SYMD 1: SMuK Dissertationspreis 2019

Zeit: Montag 14:00–16:00 Raum: Plenarsaal

Hauptvortrag SYMD 1.1 Mo 14:00 Plenarsaal
Analysis of historical solar Ca II K and sunspot data for irradiance studies — •Theodosios Chatzistergos[1], Natalie A Krivova[2], Sami K Solanki[2], Ilaria Ermolli[1], Ilya Usoskin[3], and Gennady Kovaltsov[4] — [1]INAF osservatorio astronomico di Roma, Monte Porzio Catone, Italy — [2]Max Planck institute for solar system research, Göttingen, Germany — [3]University of Oulu, Oulu, Finaland — [4]Ioffe physical-technical institute, St. Petersburg, Russia

The Sun can affect Earth's climate, however the exact mechanisms or any long-term effects cannot be accurately determined with the available measurements of solar irradiance since 1976. Models have been successful at reconstructing the solar irradiance by using maps of the surface magnetic fields of the Sun which describe the competing contributions of the dark (sunspots) and bright (faculae) magnetic features. Such maps exist since 1974 and reconstructions for earlier periods rely mainly on sunspot data alone. Furthermore, the methods employed to cross-calibrate the sunspot data have been recently criticised. The missing information about faculae for the 20th century can be provided by Ca II K observations. These data have been quite unexplored due to various issues plaguing them and the lack of information on photographic plates' response on the incident radiation. Here we present our work to automatically process and calibrate the historical Ca II K data and derive information about the evolution of faculae. We further present a new reconstruction of the group sunspot number series with a non-linear and non-parametric procedure. Our results will allow for an improved understanding of the solar influence on Earth's climate.

Hauptvortrag SYMD 1.2 Mo 14:30 Plenarsaal
MUSiC: A Model Unspecific Search for New Physics — •Deborah Duchardt[1] and Thomas Hebbeker[2] — [1]Berlin — [2]III. Physikalisches Institut A, RWTH Aachen

The Large Hadron Collider (LHC), currently the highest energy proton-proton collider and at the forefront of today's particle physics research, is an ideal setting for seeking out signatures of new physics. At the LHC's Compact Muon Solenoid (CMS) experiment dedicated searches are conducted in anticipation of revealing signs of specific theory models beyond the established Standard Model of particle physics. In doing so, some classes of collision events are left unconsidered, e.g. ones with complex final states. However, signatures of new, unthought-of theories may be hidden even there.

Therefore, the "Model Unspecific Search in CMS" (MUSiC) follows an unbiased approach, exempting dedicated theory model assumptions and specific kinematic selections. Instead, the search is carried out in several hundreds of final states. An automated statistical analysis quantifies the significance of deviations observed between the data and a Monte-Carlo simulated prediction of the Standard Model.

In this talk general concepts of the MUSiC analysis and new methods developed for my thesis will be discussed. Moreover, search results based on 8 TeV CMS data will be summarized, which show a very good agreement between data and Standard Model expectation. This analysis was also published as CMS-PAS-EXO-14-016.

Hauptvortrag SYMD 1.3 Mo 15:00 Plenarsaal
Search for solar chameleons with an InGrid based X-ray detector at the CAST experiment — •Christoph Krieger — Universität Bonn, Physikalisches Institut — Universität Hamburg, Institut für Experimentalphysik

The chameleon arises from a possible explanation for dark energy through modification of General Relativity. It features an effective mass depending on the local energy density, caused by the chameleon screening mechanism which is used to avoid unnatural effects.

As chameleons feature an effective coupling to photons, they can be produced by converting photons inside strong electromagnetic fields through the Primakoff effect similar to axions. This makes the Sun a chameleon source and allows us to use an axion helioscope like the CERN Axion Solar Telescope (CAST) to search for solar chameleons given X-ray detectors sensitive in the energy range below 2 keV.

Such an X-ray detector was build based on the InGrid technology, a Micromegas stage created on top of a pixelized readout ASIC through photolithographic postprocessing techniques. It reaches sensitivity down to the carbon K_α line at 277 eV and features a background rate of less than 10^{-4} /keV/cm^2/s below 2 keV. This was achieved through application of a topological background suppression method.

In October 2014 the detector was mounted at CAST behind an X-ray telescope and took data until the end of 2015. The search led to the world-best limit on the chameleon-photon coupling $\beta_\gamma < 5.7 \times 10^{10}$.

Hauptvortrag SYMD 1.4 Mo 15:30 Plenarsaal
Positron Annihilation Spectroscopy throughout the Milky Way — •Thomas Siegert — Max-Planck-Institut für extraterrestrische Physik, Garching, Deutschland

For more than four decades, astrophysicists are puzzled by a bright but unique signal appearing from the centre of our Galaxy. Unlike at any other observable wavelength, the 511 keV emission from electron-positron annihilation is dominated by the bulge region of the Milky Way, with only a faint and puffed up galactic disk. Per second, of the order of 10^{43} positrons annihilate in the interstellar medium. This amount of antimatter particles has to be supplied, but the sources which come into consideration are versatile - and yet to be determined. Among the most promising origins are radioactive nucleosynthesis ejecta from massive star winds, core-collapse supernovae, and thermonuclear supernovae. Also compact objects, such as highly magnetised neutron stars or black hole binary systems, are energetic enough to produce positrons. Even dark matter is invoked to explain this mysterious signal.

This talk will recap the physics of positron production, propagation, and annihilation in space by using the cumulative measurements of more than ten years of data from the gamma-ray telescope SPI onboard ESA's INTEGRAL satellite. With these measurements, positrons are caught either in the act of their making or their final fate. This paves the path through the many positron-producing astrophysical objects and phenomena that will be presented towards a budgeting of the positrons throughout the Milky Way.