T 83: Kosmische Strahlung 6

Zeit: Mittwoch 16:45–19:05 Raum: H 3

Gruppenbericht T 83.1 Mi 16:45 H 3

Anisotropies in galactic cosmic rays with AMS-02 — •Iris Gebauer, Stefan Zeissler, Matthias Weinreuter, Maura Graziani, and Fabian Bindel — Karlsruher Institut für Technologie

The Alpha Magnetic Spectrometer (AMS-02) on the International Space Station measures the fluxes of cosmic rays up to energies of a few TeV. A search for anisotropies in the arrival directions of protons, electrons and positrons was performed. The results are consistent with isotropy and no significant time dependence in the arrival directions of cosmic rays are observed. This talk will discuss the latest results from AMS-02 and their implications.

T 83.2 Mi 17:05 H 3

Correlation between arrival directions and sources of cosmic ray positrons (AMS-02) — •Matthias Weinreuter and Iris Gebauer — KIT, Karlsruhe

Since the high-precision measurement of the cosmic ray positron component was published in 2014, the astrophysical community has yet to agree on the source of the positron population at kinetic energies above a few GeV. The two most popular explanations assume either an astrophysical acceleration mechanism around pulsar magnetospheres, or understand these positrons as a product of dark matter annihilation processes; and it is currently believed that a clear distinction can be made by the analysis of the dipole anisotropy in positron flux. In particular, it is currently assumed that the pulsar hypothesis is falsifiable if the anisotropy of positrons relative to electrons lies below 1% (for energies 16 to 350 GeV). We demonstrate that the state of knowledge of close-by pulsars is sufficiently uncertain to construct various pulsar scenario explanations for the present AMS-02 measurement that show a significantly smaller degree of anisotropy. Moreover, the propagation of positrons throughout the local environment further increases the uncertainty in anisotropy prediction considerably.

T 83.3 Mi 17:20 H 3

Cosmic ray anisotropy searches with AMS-02 — •Stefan Zeissler, Iris Gebauer, Maura Graziani, and Fabian Bindel — Karlsruher Institut für Technologie (KIT)

The Alpha Magnetic Spectrometer (AMS-02) is a state-of-the-art particle detector designed to operate as an external module on the International Space Station (ISS). In this unique space environment cosmic particles can be measured with high precision over an energy range from GeV up to TeV. The AMS collaboration provided precise measurements of the electron and positron fluxes, which indicate an additional source of positrons among the various cosmic particles. Possible candidates for this source are local pulsars, a local source of positrons produced in proton-gas interactions or dark matter annihilation. In the first two cases a possible anisotropy in the electrons and positrons incoming direction at Earth might be detectable. To determine the level of isotropy the measured data is compared to reference maps, which simulate the measurement of an isotropic sky. A common choice of reference maps are proton count maps or shuffled maps, which redistribute measured incoming directions over the whole measuring time. Both choices lead to difficulties in the reconstruction of a marginal signal with a big expansion over the galactic sky as it would be the case for charged cosmic particles. We developed a method to construct reference maps based on fundamental detector characteristics such as the livetime and the geometric acceptance. Using this we are able to reconstruct the isotropic sky as it would be seen by the detector. We demonstrate the performance of the method using AMS-02 data.

T 83.4 Mi 17:35 H 3

Antiproton Flux and Antiproton-to-Proton Flux Ratio Measured with the Alpha Magnetic Spectrometer on the ISS — •Andreas Bachlechner — RWTH Aachen University

AMS-02 is a multi-purpose particle detector for cosmic rays onboard the International Space Station.

Due to the very small abundance of antiprotons in the cosmic radiation of about 10^{-5} compared to protons a very precise particle identification is crucial. The methods to identify antiprotons in the cosmic-ray measurement of AMS-02 in different energy regions will be discussed.

The precision measurement of the antiproton flux by AMS-02 and the antiproton-to-proton flux ratio in primary cosmic rays in the absolute rigidity range from 1 to 450 GV based on 3.49×10^5 antiproton events and 2.42×10^9 proton events will be presented. The antiproton-to-proton flux ratio reaches a maximum at approximately 20 GV and is rigidity independent above 60.3 GV.

T 83.5 Mi 17:50 H 3

Large Acceptance Analysis of Electrons and Positrons with AMS-02 — •Fabian Machate — RWTH Aachen University, Deutschland

The Alpha Magnetic Spectrometer (AMS-02) on the International Space Station performs precision measurements of cosmic rays in the GeV to TeV energy range. The published analyses of the electron and positron fluxes rely on the electromagnetic calorimeter (ECAL) for energy measurements and background rejection. The geometrical acceptance for the conventional analyses is restricted by the weight limitations for the calorimeter.

A new analysis procedure for electrons and positrons, which uses information from the Tracker to determine the energy scale and the Transition Radiation Detector (TRD) to reject the background, will be presented. This analysis increases the geometrical acceptance by a factor of ~ 6.

