

A high-speed photograph of a water droplet hitting a blue surface, creating a series of concentric ripples. The droplet is captured mid-splash, with a crown-like shape forming at the point of impact. The background is a solid, deep blue.

The Juno Investigation of Water in Jupiter

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Water: In the Universe

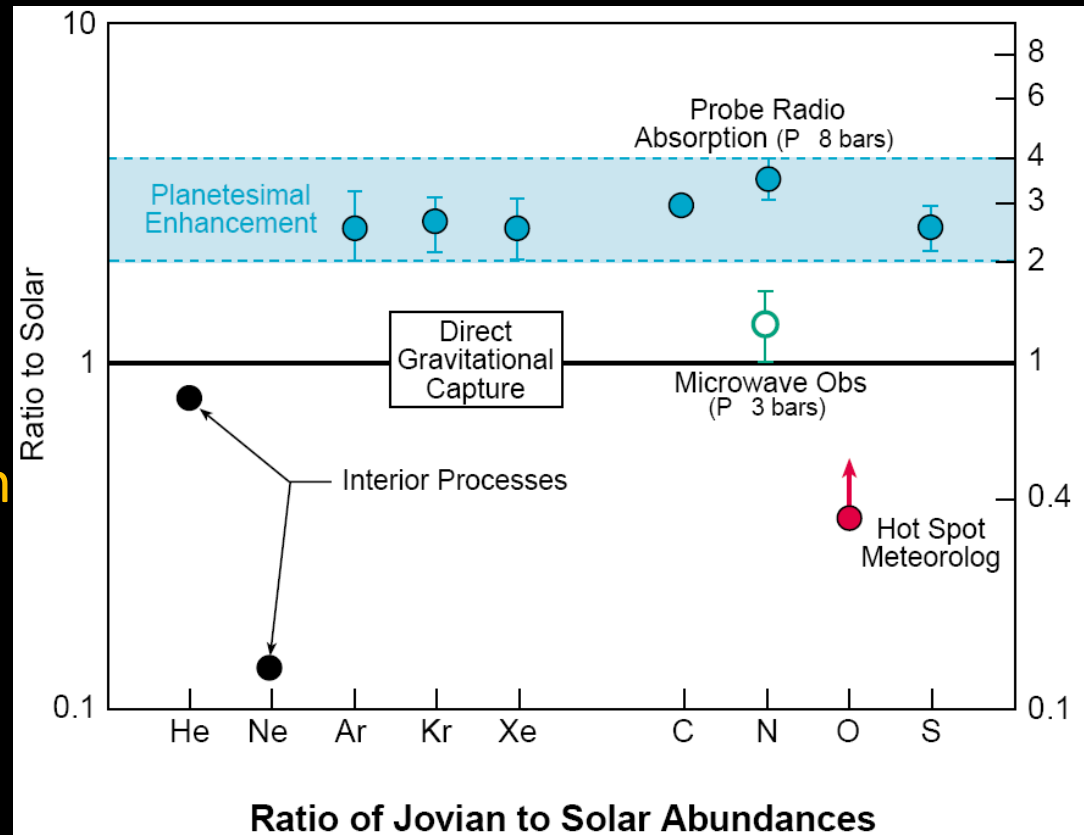
- Fundamental Importance
 - beyond the search for life
 - Oxygen is the 3rd most abundant element
 - Likely the most common multi-element molecule
- Where did the water on Earth originate?
 - Comets sampled thus far don't match
- What was the history of water and volatiles in our early solar system?
- How, when, and where did the planets form?

