Spatial Gradients of Galactic Cosmic Ray Protons in the Inner Heliosphere - PAMELA and Ulysses Observations

J. GIESELER¹, M. BOEZIO², M. CASOLINO³, C. DESANTIS³, N. DESIMONE³, V. DIFELICE³, B. HEBER¹

¹IEAP, CAU Kiel, Kiel, Germany
²INFN, Sezione di Trieste, Trieste, Italy
³INFN, Sezione di Roma, Rome, Italy
gieseler@physik.uni-kiel.de

Abstract: Ulysses, launched on the 6th of October 1990, was placed in an elliptical, high inclined (80.2 degrees) orbit around the Sun, and was switched off in June 2009. It has been the only spacecraft exploring high-latitude regions of the inner heliosphere. The Kiel Electron Telescope (KET) aboard Ulysses measures electrons from 3 MeV to a few GeV and protons and helium in the energy range from 6 MeV/nucleon to above 2 GeV/nucleon. The PAMELA (Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics) space borne experiment was launched on the 15th of June 2006 and is continuously collecting data since then. The apparatus measures electrons, positrons, protons, antiprotons and heavier nuclei from about 100 MeV to several hundreds of GeV. Due to the spacecraft’s trajectory, the measurements reflect not only the temporal variations but also the spatial distribution. In this contribution we combine Ulysses/KET and PAMELA measurements to determine the spatial gradients of galactic cosmic ray protons in the very low GeV-range in the inner heliosphere during the extended minimum of solar cycle 23.

Keywords: galactic cosmic rays, gradients, pamela, ulysses

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