Researchers reveal hemispheric asymmetry of long-term sunspot activity

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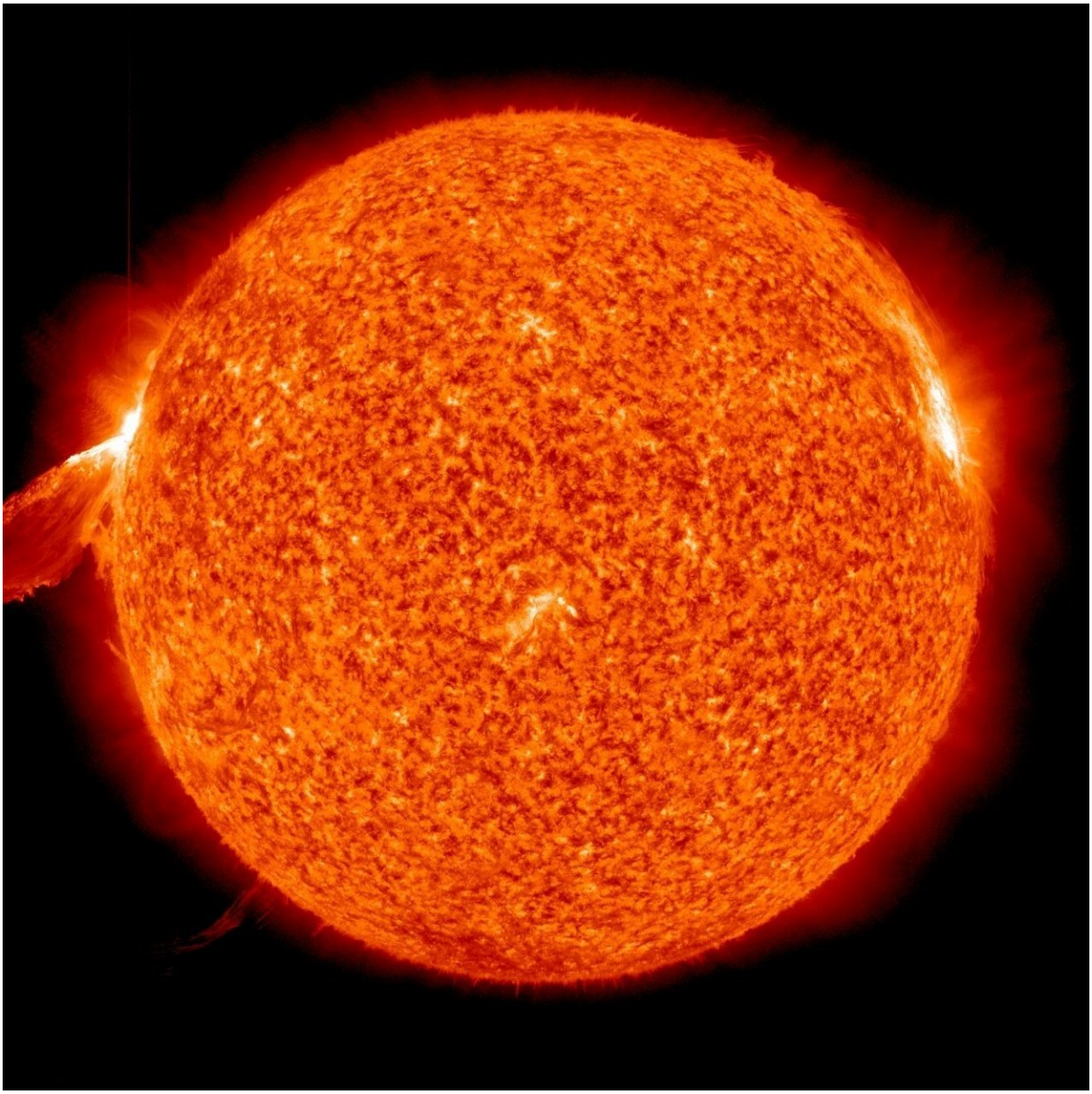

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Ph.D. candidate Zhang Xiaojuan and Prof. Deng Linhua from Yunnan Observatories of the Chinese Academy of Sciences investigated the temporal variation of the hemispheric distribution of long-term sunspot activity during the time interval from 1939 to 2019.

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Solar sunspots are the most easily visible structures in the photosphere. They are connected to most activity phenomena, such as filaments, flares and coronal mass ejections. Sunspot relative numbers are the measure of the global magnetic activity.

According to the latest dynamo theories, solar activity is not identical in the two hemispheres, i.e., there is always a hemispheric asymmetry. The hemispheric asymmetry is not an artifact of inaccurate or noisy observations, but a real feature of the solar cycle.

Studies of the temporal evolution of the solar cycles in the two separate hemispheres can provide important information for the dynamo process underlying this evolution.

In this study, the researchers investigated the temporal and spatial behaviors of the hemispheric asymmetry of sunspot relative numbers covering eight solar cycles (from March 1939 to November 2019). The solar data used in this study is a new sunspot database, which is obtained from the Mitaka observatory of the National Astronomical Observatory of Japan (NAOJ/Mitaka).

According to the cross-correlation analysis, the researchers found that the NAOJ/Mitaka sunspot relative numbers were highly correlated with the international sunspot numbers obtained from the World Data Center Sunspot Index and Long-term Solar Observations, which confirmed that the Mitaka sunspot time series could be used for hemispheric variation study.

Furthermore, for the temporal analysis, there are enhanced powers in the period ranges of quasi-biennial oscillations, around nine years, between 30 and 50 years. The analysis results reveal a possible mechanism responsible for the generation and variation of the hemispheric coupling in the sun.

More information: X J Zhang et al, Hemispheric asymmetry of long-term sunspot activity: Sunspot relative numbers for 1939-2019, *Monthly Notices of the Royal Astronomical Society* (2022). DOI: 10.1093/mnras/stac1231

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