# T 93: Experimentelle Methoden der Astroteilchenphysik V

Zeit: Donnerstag 16:30–19:00 Raum: Z6 - SR 2.013

T 93.1 Do 16:30 Z6 - SR 2.013

**Coincident air shower measurements with IceCube and IceTop** — •Dennis Soldin for the IceCube-Collaboration — University of Delaware, Bartol Research Institute and Dept. of Physics and Astronomy, Newark, DE 19716, USA

IceCube observes high energy ($\gtrsim$ 500 GeV) muons produced in cosmic ray air showers which are often in time-coincidence with surface data from IceTop. This unique data has been used in various previous analyses of cosmic rays. IceCube's main cosmic ray mass composition analysis, for example, relies on coincident events and the comparison of deep muon and surface energy. This analysis is constrained to events that are contained in IceTop to get a reliable primary energy estimate with existing air shower reconstruction techniques. Thereby, a large fraction of air shower events is discarded, especially from large inclinations above zenith angles of approximately $\theta \simeq 30°$.

We will present a new approach for the reconstruction of in-time coincident events in IceCube and IceTop. It uses events contained in the deep in-ice detector together with information from the surface array at the same time. It will be shown that this method generally improves the resolution of air shower reconstructions. Moreover, accounting for the in-ice information allows reconstruction of events which are far outside of the IceTop surface array. This enables studying events from zenith angles up to roughly $\theta \simeq 60°$ and significantly improves the statistics of successfully reconstructed air shower events. It will be shown that this new technique significantly extends the IceTop acceptance for air shower measurements towards low and high energies.

T 93.2 Do 16:45 Z6 - SR 2.013

**Lateral distribution study for the IceTop scintillator array** — •Agnieszka Leszczyńska[1], Aswathi Balagopal V.[1], Andreas Haungs[1], Thomas Huber[1,2], Donghwa Kang[1], and Max Renschler[1] for the IceCube-Gen2-Collaboration — [1]KIT, Karlsruhe, Germany — [2]DESY, Zeuthen, Germany

IceTop, a surface component of IceCube, is planned to be upgraded with a prospective scintillator array. As a first motivation, the enhancement will provide a reference signal for the IceTop Cherenkov detectors improving the accuracy of shower reconstruction. In the long term it is foreseen to constitute a large veto array discriminating the astrophysical neutrino signal from an atmospheric background. The accompanying improvement of the air-shower measurements has to be preceded with detailed studies of the foreseen array. The generic simulations allow to obtain a parameterization for the particle lateral distributions in the air showers. In addition, more precise simulations of a deposited energy were performed for a deployed prototype module. The proper description of particle lateral distributions registered by scintillation detectors can significantly improve the reconstruction process and optimization of cosmic-ray parameters. This talk will show a simulation study of air-shower properties reconstructed by the proposed scintillator array.

T 93.3 Do 17:00 Z6 - SR 2.013

**A prototype hybrid particle and radio detector for the IceCube experiment** — •Max Renscher[1], Aswathi Balagopal[1], Andreas Haungs[1], Thomas Huber[1,2], Agnieszka Leszczynska[1], Marie Oehler[1], Harald Schieler[1], Frank G. Schroeder[1], and Andreas Weindl[1] for the IceCube-Gen2-Collaboration — [1]Karlsruher Institut für Technologie - KIT — [2]Deutsches Elektronen-Synchrotron - DESY

A new hybrid particle and radio detector is currently under development to upgrade the IceTop array of the IceCube experiment facing IceCube-Gen2. Using hybrid particle and radio detectors at the IceCube site will not only improve the veto capabilities of IceTop but will also enable the enhanced measurement and reconstruction of Extensive Air Showers (EAS) induced by cosmic rays. Especially with an array of radio antennas triggered by particle detectors, highly inclined EAS can be detected. This gives rise to new science cases, e.g. the search for PeV gamma rays coming from the galactic center which is visible from the IceCube site all over the year at an inclination of 61°. In this presentation, the actual state of the development of the proposed hybrid detectors will be shown, focusing on the radio detection techniques. A possible antenna type will be introduced, first measurements with a prototype array of hybrid detectors will be presented and possible options for a DAQ of the detectors will be discussed.

