretation of anomalous white-dwarf cooling. Beyond standard axions, this new experiment will also be able to search for a large variety of ALPs and other novel excitations at the low-energy frontier of elementary particle physics. BabyIAXO is proposed as a first stage towards IAXO and aims at extending the sensitivity to axion-photon couplings down to a few 10^{-11} GeV^{-1}. Thus the experiment will deliver significant physics results while demonstrating the feasibility of the full-scale IAXO experiment by validating all subcomponents (magnet, optics, detectors, infrastructure). Here we introduce IAXO and BabyIAXO, report on the current status of both experiments and outline the expected science reach.

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Primary author: Dr VOGEL, Julia (LLNL)

Co-authors: GARCIA IRASTORZA, Igor (Universidad de Zaragoza); Dr RUZ, Jaime (LLNL); DESCH, Klaus (University of Bonn); Dr DESCALLE, Marie-Anne (LLNL); Dr PIVOVAROFF, Michael J. (LLNL)

Presenter: Dr VOGEL, Julia (LLNL)

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