



Juno

Juno Update for OPAG

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Juno Mission Overview

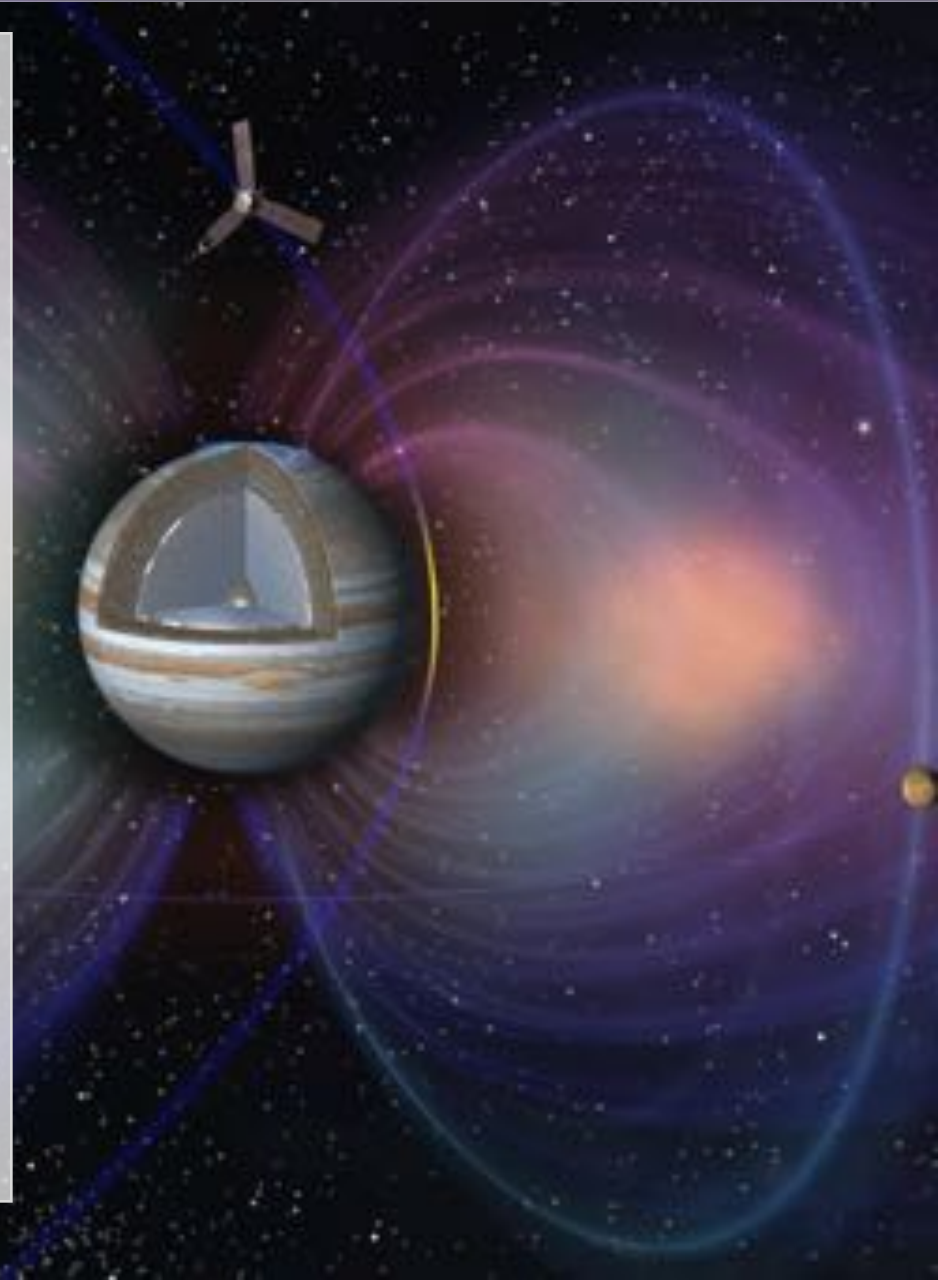
Salient Features:

- First solar-powered mission to Jupiter
- Eight science instruments to conduct gravity, magnetic and atmospheric investigations, plus a camera for education and public outreach
- Spinning, polar orbiter spacecraft launched on August 5, 2011
 - 5-year cruise to Jupiter, arrived July 4, 2016
 - 16 months of science at Jupiter, ending by diving into Jupiter in February 2018
- Elliptical 14-day orbit swings below radiation belts to minimize radiation exposure
- 2nd mission in NASA's New Frontiers Program