T 93.4 Do 17:15 Z6 - SR 2.013

**Cloud Detection using All Sky Cameras** — •Helena Nawrath[1] and Max Nöthe[2] — [1]Technische Universität Dortmund — [2]Technische Universität Dortmund

The observation time of gamma ray telescopes is limited due to bad weather, e.g. clouds or rain; exact knowledge of the atmospheric conditions is therefore crucial for the development of an efficient observation schedule. In clear nights all stars in the sky are observable; with partial cloudiness only certain parts of the sky are observable. It is important to find these cloudless regions in order to make the best use of the available observation time. The search for clouds in the night sky can be carried out using all sky cameras with an opening angle of 180° mounted at the telescope sites. In this master thesis, a method for the detection of clouds in the all sky camera image is developed by searching for bright blobs in the image and comparing them with different star catalogues afterwards. In addition, the determination of the cloudiness over a long period of time is used to characterize future telescope sites with regard to the available observation time in starry nights. This presentation gives a short overview of the developed method and shows how a cloudiness level can be determined. Furthermore, the primary aim of the work, the estimation of the observation time for IceAct, is briefly motivated.

T 93.5 Do 17:30 Z6 - SR 2.013

**Measurement of radio emission induced by ultra-high energy cosmic rays at energies above 1 EeV with the Pierre Auger Observatory** — •Florian Briechle, Martin Erdmann, and Felix Schlüter for the Pierre Auger-Collaboration — III. Physikalisches Institut A, RWTH Aachen University, Deutschland

Radio emission of extensive air showers is used to reconstruct properties of the ultra-high energy cosmic rays. Owing to the area of 17 km$^2$ covered by the radio array AERA of the Pierre Auger Observatory, sufficient event statistics for measurements above 1 EeV have been recorded in recent years. Especially interesting are air showers at large zenith angles because they induce sizable footprints covering many radio stations. New challenges in reconstructing these showers arise from the superposition of the two emission mechanisms leading to the radio signal. This leads to an asymmetric energy fluence distribution on ground, even more so for air showers at large zenith angles. This distribution needs to be described with high precision to enable a high quality reconstruction of the properties of the cosmic ray.

We discuss the shower reconstruction with emphasis on the energy estimation where the aim is to provide an absolute energy measurement of the primary cosmic ray from radio techniques exclusively.

T 93.6 Do 17:45 Z6 - SR 2.013

**Analytical Multivariate Fit in the Borexino Solar Neutrino Analysis** — •Ömer Penek[1], Simone Marcocci[2], and Alina Vishneva[3] for the Borexino-Collaboration — [1]IKP-2, Forschungszentrum Jülich, 52428, Jülich, Germany — [2]Gran Sasso Science Institute, 67100, L'Aquila, Italy — [3]Joint Institute for Nuclear Research, 141980, Dubna, Russia

The Borexino detector, located at the Laboratori Nazionali del Gran Sasso in Italy, is a liquid scintillator detector with a primary goal to measure the solar neutrino fluxes. The spectral fit of the energy spectrum has been performed for the first time in the whole energy range from ~200 keV up to ~2 MeV. This approach made it possible to obtain the fluxes of 7Be, pp, and pep solar neutrinos simultaneously. To increase the sensitivity for pep neutrinos, the multivariate fit technique has been developed, which takes into account additional information of the radial and pulse shape distributions of events. To combine the respective likelihoods with the one of the spectral fit of energy spectra, a consistent theoretical description is needed. An additional challenge is represented by the convergence time of the fit itself. The talk shows the analytical multivariate fitting strategy used to obtain the new Borexino results for the 7Be, pp, and pep rates. We focus ourselves on the construction of the likelihood used in this analysis. This talk is presented in the name of the Borexino Collaboration.

T 93.7 Do 18:00 Z6 - SR 2.013

**Neutrinos from Supernovae collapsing into Black Holes in JUNO** — •Max Büsken[1], Josina Schulte[1], Florian Kiel[1], Livia Ludhova[2], Achim Stahl[1], Jochen Steinmann[1] und Christopher Wiebusch[1] — [1]III. Physikalisches Institut B, RWTH Aachen University — [2]Institut für Kernphysik, Forschungszentrum Jülich

The 20kt liquid scintillator experiment JUNO (**J**iangmen **U**nderground **N**eutrino **O**bservatory) under construction in southern China, will begin examining the neutrino mass hierarchy in 2020. Due to its large target mass JUNO will be an excellent detector for extraterrestrial neutrinos. If a galactic core-collapse supernova occurs within the lifetime of the detector, it will measure thousands of neutrino events in a timespan of 20 seconds. Core-collapse supernovae have two possible final states, a neutron star or a black hole. With the formation of a black hole the neutrino flux will be cut off almost instantaneously. Based on simulation data an estimation on the neutrino mass limit by delayed neutrinos will be presented in this talk.