Galileo Probe Results (1995)

Galileo results show similar enrichment in key elements, independent of volatility

Results imply Jupiter formed colder and/or further out than 5 AU

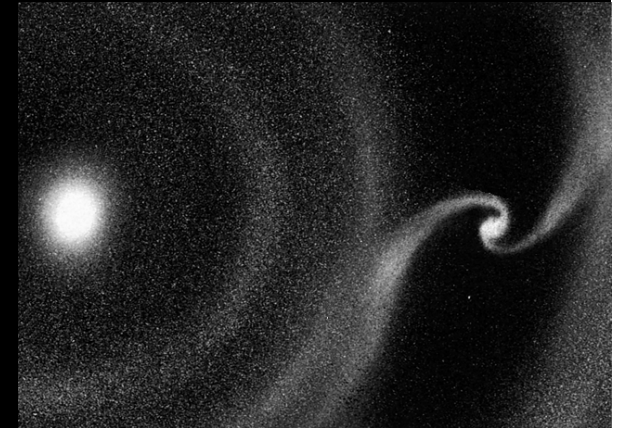
Solid material that enriched Jupiter was most abundant solid material in early solar system



Juno Science Objectives

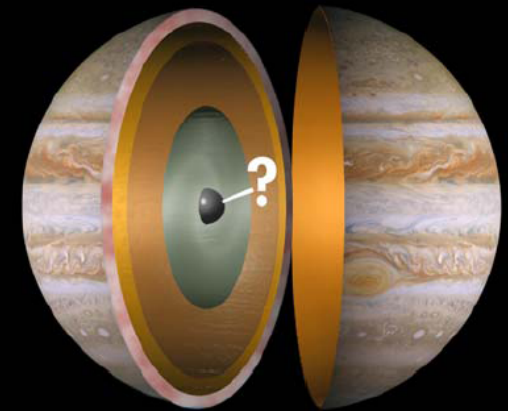
Origin

Determine O/H ratio (water abundance) and constrain core mass to decide among alternative theories of origin.



Interior

Understand Jupiter's interior structure and dynamical properties by mapping its gravitational and magnetic fields

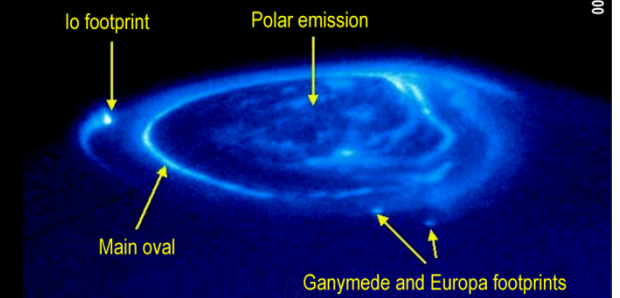


Atmosphere

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 Payload

X and Ka Band Gravity Science (JPL/ASI)

Magnetometer— MAG – ASC (GSFC/DTU)

Microwave Radiometers— MWR (JPL)

Jovian Energetic Detectors—JEDI (APL)

