T 53: Kosmische Strahlung III

Zeit: Mittwoch 16:30–19:05 Raum: Philo-HS6

Gruppenbericht T 53.1 Mi 16:30 Philo-HS6

Status and prospects of the Tunka Radio Extension (Tunka-Rex) — •Dmitriy Kostunin — Karlruhe Institute of Technology, Karlsruhe, Germany

The Tunka Radio Extension (Tunka-Rex) is a cosmic-ray experiment located in Siberia at the TAIGA facility (Tunka Advanced Instrument for cosmic rays and Gamma Astronomy). Tunka-Rex is an array of 63 antenna stations placed on 1 km^2 area and connected to the air-Cherenkov array Tunka-133 and the particle detectors Tunka-Grande, which trigger for the radio array. The antennas of Tunka-Rex detect radio pulses emitted during the development of ultra-high energy cosmic-ray air-showers in the frequency band of 30-80 MHz. The setup has been commissioned in 2012. From that time on it has achieved the number of important results, particularly that the radio technique is competitive to established techniques regarding the energy precision and can be used for cross-calibration between different cosmic ray experiments as well as for measurements of mass composition. Until now few thousands events have been detected jointly with the radio and particle setups and about more than hundred events are detected with all three setups. In the present talk I will give an overview of the Tunka-Rex instrumentation and methods, present recent results and prospects of the experiment.

T 53.2 Mi 16:50 Philo-HS6

Towards a Radio Measurements of the Energy Spectrum of Cosmic Rays with Tunka-Rex — •Vladimir Lenok for the Pierre Auger-Collaboration — Institute for Nuclear Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany

The Tunka Radio Extension is a radio detector for cosmic rays placed at the TAIGA (Tunka Advanced Instrument for cosmic ray physics and Gamma Astronomy) facility near Lake Baikal. The antenna array of the detector comprises 63 antennas spread over an area of about 1 km^2 and receives triggers from co-located air-Cherenkov and particle detectors. During the last years, the experiment has evinced high resolution for the energy of cosmic rays. Our next goal in this direction is to estimate the flux of the primary cosmic rays via radio measurements. To carry out this estimation we developed a procedure of calculation of the array aperture based on an experimental estimation of the detection threshold and simulations of the efficiency taking into account the arrival direction and core position of the shower (relative to the antenna array). In the talk details of the energy reconstruction and the calculations of aperture will be presented. Based on the results of this estimation we plan to obtain the energy spectrum of cosmic rays with a lower uncertainty than for particle detectors, but the same level of statistics as for particle detectors.

T 53.3 Mi 17:05 Philo-HS6

New Results from the KASCADE-Grande Data Analysis — •Donghwa Kang for the KASCADE-Grande-Collaboration — Karlsruhe Institute of Technology, Karlsruhe

KASCADE-Grande and its original array of KASCADE measured individual air showers of cosmic rays in the energy range of 100 TeV up to 1 EeV. The data accumulation was fully completed at the end of 2013 though, the data analysis is still in progress. Recently, we published two new results: The estimation on upper limits to the flux of ultra-high energy gamma rays, which set constraints on some fundamental astrophysical models. And the determination of the muon attenuation length by investigations on the evolution of the muon content of very-high energy air showers in the atmosphere, compared to the predictions of various hadronic interaction models.

In addition, we updated KCDC, the web-based platform where we publish the data from KASCADE and KASCADE-Grande with more than 20 years measurements. A new version of the KASCADE Cosmic Ray Data Centre (KCDC) is released, named NABOO 2.0, where we now also provide air-shower simulation data sets for three different hadronic interaction models.

In this contribution, recent results from KASCADE-Grande and the update of KCDC will be briefly discussed.