Science Objective: Improve our understanding of giant planet formation and evolution by studying Jupiter's origin, interior structure, atmospheric composition and dynamics, and magnetosphere

Principal Investigator: Scott Bolton

Southwest Research Institute





Juno Science

Juno Science Objectives

Origin

Determine the abundance of water and place an upper limit on the mass of Jupiter's dense core to decide which theory of the planet's origin is correct

Interior

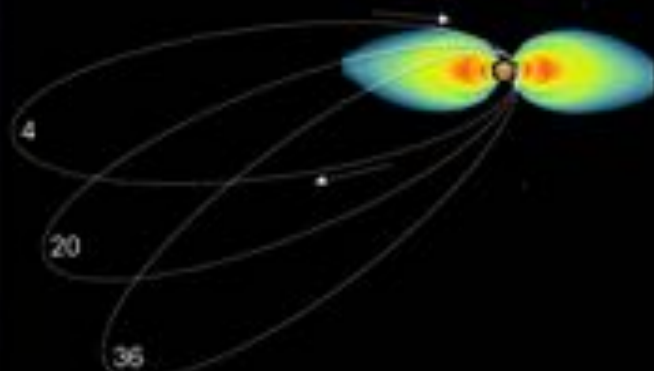
Understand Jupiter's interior structure and how material moves deep within the planet by mapping its gravitational and magnetic fields

Atmosphere

Map variations in atmospheric composition, temperature, cloud opacity and dynamics to depths greater than 100 bars at all latitudes

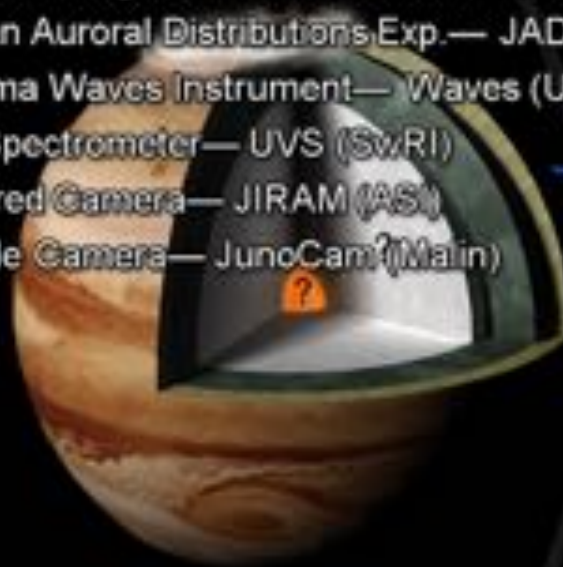
Magnetosphere

Characterize and explore the three-dimensional structure of Jupiter's polar magnetosphere and auroras.



