T 20: Kosmische Strahlung I

Zeit: Montag 11:00–12:30 Raum: VMP9 SR 29

T 20.1 Mo 11:00 VMP9 SR 29

Galactic Cosmic Ray Spectra during Solar Cycle 23 and 24 - Measurement Capabilities of the Electron Proton Helium Telescope on Board SOHO — •Patrick Kühl, Nina Dresing, Jan Gieseler, Bernd Heber, and Andreas Klassen — Christian-Albrechts Universität zu Kiel

The solar modulation of galactic cosmic rays (GCR) can be studied in detail by long term variations of the GCR energy spectrum (e.g. on the scales of a solar cycle). With almost 20 years of data, the Electron Proton Helium INstrument (EPHIN) aboard SOHO is well suited for these kind of investigations. Although the design of the instrument is optimized to measure proton and helium isotope spectra up to 50 MeV/nucleon the capability exist that allow to determine energy spectra above 1.5 GeV/nucleon. Therefore we developed a sophisticated inversion method to calculate such proton spectra. The method relies on a GEANT4 Monte Carlo simulation of the instrument and a simplified spacecraft model that calculates the energy response function of EPHIN for electrons, protons and heavier ions. As a result we present galactic cosmic ray spectra from 1995 to 2015. For validation, the derived spectra are compared to AMS, BESS and PAMELA data. Furthermore we discuss the spectra with respect to the solar modulation.

T 20.2 Mo 11:15 VMP9 SR 29

Proton energy spectra during ground level enhancements as measured by EPHIN aboard SOHO — •Bernd Heber[1], Patrick Kühl[1], Andreas Klassen[1], Nina Dresing[1], and Rául Goméz-Herrero[2] — [1]Christian-Albrechts-Universität zu Kiel, 24118 Kiel — [2]Universidad de Alcala

Ground Level Enhancements (GLEs) are solar energetic particle (SEP) events that are recorded by ground-based instrumentation. The energy of the particles is so high that they produce secondary particles in the Earth's atmosphere, i.e. protons and neutrons, which are detected as sudden increases in cosmic ray intensities measured by e.g. neutron monitors. Since the launch of SOHO in December 1995 the neutron monitor network recorded 16 GLEs. The Electron Proton Helium INstrument on board SOHO has been designed to measure protons and helium up to 53 MeV/nucleon as well as electrons up to 8.3 MeV. Above these energies, particles penetrate all detector elements and thus, a separation between different particle species becomes more complicated. Recently we developed a method that allows deriving the energy spectrum for penetrating protons up to more than 1 GeV. In this contribution we present the proton energy spectra and time profiles of above mentioned GLEs and compare them to previous measurements. Although there are differences of up to a factor two the overall shape of the energy spectra agree surprisingly well. Thus it has been demonstrated that EPHIN measurements are a valuable tool for understanding GLE.

T 20.3 Mo 11:30 VMP9 SR 29

Features of the galactic magnetic field regarding deflections of ultra-high-energy cosmic rays — •Marcus Wirtz, Martin Erdmann, Gero Müller, and Martin Urban — III. Physikalisches Institut A, RWTH Aachen University, Deutschland

Most recent models of the galatic magnetic field have been derived from Faraday rotation measurements and imply strong deflections even for ultra-high energy cosmic rays. We investigate the characteristics of the different field parametrizations and point out similarities and interesting features. Among them are extragalactic regions which are invisible for an Earth bound observation and the transition from diffuse to ballistic behaviour in the 1EeV energy regime. Applying this knowledge to a directional analysis, there are indications for deflection patterns by the galactic magnetic field in cosmic ray arrival directions measured by the Pierre Auger Observatory.

T 20.4 Mo 11:45 VMP9 SR 29

Sensitivity of a search for cosmic ray sources including magnetic field effects — •Martin Urban, Martin Erdmann, and Gero Müller — III. Physikalisches Institut A, RWTH Aachen University

We analyze the sensitivity of a new method investigating correlations between ultra-high energy cosmic rays and extragalactic sources taking into account deflections in the galactic magnetic field. In comparisons of expected and simulated arrival directions of cosmic rays we evaluate the directional characteristics and magnitude of the field. We show that our method is capable of detecting anisotropy in data sets with a low signal fraction.

T 20.5 Mo 12:00 VMP9 SR 29

Geometrierekonstruktion von niedrigenergetischen Luftschauern mit HEAT* — •Ingolf Jandt für die Pierre-Auger-Kollaboration — Uni Wuppertal

Der Fluoreszenzdetektor (FD) des Pierre Auger Observatoriums misst Lichtsignale von Luftschauern, mit Beiträgen aus Fluoreszenz und Tscherenkovstrahlung. Die High Elevation Auger Telescopes (HEAT) können als Niedrigenergie-Erweiterung des FD steiler in die Atmosphäre blicken. Dabei messen sie höhere Anteile des vorwärtsgerichteten Tscherenkovlichtes, und verkürzte longitudinale Schauerprofile. Aus diesen wenigen Messpunkten die Geometrie des Schauers zu rekonstruieren, gelingt mit den bisherigen Methoden nur begrenzt. Der Profile Constrained Geometry Fit (PCGF) bezieht die longitudinale Schauerentwicklung in die Geometriebestimmung mit ein. Damit kann die Messung des Energiespektrums bis unterhalb 10^{16} eV erweitert werden.

*Gefördert durch die BMBF Verbundforschung Astroteilchenphysik

T 20.6 Mo 12:15 VMP9 SR 29

The solar modulation potential derived by spacecraft measurements modified to describe GCRs also at energies below neutron monitors — •Jan Gieseler[1], Bernd Heber[1], and Konstantin Herbst[2] — [1]IEAP, University of Kiel, Germany — [2]Dept. of Geology, Quaternary Sciences, Lund University, Sweden

Galactic Cosmic Rays (GCRs) are modulated by various effects as they propagate through the heliosphere before they are detected at Earth. This transport can be described by the Parker equation. It calculates the phase space distribution of GCRs depending on the main modulation processes: convection, drifts, diffusion and adiabatic energy changes. A first order approximation of this equation is the force field approach, reducing it to a one-parameter dependency, the solar modulation potential ϕ. Utilizing this approach, Usoskin et al. (2005; 2011) reconstructed ϕ between 1936 and 2010, which by now is commonly used in many fields. However, it has been shown previously (e.g. by Herbst et al. 2010) that ϕ depends not only on the Local Interstellar Spectrum (LIS) but also on the energy range of interest. Using the LIS by Usoskin et al. (2005) together with published proton intensity spectra obtained by PAMELA, heavier nuclei measurements from IMP8 and ACE/CRIS as well as neutron monitors, we have investigated this energy dependence further. We will present the results that show as expected severe limitations at lower energies including a strong dependence on the solar magnetic epoch. Based on these findings, we will outline a tool to describe GCR proton spectra in the energy range from a few hundred MeV to tens of GeV over the last solar cycles.