T 53.4 Mi 17:20 Philo-HS6

Recent developments from the Auger Engineering Radio Array (AERA) — •Ewa Marlen Holt for the Pierre Auger-Collaboration — Institut für Experimentelle Teilchenphysik, Karlsruher Institut für Technologie (KIT)

The Auger Engineering Radio Array (AERA) is designed to measure the radio emission of extensive air showers initiated by cosmic rays above an energy of 10^{17} eV. The experiment is located in Mendoza, Argentina, as an extension of the Pierre Auger Observatory and is operated in coincidence with the other detectors of the observatory. Its 153 autonomous radio antenna stations are distributed over an area of 17 km^2 on a grid with a spacing ranging from 150 – 750 m. Each antenna station comprises two dipole antennas sensitive to frequencies of 30 – 80 MHz. Data taking started in 2011. Special emphasis is put on the detection of inclined air showers, which feature radio emission footprints extended over several square kilometers. The independent energy reconstruction from the radio emission has the potential to cross-check the absolute energy scale of the Pierre Auger Observatory. To reach this goal, a very precise calibration of the radio antennas has been performed. Different mass estimators are reconstructed from the radio emission such as the atmospheric depth of the shower maximum and the radio-muon ratio measured in combination with the muon detectors of the Observatory. In this talk an overview of the current status of the experiment and the latest scientific results is given.

T 53.5 Mi 17:35 Philo-HS6

Messung von horizontalen Luftschauern mit AERA * — •Marvin Gottowik für die Pierre Auger-Kollaboration — Bergische Universität Wuppertal, Gaußstr. 20, 42119 Wuppertal

Mit dem Auger-Engineering-Radio-Array (AERA) des Pierre-Auger-Observatoriums wurde die, von horizontalen Luftschauern (Zenitwinkel zwischen 60 ° und 90 °) emittierte, elektromagnetische Strahlung im Radiobereich gemessen. Im Gegensatz zu vertikalen Luftschauern kann die Emission auf einer großen Fläche von mehreren km^2 auf dem Erdboden detektiert werden. Dadurch wird die Ereignisstatistik bei den höchsten Energien im EeV Bereich erhöht. Das ist insbesondere interessant, da die Radioemission direkten Zugriff auf die Energie der elektromagnetischen Kaskade ermöglicht. In Kombination mit dem Oberflächendetektor des Pierre-Auger-Observatorium, der für horizontale Schauer hauptsächlich Muonen detektiert, kann daher die Komposition der Primärteilchen auch bei horizontalen Schauern bestimmt werden. Zusätzlich erlaubt die große Nachweisfläche die Detektion und Rekonstruktion des Lauftschauers mit einem größerem Abstand zwischen den Antennen, wie die 1,5 km zwischen den 1600 Stationen des Oberflächendetektors.

* Gefördert durch die BMBF Verbundforschung Astroteilchenphysik (Vorhaben 05A17PX1).

T 53.6 Mi 17:50 Philo-HS6

Erste Analysen des AugerPrime Engineering-Arrays* — •Sonja Schröder für die Pierre Auger-Kollaboration — Bergische Universität Wuppertal, Gaußstr. 20, 42119 Wuppertal

Das Upgrade AugerPrime des Pierre-Auger-Observatoriums in Argentinien ermöglicht es, die Genauigkeit der Kompositionsmessungen der Primärteilchen von ausgedehnten Luftschauern zu verbessern. Durch Szintillationsdetektoren (SSD) oberhalb der vorhandenen Detektorstationen kann eine Separation von elektromagnetischer und myonischer Komponente eines Teilchenschauers erreicht werden. In diesem Vortrag wird die Datenqualität des SSD Engineering-Arrays analysiert. Es werden sowohl die Langzeitstabilität der Datenqualität, als auch Parameter wie die Zeitauflösung, die Signalamplitude und Temperatureffekte der Detektoren, untersucht. Ein besonderer Fokus wird auf zwei unmittelbar benachbarte (18 m) Detektorstationen gelegt. Diese Zwillingsstationen befinden sich in einer Region, in der die Abstände der Detektorstationen von 1500 m auf 433 m verringert wurden. Dadurch ergibt sich eine Herabsetzung der Energieschwelle auf $\approx 10^{16.5}$ eV, sowie eine mindestens 10 mal höhere Ereignisstatistik im Vergleich zum regulären Feld.