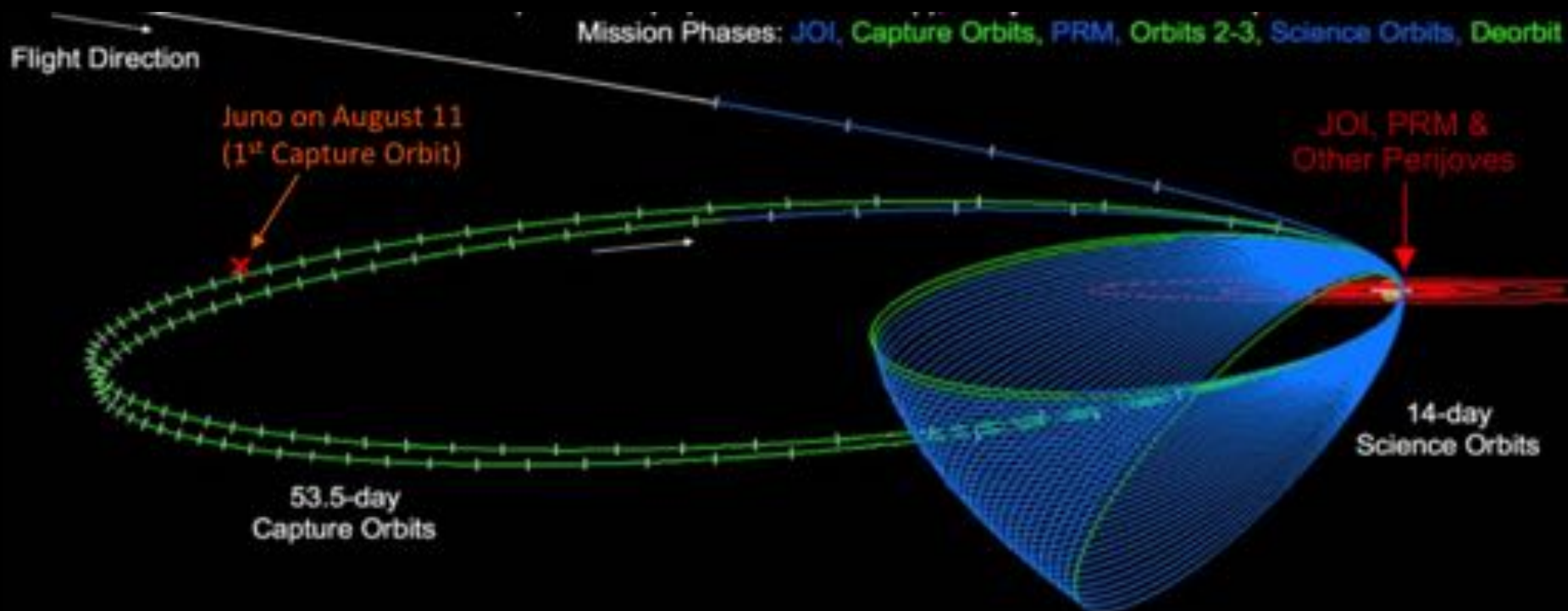
Juno Instruments

- Gravity Science (JPL, ASI)
- Magnetometer—MAG (GSFC)
- Microwave Radiometer—MWR (JPL)
- Jupiter Energetic Particle Detector—JEDI (APL)
- Jovian Auroral Distributions Exp.—JADE (SwRI)
- Plasma Waves Instrument—Waves (U of Iowa)
- UV Spectrometer—UVS (SwRI)
- Infrared Camera—JIRAM (ASI)
- Visible Camera—JunoCam (Malin)





Juno at Jupiter



PJ0 July 4: Orbit insertion went perfectly!

PJ1 August 27: First perijove pass with instruments on.

PJ2 October 19: Period Reduction Maneuver. Only MWR and MAG will be on.

PJ3 November 2: Thruster maneuver to clean up longitude. All instruments on.

PJ4 November 16: First “regular” science perijove pass (in MWR orientation).

PJ5 – PJ37 Every 14 days: 32 more perijove passes, evenly distributed in longitude.

A small image of the Juno spacecraft in the top left corner.

Juno spacecraft status

Juno is now in orbit at Jupiter !

The spacecraft is working well

- A few dozen correctible memory errors
- No problem, but perhaps a clue about the radiation belts

Post-JOI clean-up maneuver was successful

- Established the correct timing/longitude for Perijove 1



Juno science status

All instruments have been turned on post-JOI

- No evidence of any damage from perijove passage
- Jovian fields and particles detected
- MWR sees Jupiter, synchrotron, galactic plane
- Junocam images, with Nadir Spin Phase
- JIRAM pointing calibration, with Nadir Spin Phase

Science Activity Plan is complete for Perijove 1

- First perijove pass with instruments on
- MWR pass
- X/Ka Gravity Science (not over Goldstone)
- Magnetic Field (longitude not part of the regular map)

Jupiter, up close and personal, in 16 days!



First Results Sessions Planned for AGU in December

U011: Juno at Jupiter: First Results

First Results from the Jupiter Energetic Particle Detector Instrument (JEDI) Investigation Within the Magnetosphere and Over the Poles of Jupiter

Early Results from the Juno Gravity Science Experiment

First Observations Near Jupiter by the Juno Waves Investigation

First Results of the Juno Magnetometer Investigation in Jupiter's Magnetosphere

An Overview of the Juno JIRAM Results from the First Perijove Pass.

