Abstract Submitted
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Unusual magnetic fields of Uranus and Neptune WILLIAM NELLIS, Harvard Univ — Voyager 2 measured spatial distributions of the magnetic fields of Uranus and Neptune (U/N) in the 1980s. Prior to Voyager 2 known planetary magnetic fields were dipolar with dipole axis aligned closely with the axis of rotation. Surprisingly, the fields of U/N are non-dipolar and non-axisymetric. If those field geometries are force-fit to dipoles, the dipole axes are tilted ∼45 deg. from the axes of rotation and off-centered by 30% of planet radii. Stanley and Bloxham developed a 3D thin-shell dynamo model that matches measured field geometries, assuming fluid metal at radii below the inner radius of the thin shell is stably stratified [1]. Pressures and temperatures exceed ∼300 GPa and several 1000 K in that region. Consideration of measured electrical conductivities of metallic fluid H, N, O and of ionic water and SU (a representative Ice mixture) up to 180 GPa, a theoretical prediction of metallization of water at 300 GPa and several 1000 K, condensed matter physics of electrical conduction in disordered systems, and likely mutual solubilities suggests it is reasonable to expect stable stratification in the deep interiors of U/N, as assumed by Stanley and Bloxham.

[1] S. Stanley and J. Bloxham, Nature 248, 151 (2004).

William Nellis
Harvard Univ

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