



Contribution ID: 22

Type: **Oral contribution**

Microbulk Micromegas as x-ray detectors for axion searches: CAST and developments for IAXO.

Thursday, 15 October 2015 08:45 (20 minutes)

The basic layout of an axion helioscope requires a powerful magnet coupled to x-ray optics and a detector in its focal plane. When the magnet is aligned with the Sun, an excess of x-rays at the exit of the magnet is expected, over the background measured at non-alignment periods. Therefore, low background x-ray detectors are a fundamental tool for these searches, partially determining their sensitivity. One of the four detection lines of CAST (CERN Axion Solar Telescope) has been recently upgraded. It integrates for the first time an x-ray optic specifically designed for an axion application and a shielded Micromegas-based TPC, made from radiopure materials in the microbulk technique, in its focal point. In this work we present the commissioning and operation of this system, conceived as a technological pathfinder for IAXO (International Axion Observatory). Based in our understanding of the background nature of the Micromegas detectors, we also report in our current background reduction activities, aiming at levels below 10^{-7} c/keV/cm²/s. Finally, we present the R&D strategies for reducing the energy threshold to sub-keV energies, which could enlarge the physics case of axion helioscopes. These strategies are based on technological (thinner x-ray windows), electronic instrumentation (self-triggered electronics) and analysis (cluster shape versus energy) developments.

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Session Classification: Contributed talks

Track Classification: MPGD Detector Physics