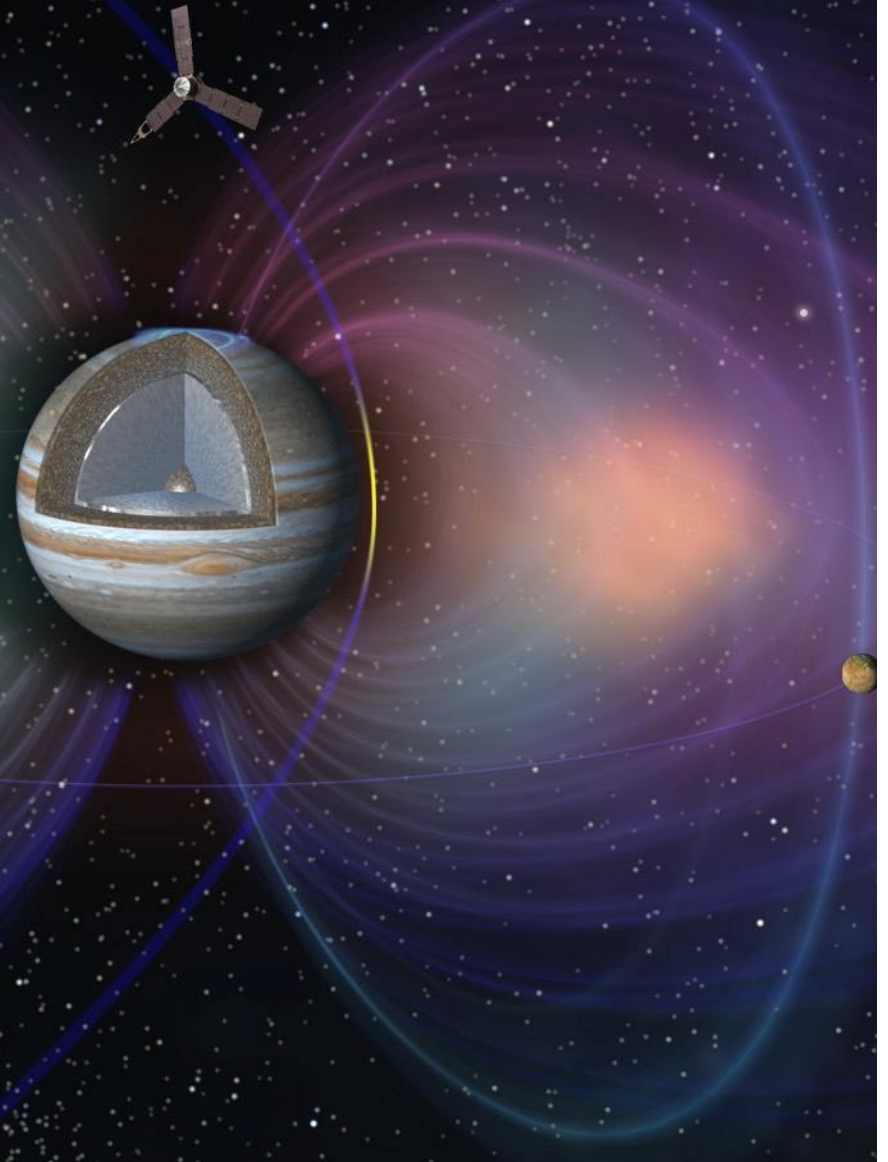
Jovian Auroral Distributions — JADE (SwRI)

Waves (U of Iowa)

UV Spectrograph— UVS (SwRI)

Visible Camera - JunoCam (Malin)

IR Camera/Spectrometer –JIRAM (ASI)



Juno Mission Design

Baseline mission:

