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Spectral Analysis of Short-Term Cosmic Ray Variations: Evidence from a MidLatitude Mini Neutron

Abstract:

Spectral analysis of cosmic ray data collected from 2020 to 2024 by the mini neutron monitor at King Abdulaziz City for Science and Technology (KACST), Riyadh, Saudi Arabia, reveals multiple significant short-term periodicities. Using Fast Fourier Transform (FFT) methodology, the investigation identified distinct periodic signals exceeding the 95% confidence threshold at 303, 210, 161-157, 87, 53-42, 35-30, 25-27, 21, and 9-10 days.

Comparative analysis with concurrent solar activity parameters and geomagnetic indices demonstrated several shared periodicities across all examined variables, notably at 210, 154-157, 25-27, and 21 days. These common oscillations suggest synchronized variations between cosmic ray flux and solar-terrestrial parameters. The results validate the KACST neutron monitor's effectiveness in detecting and characterizing short-term cosmic ray variations. The identified quasi-periodicities enhance our understanding of the dynamic relationships between solar activity, interplanetary conditions, and cosmic ray modulation mechanisms in the heliosphere. Keywords: Cosmic Ray Periodicities; Neutron Monitor; Spectral Analysis; Riydah ; Solar-Terrestrial Relations

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