Contribution ID: **105** Type: **Presentation**

Search for solar chameleons with a GridPix detector at the CAST experiment

Thursday 21 June 2018 10:15 (20 minutes)

Dark Energy can be explained by modifying General Relativity introducing a new scalar field with a coupling to matter. To avoid unnatural effects, a screening mechanism can be utilized. In case of the chameleon screening this gives rise to a new particle, the chameleon, featuring an effective mass depending on the local energy density as well as an effective coupling to photons.

Chameleons can be produced similar to axions by converting photons inside strong electromagnetic fields through the Primakoff effect. Therefore the Sun can act as a chameleon source and axion helioscopes such as the CERN Axion Solar Telescope (CAST) can be utilized as chameleon helioscopes. In contrast to axions, chameleons are produced not in the solar core but in the tachocline, a region of high differential rotation inside the Sun providing strong magnetic fields. Therefore the X-ray photons resulting from solar chameleons (re)converting to photons inside a helioscope are in the energy range of below 2 keV, thus requiring X-ray detectors sensitive to low energy X-ray photons for a solar chameleon search with an axion helioscope.

In October 2014 a low energy X-ray detector developed at Bonn was installed behind one of the X-ray telescopes of CAST. This detector utilizes a 'GridPix' device, a Micromegas stage created on top of a pixelized readout ASIC by means of photolithographic postprocessing. Due to the readout's high granularity, this technology allows for an energy threshold of a few hundred eV and in addition for a topological background suppression resulting in background rates of less than $10^{-4}\,/\mathrm{keV}/\mathrm{cm}^2/\mathrm{s}$ below 2 keV.

After successful operation until December 2015 the recorded data has been analysed. With respect to CAST's previous search for solar chameleons using a silicon drift detector, the sensitivity to the chameleon photon coupling could be increased by a factor of two for the first time allowing to probe the parameter space below the solar luminosity bound.

Primary author: KRIEGER, Christoph (University of Bonn)

Presenter: KRIEGER, Christoph (University of Bonn)

Session Classification: Plenary presentations