NEWS FEATURE

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Sun found clocking strong seismicity

Scientists now know that (and how) the Sun paces strong quakes—and not just on Earth

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"Discovery of clocking between the Sun-emitted waving jets of gas (solar wind) and seismicity on Earth, Moon, and Mars rewrites seismology and the astrophysics of stars and stellar systems."

Key words—seismogenesis, seismic prediction, space weather, fundamental questions of physics.

In his 2019 fundamental discovery of the moon-moderated mechanism for generating M6.2+ strong (tectonic) earthquakes and sequences on timescales of hours to days, Dr. Mensur Omerbashich established that this mechanism of external energy transfer/insertion into the Earth's system is **resonant**, so that mantle convection (internal heat) does not critically affect seismotectonics, in contrast to classical understanding. GPS data subsequently confirmed that find.

Now expanding on these results, Dr. Omerbashich shows in a new computational study that the **Sun forces strong seismicity** and does so not only on Earth but on the Moon and Mars too — all three worlds on which we directly collected seismometer data. The new study thus confirmed the long-suspected connection between the Sun (the magnetism) and strong seismicity, and it deciphered how that interplay works on long timescales of months to years — **the clocking mechanism**. To achieve this, Omerbashich used the Gauss-Vaníček spectral analysis as the only method for rigorously extracting periodicity from gapped measurements.

As found in the 1970s, the Sun constantly and periodically releases large amounts of its particles into space as gas jets of magnetized hot plasma called the **solar wind**. The wind's magnetization creates the **Interplanetary Magnetic Field** (IMF). Akin to gigantic tongues of fire, these densely packed jets of overheated gas flap gracefully and quasi-periodically (locally briefly) about the ecliptic. Together with other particles, including those from sudden Sun explosions, the solar wind forms a bubble of magnetism called the **heliosphere**. This bubble permanently envelopes our entire **solar system** as our star tugs us while tirelessly circumnavigating the Galactic Center.

Past geomagnetical studies had left recurrent (including auroral) interactions at the interface of the IMF and Earth's magnetic field lasting longer than half a day largely unexplored. But those solar jets have been known since the 1980s to affect the heliosphere most strongly at well beyond the just half-day rate, or once every 154 days. This cyclicity phenomenon is well-known in heliophysics and termed the **Rieger period**; it has been recognized later on as inherent to most types of heliophysical data. As Dr. Omerbashich found in a related study, the secret to the strength and ubiquitousness of this distinctive periodic dynamic in solar jets lies in it being the (folded) offshoot of the wind emitted from both the northern and southern polar regions (at solar latitudes above 70°), as the overall fastest solar wind — with ejection speeds exceeding 700 km/s. The Rieger period and its associated periodic modulations up to approximately 30-day cycles, which arise from the interplay of planetary gravitational and magnetic fields in the solar system, jointly assemble a mechanical vibration of the solar wind flapping, called the ***Rieger resonance*** and occupying the 30-180-day range.

Dr. Omerbashich looked more closely into the solar wind's dynamics in this previously unexplored range. Indeed, the Rieger period and its resonance, quite expectedly so given this periodic dynamic's vigor, emerged as **the global mechanism for seismogenic coupling** between an astronomical body and the solar wind as well — one along whose resonation periods seismicity on planets and moons then occurs. Consequently, global astrophysical seismogenesis in the band of highest planetary energies requires rethinking the **seismicity phenomenon** and reliance on **global seismic magnitude scales**.

The new result applies not only to the vicinity of our Sun but also **stellar systems around billions of trillions of Sunlike stars** in the observable universe (which means most of the stars out there, not counting dwarfs). The exact mechanism of local coupling of the solar/stellar wind to solid matter, resulting in rupturing (quakes) on planets and moons, is poised to become **the focus of cross-disciplinary research worldwide** in the coming quest for **universal quake prediction** — anywhere and at any time. The groundbreaking new study was published online last week in the world's oldest periodical in geophysics, the ***Journal of Geophysics***.

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