** Gefördert durch die BMBF Verbundforschung Astroteilchenphysik (Vorhaben 05A17PX1).*

T 53.7 Mi 18:05 Philo-HS6

Development of a universal time model for AMIGA at the Pierre Auger Observatory — •Johannes Hulsman for the Pierre Auger-Collaboration — Karlsruhe Institute of Technology, Karlsruhe,

Germany — Instituto de Tecnologías en Detección y Astropartículas (ITeDA), Buenos Aires, Argentina

Shower Universality aims to describe the atmospheric shower development of cosmic rays by accounting for the physical properties of the secondary particles. It relies on the universal behavior of the EM and muonic longitudinal profiles. To successfully map the EAS 1-to-1, it is pertinent to properly parameterize the detector signal as a function of position and shower stage. At the Pierre Auger Collaboration, such a universal model has been developed for the timing of the surface detectors for energies between $10^{18.5}$eV and 10^{20}eV. Each shower is described with a set of global parameters (X_{max}, energy, geometry and normalized muonic component) and predicts the expected signal with 10% accuracy. Combining these results with the 100% duty cycle of the surface detectors allows for mass composition and anisotropy studies with great event statistics.

The AMIGA underground muon detector is an upgrade of the Pierre Auger Observatory and aims to directly measure the muons from air showers and extend the energy range towards 10^{17}eV. In addition to extending the time model of the surface detectors for lower energies, a dedicated time model is being developed and will account for the muonic production depth X^{μ}_{max}. Combining both will provide more insight into the air shower. Initial results will be shown.

T 53.8 Mi 18:20 Philo-HS6

Performance of the upgraded surface detector stations of the Pierre Auger Observatory — •Alexander Streich, Alvaro Taboada, Darko Veberic, Markus Roth, and Ralph Engel for the Pierre Auger-Collaboration — Karlsruher Institut für Technologie, Deutschland

In September 2016, the major phase of the AugerPrime upgrade of the Pierre Auger Observatory started with the installation of the first scintillator detectors on top of the existing water-Cherenkov tanks. By providing a complementary measurement of the different components of air shower particles the Scintillator Surface Detectors will significantly improve the analysis of cosmic rays, for example the determination of the mass composition of the primary particles. This presentation will focus on the performance of the upgraded surface detector stations deployed in the Engineering Array of the Observatory. In addition, the presentation will provide a short update on the ongoing production of the Scintillator Surface Detectors including measurements for the quality control and for the characterization of the new detectors.

T 53.9 Mi 18:35 Philo-HS6

Evaluation of SALLA Antennas for Radio Observations of Inclined Air Showers — •Vladimir Lenok for the Pierre Auger-Collaboration — Institute for Nuclear Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany

The Auger Engineering Radio Array (AERA) is a cosmic-ray experiment at the Pierre Auger Observatory in the Province of Mendoza, Argentina. The array comprises about 150 antennas of log-periodic and butterfly types spread over an area of 17 km^2 and is used for detection of radio emission from air showers of energies above 0.1 EeV in the band of 30–80 MHz. Recently, at the site of AERA three short aperiodic loaded loop antennas (SALLA) were installed. These three antennas are a pathfinder for a future radio detector aimed at the observation of inclined air showers at the Auger Observatory. Combined radio and particle measurements are sensitive to the type of the primaries, even for the inclined showers. This will enable to resolve the recently found anisotropy into heavy and light components and at the same time increase the area of observed sky. In this talk the results of a preliminary analysis will be presented.

T 53.10 Mi 18:50 Philo-HS6

A Surface Radio Array for IceCube-Gen2 — •Aswathi Balagopal V. — Karlsruhe Institute of Technology, Institute for Experimental Particle Physics, Hermann-von-Helmholtz-Platz 1, 76344, Eggenstein-Leopoldshafen

Radio detection of air showers has proven to be an effective method for extracting information of air showers and their properties. Primary particles with energies of hundreds of PeV have been successfully measured with the method of radio detection. Existing experiments measuring such air showers operate in the frequency range of 30-80 MHz. An optimization of the frequency range of operation can be done for maximizing the signal-to-noise ratio that can be achieved by an array of radio antennas at the South Pole. The prospects of using such an optimized radio array for measuring gamma-rays of PeV energies from the Galactic Center will be presented in this talk.