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# A new rotation period and longitude system for Uranus at the basis of a long-term analysis of magnetospheric dynamics

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## Résumé

The rotation period of Uranus was estimated to be  $17.24 \pm 0.01$  h in 1986 from radio auroral measurements during the brief Voyager 2 flyby. This value is the basis for the Uranian SIII longitude system still in use. However, the poor period uncertainty limited its validity to a few years, after which the orientation of the magnetic axis was lost. Alternate, conflicting, rotation periods have also been proposed since then. Here we use the long-term tracking of Uranus' magnetic poles between 2011 and 2022 from Hubble Space Telescope images of its ultraviolet aurorae to achieve an updated, independent, extremely precise rotation period of  $17.247864 \pm 0.000010$  h, only consistent with the Voyager 2 estimate. Its 28-s-longer value and improved accuracy yields a new longitude model now valid over decades, up to the arrival of any future Uranus mission, which will allow the reanalysis of the whole set of Uranus observations. In particular, average cylindrical projections reveal that Uranus acceleration mechanism apply to the same, limited, range of longitudes whatever the Uranus geometric configuration with respect to the solar wind, revealing an important invariant of the Uranian magnetosphere.

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