Researchers investigate quasi-periodic variations of coronal mass ejections

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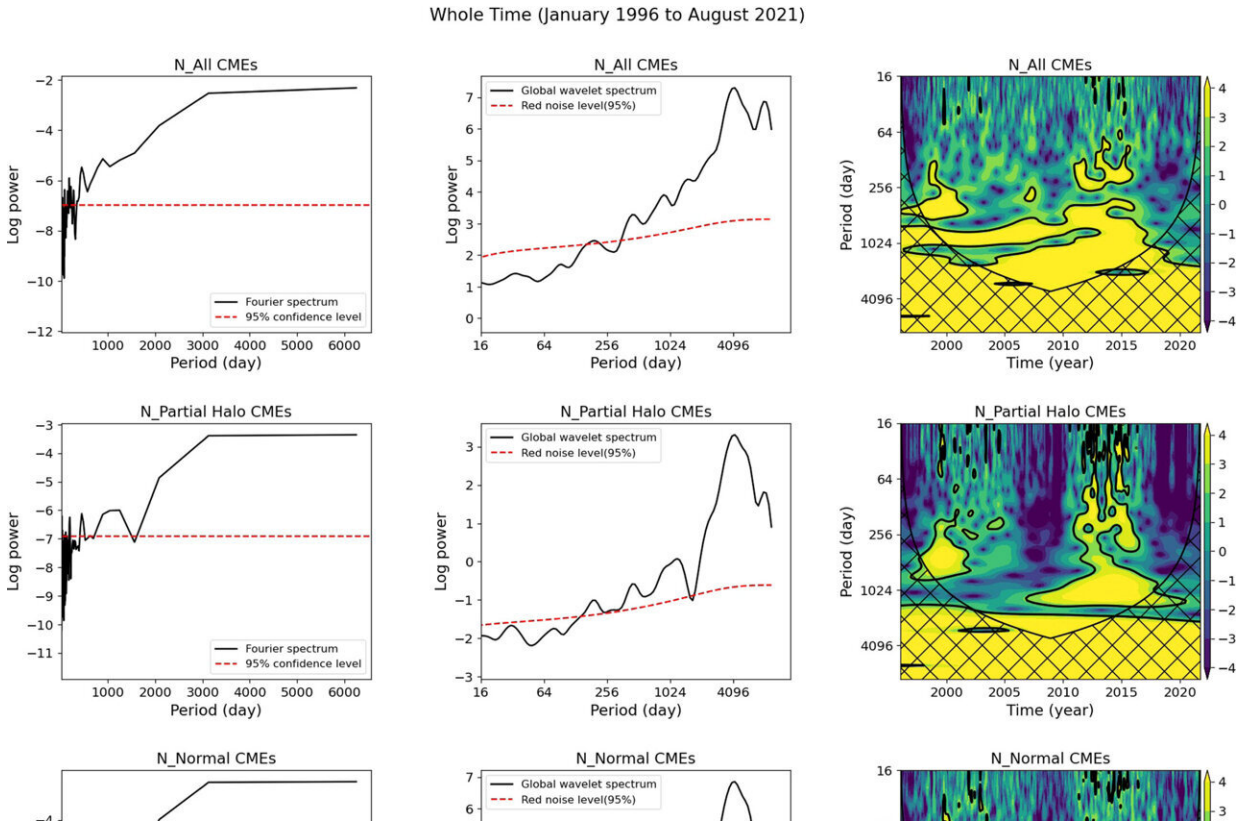

Fourier spectra (left column), global wavelet spectra (middle column), and local wavelet spectra (right column) for different angular widths of daily CMEs in the northern hemisphere. From top to bottom the first/second/third/fourth rows show all/partial-halo/normal/narrow CMEs, respectively. Credit: *The Astrophysical Journal Supplement Series* (2023). DOI: 10.3847/1538-4365/acb431

Coronal mass ejections (CMEs) are large expulsions of magnetized plasma from the sun. Determining the spatial and temporal evolution characteristics of CMEs, especially their possible periodic patterns, is valuable for establishing the unique correlations among CMEs, intense solar flares, and geomagnetic disturbances.

The quasi-periodicity of the CMEs with different angular widths can reveal whether CMEs with different geomagnetic effectiveness have different periods.

Researchers led by Prof. Deng Linhua from the Yunnan Observatories of the Chinese Academy of Sciences (CAS) and their collaborators from Guangzhou University classified the CMEs from Jan. 1, 1996, to Aug. 31, 2021, by angular width, and systematically analyzed the quasi-periodic variations corresponding to CMEs with different angular widths in the northern and southern hemispheres.

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The researchers used the latest Coordinated Data Analysis Workshops (CDAW) catalog to study the quasi-periodicity of CMEs with different angular widths based on the CME occurrence rate. The CMEs were classified into four types: narrow CMEs, normal CMEs, partial-halo CMEs, and halo CMEs. They found that for CMEs of different angular widths, there were indeed various periods: the Rieger-type periodicity, the 10 rotations, and the quasi-biennial oscillations.

"The occurrence rate of CMEs exhibits statistically significant short- and medium-range oscillations characterized by various periodicity, intermittency, and asymmetric development in the northern and southern solar hemispheres," said Prof. Deng.

The quasi-periodicities of the CMEs obtained in this study were

previously found in solar flare activity, in the solar wind, in the interplanetary magnetic field, and in the geomagnetic activity. Therefore, the quasi-periodic variations of the CMEs should be a connecting agent among the oscillations in the coronal magnetic activity, solar flare eruptions and interplanetary space.

"Our study can help to understand how magnetic energy is built up, stored, and released in magnetic flux systems, the origin and the formation process of CMEs, which are essential for solar physicists to reveal magnetic activity cycle and predict catastrophic space weather," said Prof. Deng.

More information: Xia Li et al, Quasiperiodic Variations of Coronal Mass Ejections with Different Angular Widths, *The Astrophysical Journal Supplement Series* (2023). DOI: 10.3847/1538-4365/acb431

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