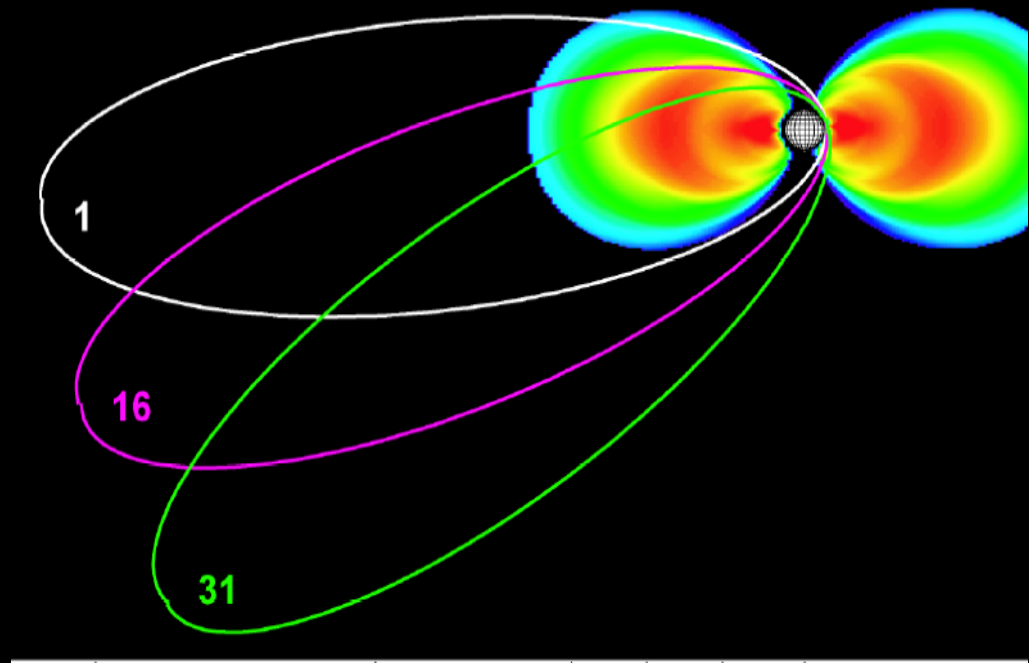
32 polar orbits

Perijove ~5000 km

14 day period

Spinner

Solar-powered

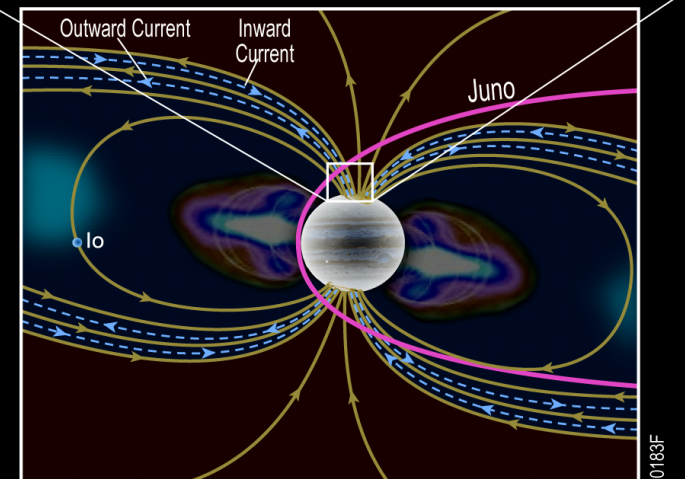
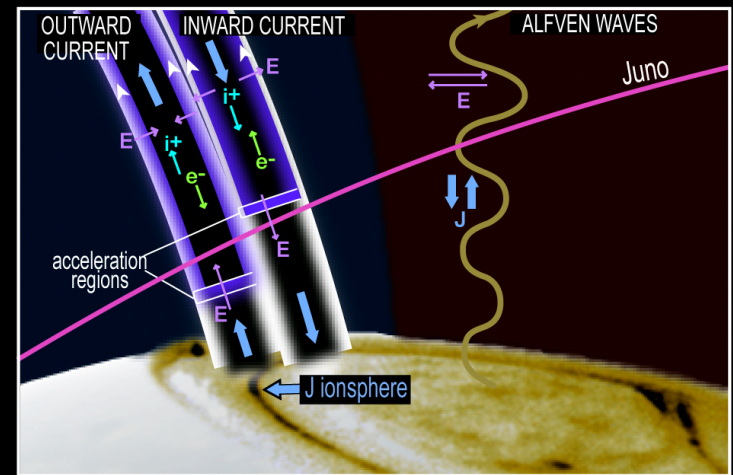
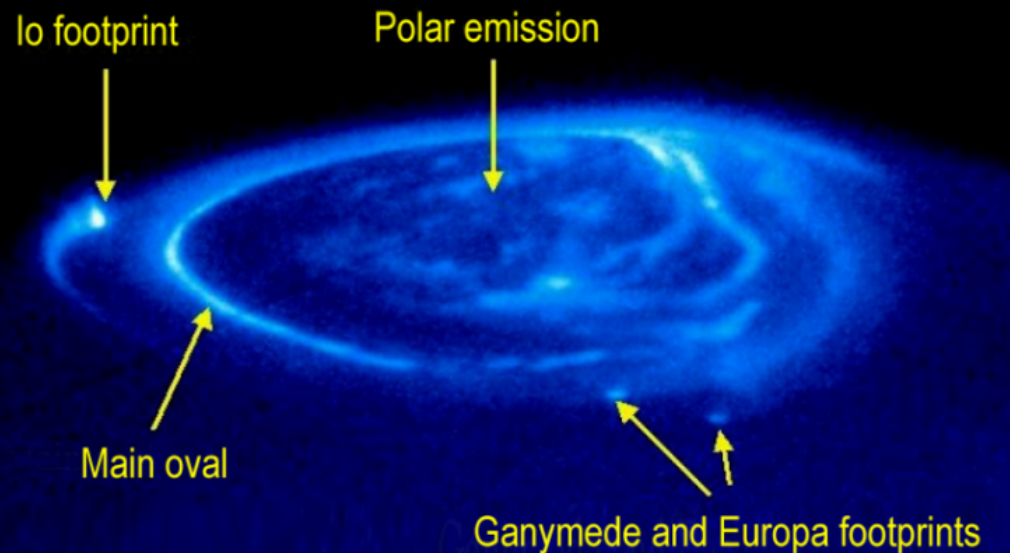


