Researchers observe total reflection of ultraviolet wave train at a coronal hole

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Researchers from Yunnan Observatories of the Chinese Academy of Sciences observed and verified for the first time that the coronal wave train totally reflected at the coronal hole boundary, which provides

essential evidence for the essence of the coronal wave.

The study was published in *Astronomy and Astrophysics* on March 22.

The highly structured corona is an inhomogeneous and anisotropic medium full of hot magnetized plasma. Waves often encounter regions where physical parameters (e.g., magnetic field strength, density, temperature) vary considerably during propagation, such as active regions and coronal holes.

Since these regions have fast fast-mode magnetosonic wave velocities, waves encountering these regions are often affected and exhibit true wave properties, such as refraction, reflection and transmission. However, as an essential feature of the fluctuation theory, total reflection has not yet been detected.

The researchers analyzed a coronal wave train excited from the eastern edge of the Sun using high spatial and temporal imaging observations. "This wave train propagated southwestward along the corona and was reflected at the boundary when it encountered the coronal hole located at the south pole," said Zhou Xinping, the first author of the study.

The critical angle for total reflection was 38 degrees, obtained by combining the differential emission measure (DEM) method with the electron density ratio inside and outside the coronal hole boundary. The incident angle was 33°, obtained from the observation.

"The incident angle and reflection angle meet the condition of total reflection, i.e., the incident angle is smaller than the critical angle, which proves that the reflection of the wave train at the boundary of the coronal hole was a total reflection," said Zhou.

The total reflection observed in this study further enriches the

characteristics of the interaction between the coronal wave and coronal hole. So far, all possible transmission, partial reflection, refraction and total reflection phenomena have been observed.

This study provides observational evidence for the true wave theory of coronal waves.

More information: Xinping Zhou et al, Total reflection of a flare-driven quasi-periodic extreme ultraviolet wave train at a coronal hole boundary, *Astronomy & Astrophysics* (2022). DOI: 10.1051/0004-6361/202142536

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