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Search for Dark Matter with the Cern Axion Solar Telescope (CAST)



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Prof. Hoffmann is experts on the field of high energy physics with intense heavy ion and laser beams. Recently, he made some creative works on the laboratory research of dark mater with the CERN (European Organization for Nuclear Research) Axion Solar Telescope. On 1979, he obtained his first PhD of Physics at Technical University of Darmstadt. On 1993, he got the Habilitation degree (A German academic degree). After six years (1999), he obtained his second Doctor degree of Technology from Russian Academy of Sciences. He has a prolific experience. After he got his first PhD, he start his first job position under the Humboldt Scholarship at Stanford University. From 1982, he took part in Technical University Darmstadt and GSI on atomic nuclear physics fields. From 1985, he worked at Max Planck institute for Quantum-Optics at Garching, Germany. On 1989, he returned to GSI, and started research on plasma physics. On 1994, he got a Professor position at University Erlangen, Bavaria. On 1998, He return GSI again, and become Director of plasma division. Since 1998, he has been working at Techincal University Darmstadt at Professor position on Physics.

Abstract

The CAST is designed to search for solar axions which are produced in the interior of the sun via the Primak off effect. The central part of the experiment, the helioscope is an LHC prototype magne tthat has attached different types of sensitive detectors for x-rays in the regime of 1-10 keV. The experiment has been taking data since 2003 and provided the most restrictive limits on the axion-photon coupling in a broad mass range. Beyond $0,02\text{eV}/c^{**2}$ the mass the sensitivity is degraded due to coherence loss. In order to restore coherence, the magnet can be filled with a buffer gas providing an effective mass to the photon. By changing the pressure of the buffer gas in steps, one can scan an entire range of axion mass values. The CAST experiment started this gas program entering its phase II at the end of 2005. From 2005 to 2007, the magnet bore was filled with 4He gas extending the sensitivity to masses up to 0.4 eV. From March 2008 onwards the magnet bore has been filled with 3He. With the end of the 2011 data taking in July, the CAST experiment has covered axion masses up to 1.18 eV surpassing the initial goal of the phase II which was to reach 1.16 eV. The results of the first part of the 3He, with a sensitivity up to 0.64 eV, have been finalized and accepted for publication in PRL. Exclusion plot with this recent result was compared to other measurements, theoretical and astrophysical bounds. An overview on the current status of CAST and the future perspectives will be given.

