Evidence of Interplanetary Forces: Uranus' Influence on Saturn

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Context: It is hypothesized that a fifth force of nature can be observed as interplanetary forces. Here, we look at potential evidence that Uranus acts on Saturn according to the expression

$$U(\text{Uranus}) = -C\frac{\sin(\delta)T}{M}\hat{M}_{NP} \cdot (\hat{S}_{NP} \times \hat{M}_S)$$

when Uranus-Saturn distance is less than Uranus-Sun, Uranus-Jupiter, and Uranus-Neptune distances; C is some positive constant; δ is Saturn's latitude from Uranus; T and M are Uranus' sidereal rotation period and mass, respectively; and $\hat{M}_{NP}$, $\hat{S}_{NP}$, and $\hat{M}_S$ are unit vectors representing Uranus' north celestial pole, Saturn's north celestial pole, and Uranus' position from Saturn, respectively. A full description can be found on this page (ltresearchblog.com): Mathematical Model Used to Predict Interplanetary Phenomena.

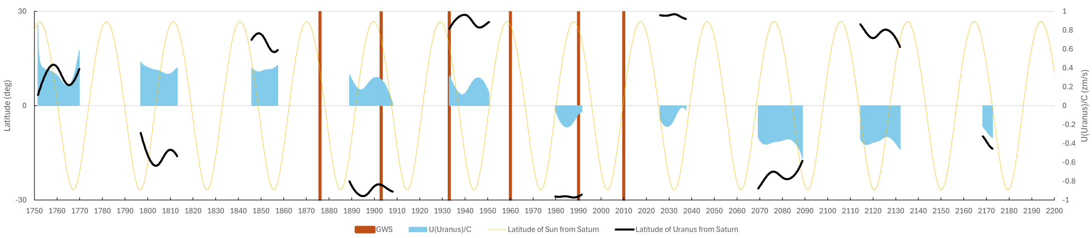

Figure 1: U(Uranus) effect on Saturn 1750-2200.

Effect on zonal winds

Figure 2 shows that Saturn has a strong prograde zonal wind profile, and figure 1 shows that U(Uranus) has been consistently positive for centuries. This means that the velocity boosts **U** have been pointing in the same direction as Saturn's equatorial winds. The exception to this was during the period 1979-1991 when U(Uranus) was negative. It was expected, then, that wind speeds during this period should have slowed down. Sánchez-Lavega et al (2003) indeed found a large decrease in Hubble's measurements of Saturn's equatorial jet during 1996-2002 compared to Voyager's measurements during 1980-81 (figure 2).[1]

However, this is a coincidence that should be treated with caution. Although there is still no single, settled explanation, this decrease is now understood not as a permanent weakening of

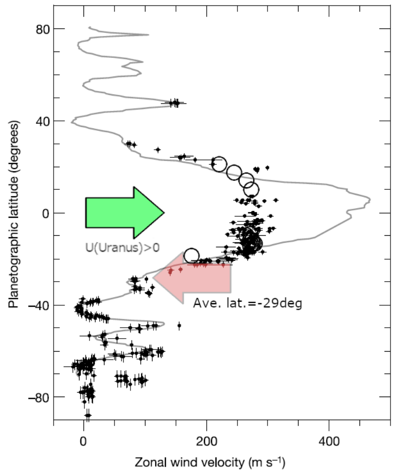

Figure 2: Apparent slowdown of Saturn's equatorial jet (adapted from Sánchez-Lavega et al, 2003[1]). Green arrow represents the average long-term (1750-present) direction of U(Uranus). Red arrow represents the direction of U(Uranus) during 1979-91. Continuous black lines represent Voyager profiles from 1980-81. Circles represent ground-based telescope measurements during 1995-97. Dots represent HST velocity measurements during 1996-2002.

the deep jet, but primarily as an effect of where in the atmosphere the winds were being measured. Later Cassini observations showed that Saturn's equatorial winds have strong vertical shear, so cloud features at higher altitudes move significantly more slowly than those deeper down. The 1996–2002 HST measurements tracked clouds that likely formed higher in the atmosphere following major equatorial storms and seasonal radiative changes, making the jet appear slower even though the deeper circulation remained fast and stable. Seasonal forcing, ring shadowing, and storm-driven changes in cloud structure all contribute to this variability, explaining why the equatorial jet shows much larger apparent changes than Saturn's other, more stable jets.

So bearing this in mind, and with U(Uranus) once again becoming non-zero today (December 28, 2025) because of the fact that the distance Uranus-Saturn becomes less than Uranus-Jupiter, the next twelve years will be interesting.

Great White Spots

Figure 1 compares the first-detection dates of the six known atmospheric storms known as Great White Spots (GWS)[2] with U(Uranus) periods. If it's true that U(Uranus) can cause a major slowdown in Saturn's equatorial jet, then it's also reasonable to assume that it causes visible disturbances in the atmosphere, like those shown in figures 3 and 4. Indeed, all three periods since 1876 where U(Uranus) was non-zero included a GWS appearance (1903, 1933, 1990). The period before 1876 is known as The Gap, where there is an absence of GWS. This is possibly due to poor recording. If the pattern held, I would have expected there to be a GWS during 1845-57.