Polar Magnetosphere Exploration

Location is Key: Juno passes directly through auroral field lines.

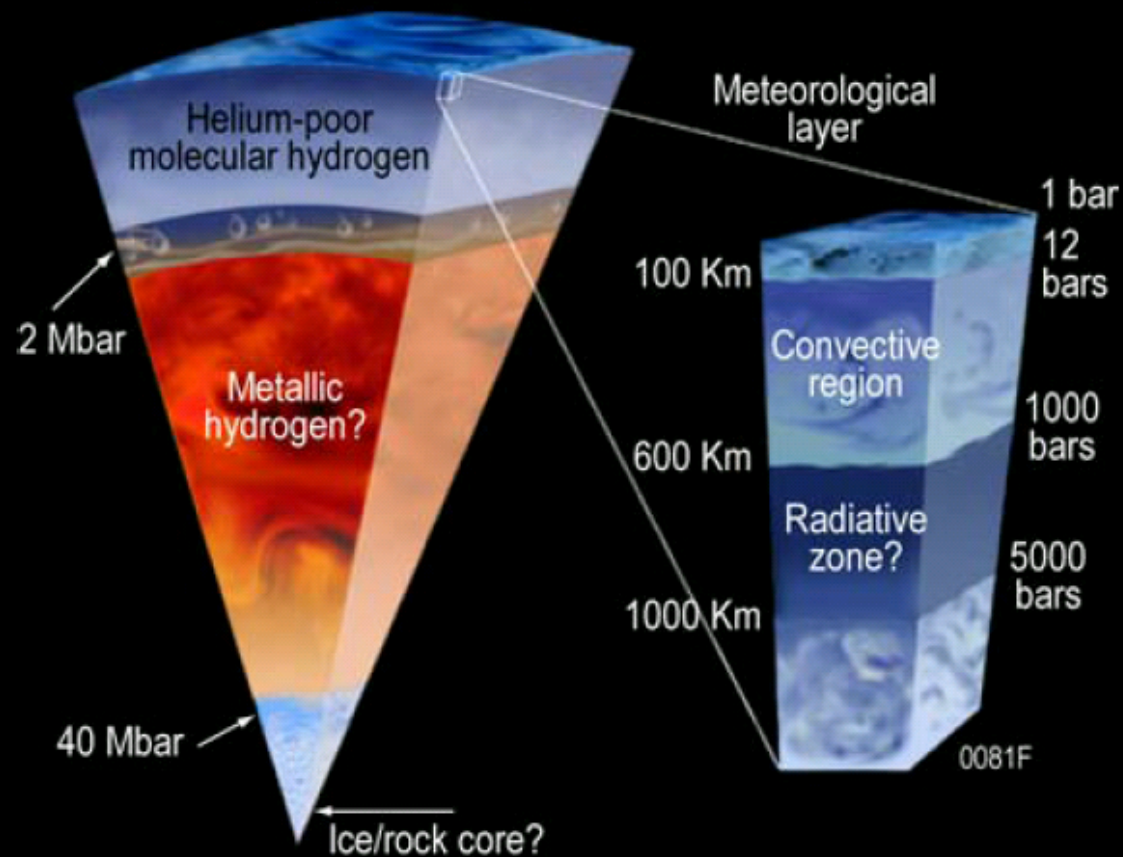
A suite of instruments are used to understand the physics:

JADE, JEDI, MAG, Waves, JIRAM, UVS



Probing the deep interior from orbit

Juno maps Jupiter from the deepest interior to the atmosphere using microwaves, magnetic and gravity fields.

