The Aurora and Magnetic Field of Uranus

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Resolution of the details of a planetary magnetic field from magnetometer measurements made during a single flyby can be severely limited, because of the incomplete geometrical sampling of the planetary neighborhood by the flyby trajectory. This problem was especially severe for the only spacecraft encounter with Uranus, that of Voyager 2 in 1986. Fortunately, auroras at the magnetic field-line footprints serve as additional constraints that may be used to determine the higher multipole moments of planetary fields [Connerney, JGR 103:11,929, 1998]. In the present work, this approach is applied to improving the resolution of the magnetic field of Uranus. The auroral emission distribution at Uranus is determined from scans by the Voyager 2 Ultraviolet Spectrometer (UVS), enhancing an earlier analysis [Herbert and Sandel, JGR 99:4143, 1994] by incorporating more observations and by using more powerful analysis techniques. The resulting new determination of the auroral ovals is well correlated with the field lines associated with the strongest plasma wave and radio emissions, but differs from model ovals computed from the Q3 magnetic field model for Uranus [Connerney et al., JGR 92:15,329, 1987]. Consequently, a search has been initiated for model coefficients of the planetary magnetic field that agree both with the magnetic-field observations and also with the reasonable assumption that the newly determined auroral emissions lie at the magnetic footprints of an equi-distant circum-Uranian region of the magnetosphere. The dipole and quadrupole terms of the new field model, termed AH5, are similar to those of the dipole+quadrupole Q3 model, but the Q3 higher multipole terms diverge from the dipole+quadrupole+octupole I3E1 model [Connerney et al., 1987] from which the Q3 model was derived. Inasmuch as theI3E1 octupole terms were not resolved, the AH5 model derived here comprises a first estimate of the higher multipole moments of Uranus' magnetic field.

Super-Ios?: Exploring the Possibility of Io-like Extrasolar Planets

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