T 93.8 Do 18:15 Z6 - SR 2.013

**Das Minidex-Experiment zur Vermessung Myonen-induzierter Neutronen** — •Raphael Kneissl[1], Iris Abt[1], Allen Caldwell[1], Christopher Gooch[1], Xiang Liu[1], Bela Majorovits[1], Matteo Palermo[2], Qiang Du[3], Oliver Schulz[1] und Laura Vanhoeffer[1] — [1]Max-Planck-Institut für Physik, Deutschland — [2]Now University of Hawaii, US — [3]Sichuan University, China

Die Beobachtung sehr seltener Prozesse, wie z.B des neutrinolosen Doppelbetazerfalls, erfordert extrem strahlungsarme Umgebungen und Detektoren. Um die nötige Sensitivität zu erreichen, ist es wichtig, die noch vorhandenen Strahlungsuntergründe zu unterdrücken und zu verstehen. Ein solcher Untergründe sind Myon-induzierte Neutronen, die außerhalb im Gestein oder direkt in den Abschirmungsmaterialien des Experiments erzeugt werden. Die Neutronenproduktionsraten durch Myonen in verschiedenen Materialien sind nicht genau vermessen. Um genauere Vorhersagen darüber machen zu können, welcher Untergrundbeitrag in zukünftigen Experimenten erwartet wird, wurde der Minidex (Muon induced neutrons indirect detection experiment) Aufbau im Tübinger Untergrundlabor errichtet. Mit diesem Aufbau können Neutronen, die im untersuchten Material durch Myonen induziert wurden, nachgewiesen werden. Dies geschieht mit HPGe Detektoren, die den thermischen Einfang von Neutronen an Wasserstoffatomen nachweisen. Es sollen Neutronenproduktionsraten in verschiedenen Abschirmmaterialien untersucht werden. Im Vortrag werden Aufbau, Datenanalyse sowie neue Ergebnisse des Minidex-Experiments vorgestellt.

T 93.9 Do 18:30 Z6 - SR 2.013

**Demonstrating Electromagnetic Properties of a MADMAX prototype booster** — •Jacob Egge for the MADMAX-Collaboration — Max-Planck-Institut für Physik

Axions are a promising candidate for dark matter. The Magnetized Disc and Mirror Axion Experiment (MADMAX) uses dielectric discs to boost axion to photon conversion by the Primakoff-effect. A small scale prototype for the MADMAX experiment is being developed. The purpose of this setup is to demonstrate the ability to understand the electromagnetic properties of a future dielectric haloscope with a given boost factor. This is done by arranging 20 saphire discs with micrometer precision motors in different configurations and measuring reflections of microwaves with a vector network analyzer. By comparing the electromagnetic properties with simulations a boost factor can be inferred. We will present the latest results of this ongoing process with emphasis on the procedure used to optimize discs arrangements.

T 93.10 Do 18:45 Z6 - SR 2.013

**KWISP - Hunting Chameleons with the CAST Experiment at CERN** — •Justin Baier — University of Freiburg, Germany

The KWISP (Kinetic Weakly Interacting Slim Particle) detector is part of the CAST experiment at CERN exploring the dark sector. It utilizes an ultra-sensitive 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 local density-dependent direct coupling to matter. Considering this characteristic a flux of solar chameleons hitting a solid surface at a grazing incidence angle 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. The reflection of the chameleons off the membrane surface causes a displacement from its equilibrium position, which again will cause cavity mode frequencies to experience a shift. This shift is then sensed in the feedback correction signal. The sensitivity of the detector is determined by the finesse of the cavity and can be enhanced by exploiting the property of the membrane as a mechanical resonator and cooling it down to sub-K temperatures resulting in a projected force sensitivity as low as $\approx 8.0 \times 10^{-18}\mathrm{N}/\sqrt{\mathrm{Hz}}$, yielding various possible applications for the study of new physics.