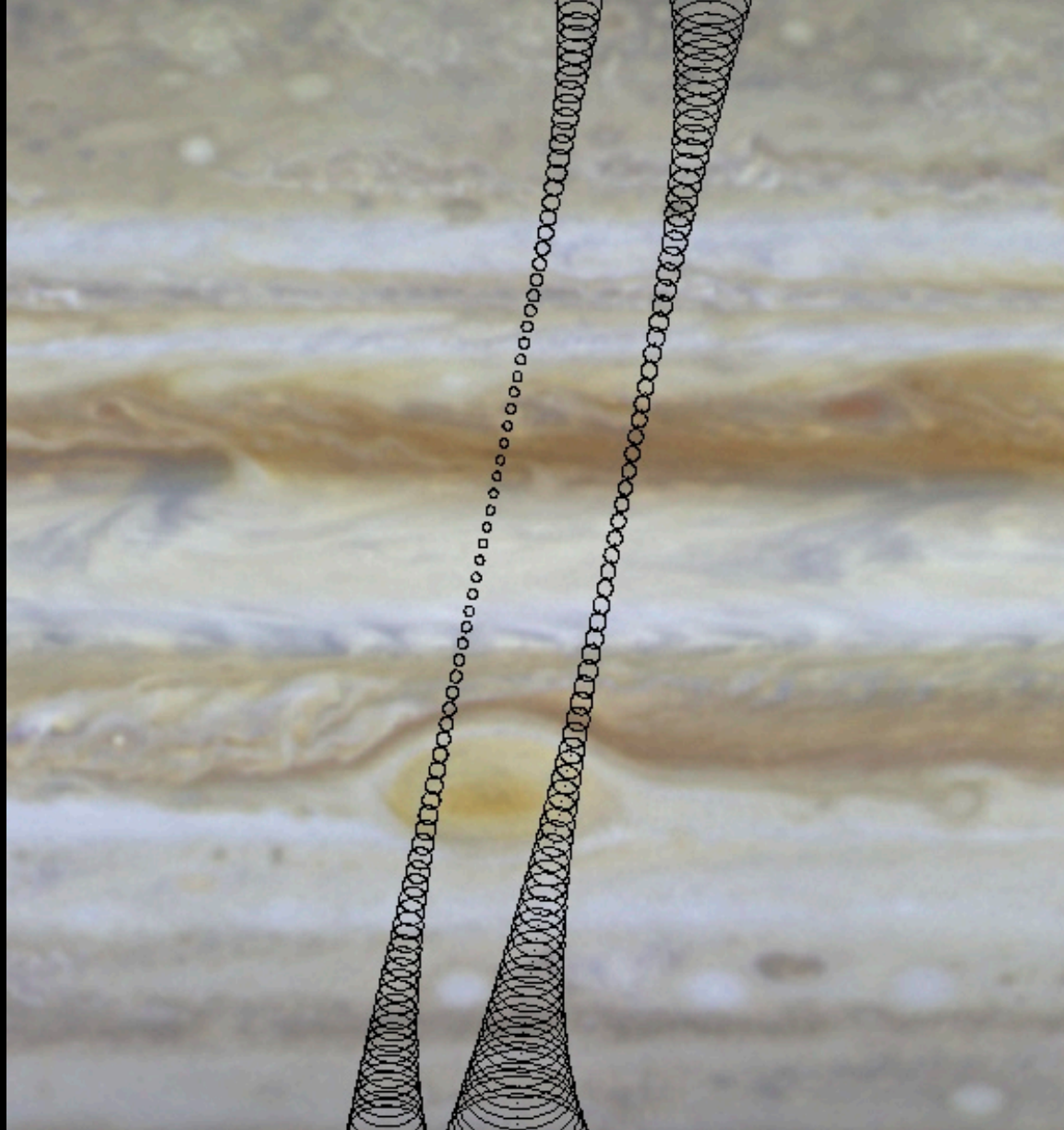


Microwave Instrument(s)

