T 70: Cosmic Ray III

Time: Wednesday 15:50–17:20 Location: POT/0013

T 70.1 Wed 15:50 POT/0013

measurment of the cosmic ray electron flux with AMS02 — •Yasaman Najafijozani — RWTH Acchen University, Sammelbau Physik, Sommerfeldstr. 14, Turm 28, 52074 Aachen, Germany

The Alpha Magnetic Spectrometer (AMS-02) on the International Space Station has been performing precision measurements of cosmic rays in the GeV to TeV energy range since 2011. The fluxes of electrons and positrons are potential probes of dark matter or new astrophysical phenomena. With AMS-02, electrons and positrons are identified by two independent subdetectors, a transition radiation detector, and an electromagnetic calorimeter. I will present my analysis of the cosmic-ray electron flux from 0.5 to 1000 GeV.

T 70.2 Wed 16:05 POT/0013

3D modelling of the Galactic Center region — •Julien Dörner[1,2], Julia Becker Tjus[1,2], Paul-Simon Blomenkamp[1,2], Horst Fichtner[1,2], Anna Franckowiak[1,2], Mario Hoerbe[1,2], and Memo Zaninger[1,2] — [1]Ruhr-Universität Bochum, 44801 Bochum, Deutschland — [2]RAPP-Center at Ruhr University Bochum, Bochum, Germany

The Galactic Center (GC) region is a unique astrophysical environment, which has been intensively studied in the past decades. In the HE and UHE gamma-ray regime several point like sources and a diffuse emission have been discovered. In addition, observation in the emission with FermiLAT show an excess, which may hint to a population of unresolved sources. The detection of the first *PeVatron* by H.E.S.S. indicates that cosmic-rays (CRs) can be accelerated up to PeV energies in the GC. While 3-D transport models for the entire Galaxy do exist in well-advanced states, the GC region in these global models is not well-represented and dedicated 3-D models of this region are missing. We present the first model using a realistic 3D distribution of the gas and the magnetic field for the Central Molecular Zone. The magnetic field is composed by a large-scale structure, as well as a contribution from several molecular clouds and non-thermal filaments. We use an anisotropic diffusion tensor defined by the ratio of the perpendicular and the parallel diffusion coefficient with respect to the local magnetic field direction. In the end, we compare our model with the observation by H.E.S.S. and calculate synthetic 2D count maps with predictions for the observability by CTA and for the expected neutrino flux.

T 70.3 Wed 16:20 POT/0013

Modeling of the Galactic Cosmic-Ray Antiproton Flux — •Thomas Pöschl[1], Laura Fabbietti[1], Maximilian Horst[1], Laura Serksnyte[1], and Andrew Strong[2] — [1]Technische Universität München, Garching, Deutschland — [2]Max-Planck-Institut für extraterrestrische Physik, Garching, Deutschland

Cosmic-ray particles are an excellent probe to study processes in our galaxy and can hint at exotic sources of energetic particles, such as dark-matter annihilation. In particular, cosmic-ray antinuclei are informative since these particles are expected to be only rarely produced in conventional reactions. However, the interpretation of cosmic antinuclei measurements requires a good understanding of all involved processes of the creation and propagation of the antiparticles and a realistic estimate of the involved modeling uncertainties to distinguish potential exotic contributions from ordinary production.

In this contribution, we review the current understanding of the production and propagation of charged cosmic rays in our galaxy and the thereon-based modeling of galactic cosmic-ray fluxes, with a special focus on cosmic-ray antiprotons. We quantify systematic deviations of the modeled flux that arise due to inaccuracies of the numerical solution of the propagation equation, different models of propagation processes, and different models of the antiproton-production cross section. Based on the found systematic uncertainties, we comment on the agreement between the modeled fluxes and recent measurements.

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T 70.4 Wed 16:35 POT/0013

Charge sign dependent modulation of protons and electrons during solar cycle 22 and 23 — Johannes Marquardt, •Bernd Heber, Carlotta Jöhnk, Marlon Köberle, and Lisa Romaneehsen — Christian-Albrechts-Universität Kiel, D

The cosmic ray electron and proton flux observed with the Kiel Electron Telescope (KET) onboard the Ulysses space probe varies with solar activity as well as with heliospheric position. Ulysses' launched in 1990 completed its mission in 2009. The KET measured the electron, proton and helium flux during the declining phase of solar cycle 22 and during the full solar cycle 23 during an $A > 0$ and $A < 0$-solar magnetic epoch. In this contribution we discuss the flux variation of protons/anti protons and electrons/positrons at an averaged rigidity of 2.5 GV that were corrected for spatial gradients and compare our measurements with the ones from AMS 02 showing clear signatures of charge sign dependent modulation.

T 70.5 Wed 16:50 POT/0013

Measurement of the p-p cross section at $\sqrt{s} \geq 50$ TeV using cosmic-ray induced air showers detected with the Pierre Auger Observatory — •Olena Tkachenko for the Pierre Auger-Collaboration — Karlsruhe Institute of Technology, Karlsruhe, Germany

In this talk, we present a measurement of the proton-proton interaction cross sections from the distribution of the depth of air shower maximum, $X_{\max}$, measured by the fluorescence detector of the Pierre Auger Observatory. In previous analyses, the interaction cross section was obtained assuming the predominance of protons in the tail of the $X_{\max}$ distribution. Similarly, assumptions on hadronic interactions in air showers were needed to estimate the mass composition of cosmic rays. To get a self-consistent estimation of the interaction cross sections and cosmic-ray primary composition, we implement an algorithm for the combined measurement of the interaction cross sections and composition fractions. For this, we perform a standard binned maximum-likelihood mass composition fit with the varied proton-proton interaction cross sections. The conversion from the modified proton-proton to the corresponding nucleus-nucleus cross sections is done via the Glauber formalism. We include a shift in the $X_{\max}$ scale to account for systematic uncertainties of the data and theoretical uncertainties of the properties of particle production in air showers. The preliminary cross sections and composition fractions obtained using this novel self-consistent approach will be compared to the previous measurements and future improvements to the method will be discussed.

T 70.6 Wed 17:05 POT/0013

A new bound on Lorentz violation based on the absence of vacuum Cherenkov radiation in ultra-high energy air showers — •Fabian Duenkel, Marcus Niechciol, and Markus Risse — Center for Particle Physics Siegen, Experimentelle Astroteilchenphysik, Universität Siegen

In extensive air showers induced by ultra-high energy (UHE) cosmic rays, secondary particles are produced with energies far above those accessible by other means. These extreme energies can be used to search for new physics. We study the effects of isotropic, nonbirefringent Lorentz violation in the photon sector. In case of a photon velocity smaller than the maximum attainable velocity of standard Dirac fermions, vacuum Cherenkov radiation becomes possible. Implementing this Lorentz-violating effect in air shower simulations, a significant reduction of the calculated average atmospheric depth of the shower maximum $\langle X_{\max} \rangle$ is obtained. Based on $\langle X_{\max} \rangle$ and its shower-to-shower fluctuations $\sigma(X_{\max})$, we present a new bound on Lorentz violation sensitive to vacuum Cherenkov radiation from fundamental particles (electrons and positrons) in air showers.

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