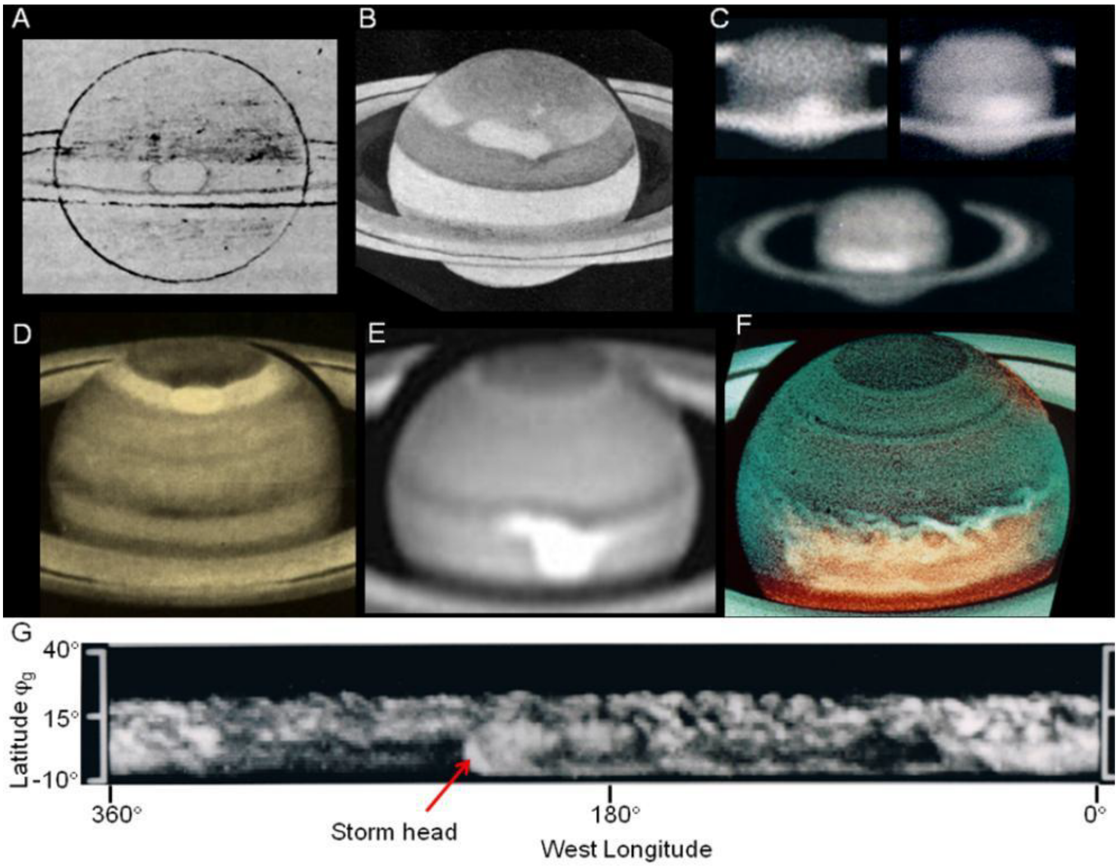

Figure 3: Great White Spots 1876-1990. (From Sanchez 2019, figure 13.2[2]). GWS dates: (A) 1876, (B) 1903, (C) 1933, (D) 1960, (E-G) 1990.

Probabilities

In terms of probabilities, I found the following. Given Uranus has no influence on Saturn's atmosphere:

- Probability that 3 out of the 6 GWS occured during non-zero U(Uranus) periods between January 1876 and December 2025: 0.22.
- Probability that all three non-zero U(Uranus) periods over the same period included a GWS appearance: 0.084.
- The average number of years between GWS first appearances is 26.8. Based on this, assume two more GWS between 2010 and 2069 (the start of another non-zero U(Uranus) period). The probability that all four non-zero U(Uranus) periods between January 1876 and April 2069 include a GWS appearance: 0.028 (2σ significance).

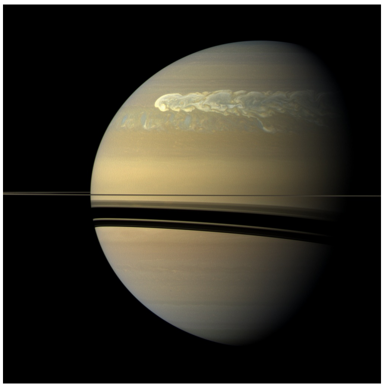

Figure 4: Great White Spot 2010.

References

[1] Sánchez-Lavega, A., Pérez-Hoyos, S., Rojas, J., Hueso, R. & French, R. A strong decrease in saturn's equatorial jet at cloud level. *Nature* **423**, 623–625 (2003).

[2] Sánchez-Lavega, A. *et al.* The great saturn storm of 2010–2011. *Saturn in the 21st Century* **20**, 377–416 (2019).