First Results at Jupiter from the Microwave Radiometer Investigation

Initial observations of Jupiter's aurora from Juno's Ultraviolet Spectrograph (Juno-UVS)

First observations of Jupiter's polar magnetosphere from the Jovian Auroral Distributions Experiment (JADE)



First Results Sessions Are Planned for AGU in December

P015: Juno's Exploration of Jupiter and the Earthbased Collaborative Campaign

Early Science Results From The Juno Mission (invited)

Scales of wave-particle interaction processes in Jupiter's magnetosphere: Implications for JUNO/JEDI measurements

Observations from Juno's Radiation Monitoring Investigation during Juno's First Look at Jupiter's Inner Radiation Belts: Perijove 1

First Hubble Space Telescope Movies of Jupiter's Ultraviolet Aurora During the NASA Juno Prime Mission

Juno-JIRAM: Overview of Preliminary Results in the Study of Jupiter Hot-Spots

Jupiter's distant magnetic equator region in energetic charged particle data

Results from Joint Observations of Jupiter's Atmosphere by Juno and a Network of Earth-Based Observing Stations

Accelerated Flows at Jupiter's Magnetopause: Evidence for Magnetic Reconnection Along the Dawn Flank

Search for low-latitude atmospheric hydrocarbon variations on Jupiter from JunoUVS measurements

Continuous Monitoring of Jupiter's Aurora and Io Plasma Torus with the Hisaki Satellite during Joint Observing Campaign with Juno

The complex behavior of the satellite footprints at Jupiter: the result of universal processes?

The magnetic field in Jupiter's plasma sheet and magnetopause boundary layers

First observations of Jupiter Aurorae by JIRAM on board Juno.

Interaction of Jovian energetic particles with moons and gas tori based on recent Juno/JEDI data

Observations of Jupiter's Low-Frequency Radio Emissions from the Juno Waves Instrument in Collaboration with the Earth-Based Radio Telescopes

Modeling the Jovian Magnetopause in Support of Juno

Juno-Cam's Images of Jupiter (Invited)

The Juno Jupiter Energetic Particle Detector Instrument (JEDI) Investigation Data Structures and Analysis Tools

Electron measurements by the Jovian Auroral Distributions Experiment-Electrons (JADE-E) on the Juno Mission to Jupiter

Stochastic energetic electron bursts observed by Juno-JEDI: a signature of structured auroral activity?

Statistical study of solar wind control on Jovian UV auroral activity obtained from long-term Hisaki EXCEED observations

Jupiter cloud morphology and zonal winds from ground-based observations before and during Juno exploration

First steps toward data assimilation of Jupiter's radiation belts using Juno and radio observations and physics-based models



First Results Sessions Are Planned for AGU in December

P015: Juno's Exploration of Jupiter and the Earthbased Collaborative Campaign

A 1D Forward Model of Solar Wind Conditions Using JADE-I

Quicklook Constituent Abundance and Stretch Parameter Retrieval for the Juno Microwave Radiometer using Neural Networks

Early Juno Era Optical Imaging and Analysis of Jupiter's Atmospheric Structure and Color with the NMSU Acousto-optic Imaging Camera

Jovian bow shock and magnetopause encounters by the Juno spacecraft

The Goldstone Apple Valley Radio Telescope (GAVRT) Jupiter Radio Data: Online Access and Analysis Tools

Retrievals of atmospheric parameters from radiances obtained by the Juno Microwave Radiometer

Modeling the disequilibrium species for Jupiter and Saturn: Implications for Juno and Saturn entry probe

The strength and evolution of stratospheric-auroral processes on Jupiter, as observed by IRTF-TEXES

Measurements of the Dawn-side Jovian Magnetosheath by Juno/JADE

Jupiter's auroras during the Juno approach phase as observed by the Hubble Space Telescope

Predicting Juno's Possible Internal Field and Secular Variation Models Based on Numerical Dynamo Simulations

Feasibility of Juno radio occultations of the Io plasma torus

Modelling the Auroral Magnetosphere-Ionosphere Coupling System at Jupiter

JEDI observations of energetic ions in the Jovian polar regions

Determining the depth of atmospheric and interior flows on Jupiter using the Juno gravity measurements

Predicting Juno Evidence for a Solid Methane Gas Hydrate Jupiter

Xray Monitoring of the Jovian Polar Aurora during Juno Approach

Empirical Modeling of Jovian Electron Distributions Using Juno's MWR Synchrotron Radiation Observations

Juno, The Cultural Connection

Calibration and Performance of the Juno Microwave Radiometer during the First Science Orbits

