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The New Jupiter as Revealed by Juno

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Abstract

Juno is the first mission to investigate Jupiter using a close polar orbit. The Juno science goals include the study of Jupiter interior composition and structure, deep atmosphere and its polar magnetosphere. All orbits have perijove at approximately 5000 km above Jupiter's visible cloud tops. The payload consists of a set of microwave antennas for deep sounding, magnetometers, gravity radio science, low and high-energy charged particle detectors, plasma wave antennas, ultraviolet imaging spectrograph, infrared imager and spectrometer and a visible camera.

1. Introduction

The primary science goal of Juno is the understanding of the origin and evolution of Jupiter, the history of our solar system and the more general theory of planetary system formation. To address these goals, Juno probes significantly below the cloud decks to constrain its interior structure using measurements of Jupiter's gravity and magnetic fields and deep atmospheric composition [1]. Juno's elliptical orbit provides multiple periapsis passes very close to Jupiter, on a pole-to-pole trajectory. The very close-in polar orbits enable a unique exploration of Jupiter's polar magnetosphere [2]. Juno's payload of science investigations include an X-band and Ka-band communications subsystem for determining Jupiter's gravity field, dual magnetometers to map Jupiter's internal magnetic field, a set of microwave radiometers to probe Jupiter's deep atmosphere, a visible color camera and an infrared spectrometer/imager and ultraviolet spectrograph/imager to capture views of Jupiter. Juno also carries a suite of fields and particle instruments for in-situ sampling Jupiter's magnetosphere and investigating its powerful aurora [2].

2. Science Results

On July 4, 2016, the Juno spacecraft arrived at Jupiter to begin the investigation of Jupiter. The spacecraft acquired science observations of Jupiter, passing within 3000 km of the equatorial cloud tops. Images of Jupiter's poles indicate cyclonic activity unique to the solar system. Microwave sounding reveals weather features, dominated by an ammonia-rich, narrow low-latitude plume. Near-infrared mapping reveals the relative humidity within prominent down-welling regions. Juno's measured gravity field differs significantly from the current knowledge and is one order of magnitude more precise. This has implications for the distribution of heavy elements in the interior including the existence and mass of Jupiter's core. The observed magnetic field exhibits smaller spatial variations than expected. Direct observations of the Jovian polar magnetosphere provide the first close-up observations of Jupiter's auroral regions. Energetic particle and plasma detectors measured electrons precipitating in the polar regions, exciting intense aurorae, observed simultaneously by the ultraviolet and infrared imaging spectrographs.

Acknowledgements

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References

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