T 34: Axionen I

Zeit: Dienstag 16:00–17:45 Raum: S09

T 34.1 Di 16:00 S09

KWISP - Hunting Chameleons with the CAST Experiment at CERN — •Justin Baier, Horst Fischer, and Marc Schumann for the CAST-Collaboration — University of Freiburg

The KWISP (Kinetic Weakly Interacting Slim Particle) detector is part of the CAST experiment at CERN exploring the dark sector. It utilizes an ultrasensitive opto-mechanical force sensor for the search for solar chameleons. A chameleon is a hypothetical scalar particle postulated as dark energy candidate, which has a direct coupling to matter depending on the local density. Considering this characteristic a flux of solar chameleons hitting a solid surface at grazing incidence will, under certain conditions, reflect and exert the equivalent of a radiation pressure. To exploit this trait the KWISP sensor consists of a thin and rigid dielectric membrane placed inside a resonant optical Fabry-Pérot cavity utilizing an active electrooptical feedback system to keep the laser frequency-locked. In this talk, the principle and the setup of the KWISP detector will be explained and first results will be presented.

T 34.2 Di 16:15 S09

Hunting Axion Dark Matter with MADMAX - Idea and First Proof of Principle Results — •Stefan Knirck for the MADMAX-Collaboration — Max-Planck-Institute for Physics, Munich, Germany

While the QCD axion was introduced to explain CP conservation in strong the interaction, it is also an excellent dark matter candidate. Axions could be detected using their conversion to photons at boundaries between materials of different dielectric constants in a strong magnetic field. Combining many such surfaces, one can enhance this conversion significantly using constructive interference and resonances. The proposed "Magnetized Disk and Mirror Axion eXperiment" (MADMAX) containing approximately 80 high dielectric disks with 1m diameter in a 10 T magnetic field could probe the well-motivated mass range of $(40 - 400)\mu$eV, a range which is at present inaccessible by existing cavity searches. After explaining the foundations of this approach, we present results from first proof of principle measurements. By comparing a 5 Sapphire disk setup with simulations, we demonstrate the needed disk positioning accuracy and show that the predicted electromagnetic properties are reproduced. We study systematic effects from antenna reflection, beam shape, tilts and others and conclude with an outlook for the final MADMAX setup.

T 34.3 Di 16:30 S09

Current status of the ALPS II detector — •Rikhav Shah for the ALPS-Collaboration — Johannes Gutenberg-Universität Mainz — DESY Deutsches Elektronen-Synchrotron

The Any Light Particle Search II (ALPS II) is an experiment that utilizes the concept of resonance enhancement to improve on the sensitivity of traditional light shining through a wall style experiments. These experiments attempt to detect photons passing through an opaque wall by converting to relativistic weakly interacting sub-eV particles and then reconverting back to photons. The detection of these photons requires a detector capable of observing the extremely small rates, of the order of $10^{-5}\,\mathrm{s}^{-1}$. Thus the detector must have a low dark count rate as well as a high detection efficiency. This is achieved with a transition edge sensor (TES), i.e. a cryogenic calorimeter, which exploits the drastic dependence of a material's electrical resistance on the temperature at the superconducting edge. One major experimental challenge is the suppression of background dominated by blackbody radiation to a sufficiently low level. The setup of the TES at ALPS II will be presented. We discuss the current status as well as the first measurements of the detector preparing for data taking starting in 2020.

T 34.4 Di 16:45 S09

Status of ALPS IIa and lessons learned for ALPS II — •Richard Smith for the ALPS-Collaboration — DESY, Hamburg

ALPS IIa is a smaller-scale testbed of the 2 x 100m long ALPS II experiment. ALPS IIa uses two 10 m long optical cavities to develop and test the length and alignment sensing and control schemes needed for ALPS II. The experience gained is currently used to guide the design of ALPS II. This talk will provide an update on the status of ALPS IIa, some examples of solutions to challenges encountered, and the projected performance of ALPS II.

T 34.5 Di 17:00 S09

Preparation of a GridPix detector for solar axion search at IAXO — •Hendrik Schmick, Klaus Desch, Jochen Kaminski, Sebastian Schmidt, and Tobias Schiffer for the CAST-Collaboration — Physikalisches Institut, Universität Bonn

The International Axion Observatory (IAXO) is an experiment, currently in development, to search for solar axions. The inverse Primakoff effect is utilized to reconvert the particles into X-rays in a magnetic field.

To test and optimize detectors for IAXO we use the CERN Axion Solar Telescope (CAST). The current gaseous X-ray detector consists of 7 GridPixes, a Timepix ASIC and an integrated MicroMegas stage on top. Additionally the analogue signals induced on the grid of the central GridPix are decoupled and recorded with an FADC. Moreover, two veto scintillators are installed for further background rejection.

Primary object of the talk will be auxiliary detector components (FADC + scintillators). The connection between the FADC, the central GridPix and the scintillator signals will be explained and the ways to use this information to improve background rejection will be presented.

The results presented wil be based on the 2017/18 data taking period at CAST.

T 34.6 Di 17:15 S09

Search for hidden-photon dark matter with FUNK — •Arnaud Andrianavalomahefa[1], Kai Daumiller[1], Ralph Engel[1], Hermann-Josef Mathes[1], Markus Roth[1], Christoph M. Schäfer[1], Thomas Schwetz-Mangold[1], Ralf Ulrich[1], Darko Veberic[1], Babette Döbrich[2], Joerg Jaeckel[3], Axel Lindner[4], Marek Kowalski[4,5], and Javier Redondo[6] — [1]Institute for Nuclear Physics, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [2]Physics Department, CERN, Geneva, Switzerland — [3]Institute for Theoretical Physics, Heidelberg University, Germany — [4]Deutsches Elektronen Synchrotron (DESY), Zeuthen, Germany — [5]Department of Physics, Humboldt University, Berlin, Germany — [6]Department of Theoretical Physics, University of Zaragoza, Spain

The FUNK experiment was built to search for hidden and light U(1) gauge force carriers, named hidden photons, which are suitable candidates for cold dark matter. At low energies, these photons with small mass couple dominantly with regular photons via a weak kinetic mixing. As an immediate consequence, when propagating across two different dielectric media a certain probability exists that the dark-matter field emits a faint but measurable ordinary electric field. The FUNK experiment uses a large spherical mirror to capture this conversion. A photomultiplier tube is installed at the radius point where the signal is expected. We scanned the whole optical range of frequencies extended to far-UV and looked for hidden photons with masses from 2 to 8 eV. In this region we found no significant evidence of hidden-photon dark-matter but set an upper bound on the mixing parameter to 10^{-12}.

T 34.7 Di 17:30 S09

Search for Axion-Like Particles produced in e^+e^- collision at Belle II — •Michael De Nuccio — DESY, Hamburg, Germany

The Belle II experiment, located at the asymmetric e^+e^- collider SuperKEKB in Tsukuba, Japan, is a second-generation B factory experiment. A first commissioning run took place in Spring 2018. The main physics data taking will begin in early 2019. Thanks to the very clean environment and dedicated triggers, Belle II is suited to perform searches for dark-sector particles.

ALPs are light neutral pseudoscalars interacting predominantly with Standard Model photons, and have been proposed as both candidate dark matter particles or as portal particles to the dark sector. The sensitivity for ALPs produced in association with a recoil photon from e^+e^- collisions, and decaying promptly into two photons, is already competitive using the small commissioning collisions dataset collected at Belle II. This talk will discuss the expected sensitivity and the status of the ongoing analysis for this search.