A QuickLook Method for the Analysis of Juno Microwave Radiometer Data

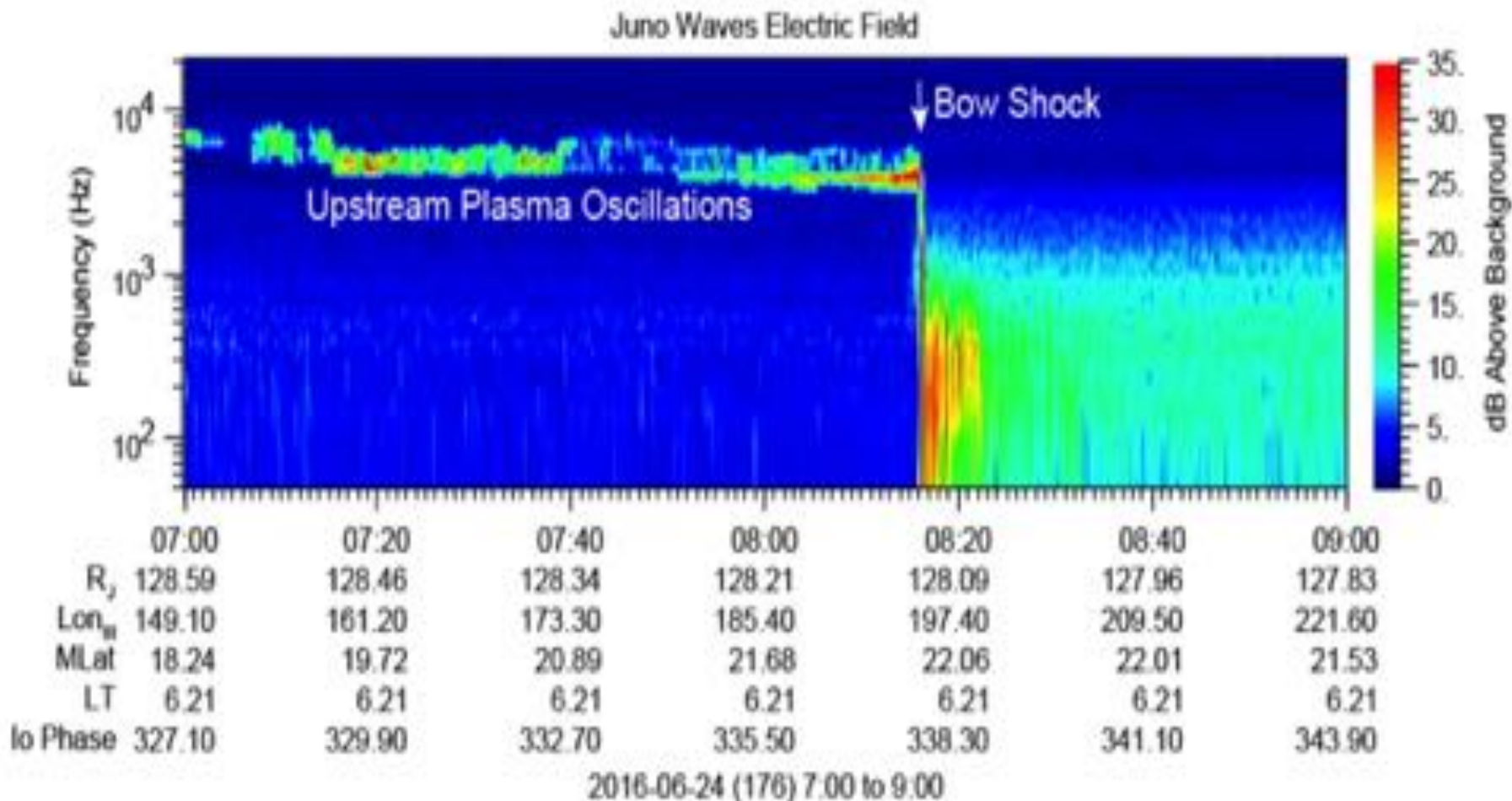
Simulation of Antenna Brightness Temperatures for the Juno Microwave Radiometer

Variability of Mid-Infrared Aurora on Jupiter: 1979 to 2016



We crossed the bow shock on June 24...

<http://www-pw.physics.uiowa.edu/plasma-wave/juno/audio>





and we made a movie on the way in.

<https://www.missionjuno.swri.edu/media-gallery/jupiter-approach>



“Marble Movie” images on the website

<http://www.missionjuno.swri.edu>