T 83.6 Mi 18:05 H 3

Electron and Positron Fluxes in Primary Cosmic Rays Measured with the Alpha Magnetic Spectrometer on the International Space Station — •Nikolas Zimmermann — RWTH Aachen University

Precision measurements by the Alpha Magnetic Spectrometer on the International Space Station of the primary cosmic-ray electron flux in the range 0.5 to 700 GeV and the positron flux in the range 0.5 to 500 GeV are presented. The electron flux and the positron flux each require a description beyond a single power-law spectrum. Both the electron flux and the positron flux change their behavior at ~ 30 GeV but the fluxes are significantly different in their magnitude and energy dependence. Between 20 and 200 GeV the positron spectral index is significantly harder than the electron spectral index. The results show, for the first time, that neither e^+ nor e^- can be described by a single power law above 27.2 and 52.3 GeV, respectively. The determination of the differing behavior of the spectral indices versus energy is a new observation and provides important information on the origins of cosmic-ray electrons and positrons. The time dependence of the electron and positron fluxes will also be discussed.

T 83.7 Mi 18:20 H 3

Verlängerte Messzeit für Fluoreszenzteleskope — •Joachim Debatin, Michael Unger, Ralph Engel und Radomir Smida für die Pierre Auger-Kollaboration — Institut für Kernphysik (IKP), Karlsruher Institut für Technologie (KIT), Karlsruhe, Deutschland

Fluoreszenzteleskope werden benutzt um Luftschauer kosmischer Strahlung zu messen. Sie verbinden eine kalorimetrische Messung der Energie im Luftschauer mit der Möglichkeit die longitudinale Schauerentwicklung zu studieren. Fluoreszenzteleskope werden von den beiden größten Luftschauerexperimenten, dem Pierre-Auger-Observatorium und Telescope Array, benutzt um ihren Oberflächendetektor zu kalibrieren.

Eine Einschränkung von Fluoreszenzteleskopen ist jedoch, dass nur in klaren, mondlosen Nächen gemessen werden kann. Daraus ergibt sich typischerweise ein Messzeitanteil von ungefähr 15 %. Jeder einzelne, bei höchster Energie mit Fluoreszenzteleskopen gemessene Luftschauer ist dabei sehr wichtig für die Energiekalibration. Am Pierre-Auger-Observatorium wird derzeit daran gearbeitet den Messzeitanteil der Fluoreszenzteleskope zu erhöhen. Während ein erhöhtes Hintergrundlicht für den Nachweis von Schauern oberhalb 10^{19} eV unproblematisch ist, kann dieses jedoch eine vorzeitige Alterung der Kamera-PMTs bewirken. Deshalb wird bei höherem Untergrundlicht mit niedrigerer Hochspannung an der Kamera des Teleskopes gemessen. Studien am KIT haben bereits gezeigt, dass dies ohne Schäden an den benutzten Photomultipliern möglich ist. In diesem Vortrag wird der Einfluss auf die Apertur des Fluoreszenzdetektors diskutiert.

T 83.8 Mi 18:35 H 3

Characterisation of 64 channel SiPM arrays for the SiECA project — •Max Renschler[2], Francesca Bisconti[1], Andreas Haungs[1], Thomas Huber[2], Alexander Menshikov[3], and William Painter[1] for the JEM-EUSO-Collaboration — [1]Institut für Kernphysik (IKP) , KIT — [2]Institut für experimentelle Kernphysik (IEKP), KIT — [3]Institut für Prozessdatenverarbeitung und Elektronik (IPE), KIT

To investigate the possibility of replacing conventional Multi Anode Photomultiplier Tubes (MAPMTs) with Silicon Photomultipliers (SiPMs), the 'Silicon Elementary Cell Add-on' (SiECA) is at the moment under development and in its final steps. The aim of SiECA is the detection of UHECRs with SiPMs within the frame of the 'Extreme Universe Space Observatory' (EUSO) pathfinder experiment 'EUSO-Super Pressure Balloon'. In this context, 64 channel SiPM arrays of the newest series manufactured by Hamamatsu have been studied and characterized. The motivation, the idea and the current status of SiECA will be presented and the results of our work on characterizing the newest 64 channel SiPM arrays will be discussed. With the focus on these particular studies, the talk will also give a short overview of the status of JEM-EUSO in general and of its other pathfinder studies.

T 83.9 Mi 18:50 H 3

Mini-KASCADE electronics miniaturization — •Christian Tesch, Günter Quast, Andreas Haungs, Harald Schieler und Bernd Hoffmann — KIT IKP, Karlsruhe, Deutschland

Mini-KASCADE is the attempt to provide a high-quality, mobile small scintillator array to detect cosmic ray air showers. In my master thesis I am recycling scintillators from the KASCADE experiment for such a small modular detector array. The main goal is to replace the currently used DAQ-rack from the KASCADE era with small DAQ-cards. Focusing on miniaturization and reducing the data per event in the DAQ chain as early as possible, the data rate should be low enough to use a small single-board computer to exchange events between the detectors and the master node, which then handles the data analysis.