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Solar Wind And Heliospheric Magnetic Field Behaviour During Solar Cycle 23-24

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Magnetic field and solar wind particle data from the ACE satellite will be used to perform a spectral analysis of the solar wind charge state ratios, e.g. $O7+/O6+$ and $C6+/C5+$ as well as the alpha to proton abundance ratios during solar cycle 23 and 24. These oxygen and carbon charge state ratios are a proxy for the electron temperature in the solar corona while the solar wind elemental composition abundances are related to processes in the source region of the solar wind. As the solar corona expands and collision rates drop, these properties are then embedded into the solar wind plasma and contrary to the solar wind velocity, do not evolve as the solar wind travels to 1 AU. Solar wind composition observations and measurements by ACE at 1 AU therefore encapsulate imprints of the conditions under which the solar wind formed. Lomb-Scargle and Morlet wavelet spectral analysis techniques will be used to investigate the evolution of several periodicities of solar wind parameters during cycle 23-24, particularly the unusual minimum between these cycles. Pearson correlation analysis between ACE magnetic field observations and solar spherical harmonic coefficients as a function of the 27-day Carrington rotation also reveals that the sectorial solar magnetic is dominating during the minimum 23-24, indicating an unusual configuration of the solar dynamo.

Summary

Lomb-Scargle and Morlet wavelet spectral analysis techniques have been used to investigate the evolution of several periodicities of solar wind parameters during cycle 23-24, particularly the unusual minimum between these cycles.

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