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Cosmic Ray Modulation over the 22 Year Magnetic Cycle Observed by Neutron Monitors

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Neutron monitors (NMs) are large ground-based instruments for precise time tracking of the variations in the Galactic cosmic ray (GCR) flux at the GeV-range. NMs count the secondary particles (mostly neutrons) issued from the interaction of the cosmic rays in the Earth's atmosphere. The sensitivity to GCR variations depends on the geomagnetic cutoff at the location of measurement as well as on the altitude of detection. Since late 2007, the Princess Sirindhorn Neutron Monitor (PSNM), at the summit of Doi Inthanon, Thailand's highest mountain (2565 m altitude), has recorded the flux of galactic cosmic rays with the world's highest vertical rigidity cutoff for a fixed station, 16.8 GV. We present here the observations of PSNM since the beginning of its operation. We have also developed Monte Carlo simulations of cosmic ray interactions in the atmosphere and in PSNM (with its surroundings), which includes the tracing of cosmic ray trajectories through Earth's magnetic field to model the cosmic ray suppression at low rigidity at the location of PSNM. The simulated count rate is in reasonable agreement with the data. Variations of the GCR flux, such as the solar modulation effect, are investigated for the first time with a fixed ground-based NM at such a high geomagnetic cutoff, and the observed solar modulation is much weaker than predicted by the force field model with Φ inferred from NM data at low cutoff. We also discuss the effect of solar magnetic polarity as determined by a recent series of latitude surveys, and an apparently long time lag between solar polarity reversal and the GCR minimum. Partially supported by a postdoctoral fellowship from Mahidol University, the Thailand Research Fund (BRG 5880009, PHD/0136/2552), the Graduate School of Mahidol University and US National Science Foundation awards PLR-1341562, PLR-1245939, and their predecessors.

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