Early Observations of Jupiter with Juno's Microwave Radiometer

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The Juno Microwave Radiometer (MWR) was designed to investigate Jupiter's atmosphere and radiation belts as one of a suite of instruments that are the core of the Juno mission. The Juno spacecraft was placed into orbit on July 4, 2016, with a primary goal of exploring the unknown properties of Jupiter's deep atmosphere and interior. The MWR's main objectives are to investigate the composition and dynamics of Jupiter's deep neutral atmosphere, with a secondary objective to study Jupiter's radiation belts. Jupiter's deep abundance of elements in relation to H and He, particularly oxygen, are anticipated to shed light on the origin of Jupiter. Very little is known about the structure of Jupiter's atmosphere beneath the ammonia cloud deck, including its deep circulations and composition. The innermost regions of the magnetosphere are similarly unexplored.

The MWR is a six-frequency microwave radiometer with frequencies distributed approximately by octave from 600 MHz to 22 GHz and antennas mounted on the spacecraft perpendicular to its spin axis. Combined, these allow the atmosphere to be probed continuously from the vicinity of the NH3 cloud tops at around the 1-bar pressure level to at least as deep as 1000 bars. The low microwave frequencies necessitate low angular resolution antennas (12 to 20 degrees HPBW); however, in its highly eccentric orbit Juno passes to within ~4000 km of Jupiter at periapsis, enabling ~1 degree latitude spatial resolution in the equatorial regions. The polar orbit with the spacecraft spin axis perpendicular to the orbit plane allows the MWR to observe all locations along the subspacecraft track at multiple emission angles, ideal for remote sensing. By the time of the meeting Juno will have made seven periapsis passes of Jupiter, distributed over a range of longitudes. Preliminary results from the first part of this data set will be presented on the nature and depth of the atmospheric circulations that are seen, along with details of the workings of the inner radiation belts.