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Implications of Initial Juno Magnetic Field Models for the Jovian Dynamo

Kimberly Moore (1), Jeremy Bloxham (1), John Connerney (2,3), John Jorgensen (4), Jose Merayo (4), Steven Levin (5), and Scott Bolton (6)

(1) Harvard University, Earth and Planetary Sciences, Cambridge, United States (kimberlymoore@g.harvard.edu), (2) NASA Goddard Space Flight Center, Greenbelt, USA, (3) Space Research Corporation, Annapolis, USA, (4) National Space Institute, Technical University of Denmark, Kgs. Lyngby, Denmark, (5) NASA Jet Propulsion Laboratory, Pasadena, USA, (6) Southwest Research Institute, San Antonio, USA

As of late October 2016, Juno has collected magnetic field data from 8 perijove passes. With the near polar orbit around Jupiter, the roughly equal longitudinal spacing of the orbits and, most importantly, the close approach of Juno to Jupiter's dynamo (within about 20% of the planetary radius) these data provide an unprecedented view of an active dynamo. The initial results are unexpected. While these data might have been expected to reveal progressively smaller-scale structure in the field, instead what is seen is different.

First, at the top of the nominal dynamo region, we see large-scale field organization. Flux emerges from Jupiter's northern hemisphere in a relatively narrow band around 45 degrees N, and stretches across about 270 degrees of longitude. In contrast, in the southern hemisphere we see flux re-enter over a large diffuse region, in which the maximum radial flux is only a third of that seen in the northern hemisphere. Elsewhere (except near the equator), the radial field is much weaker, including at high northern latitudes.

Second, at the equator we see an extraordinarily intense and localized spot of negative flux, in which the radial flux is three times stronger than any other negatively signed flux. These inferences are robust, even at this early stage of analysis, in spite of significant unmodeled fields (of order 1000 nT) attributed to smaller scale spatial variations especially near the equator. In addition, there are unmodeled auroral field aligned currents, and other field sources presently under study.

Although the full 32 orbits planned for Juno will be necessary to reveal these features more fully, we will discuss the initial implications of these two features for Jupiter's dynamo.