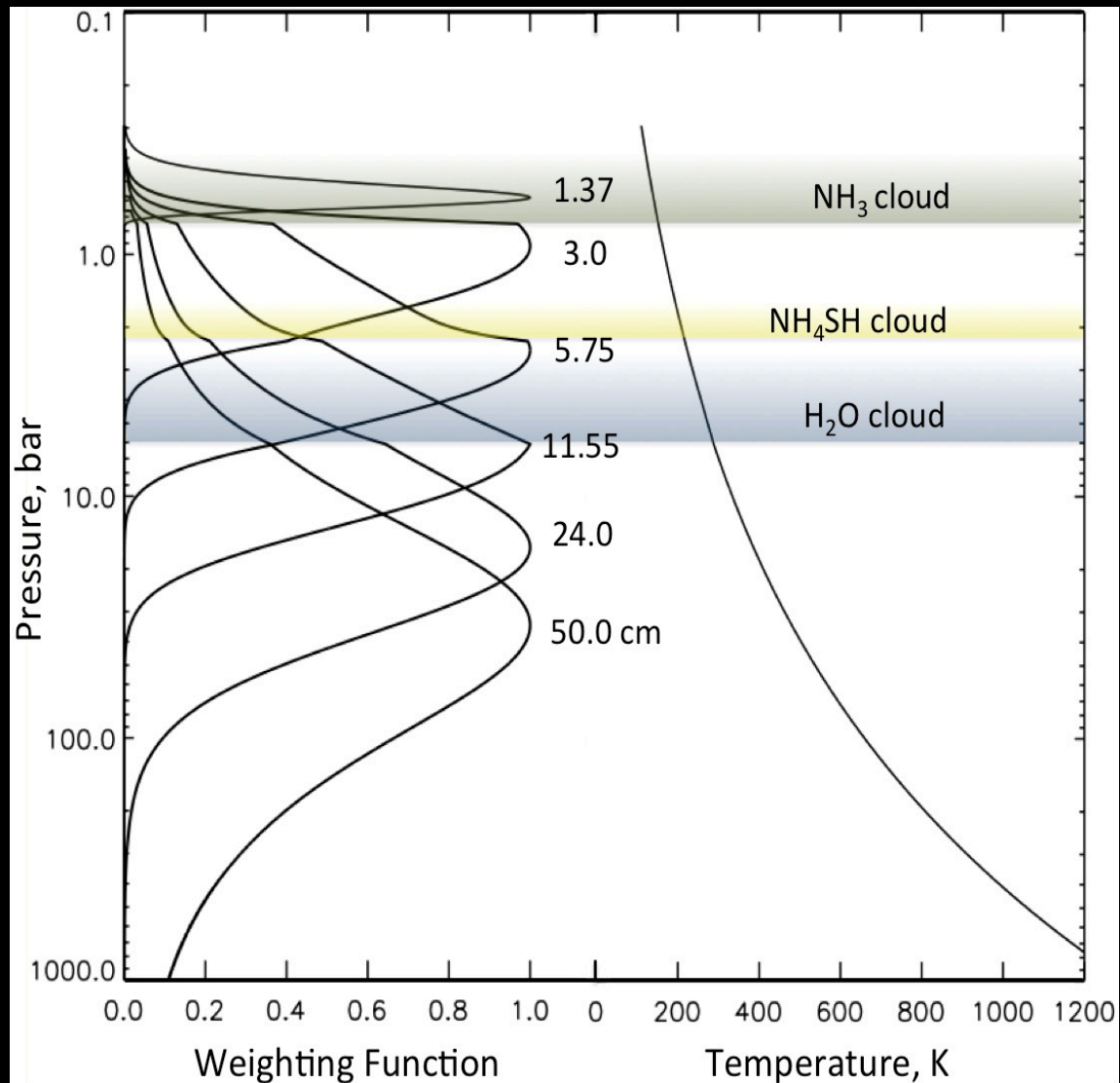
Antenna	Nominal Center Frequency [GHz]	Band- width ¹ [%]	Beam- width ² [deg]	Design	Dimensions LxWxD [cm]	Mass [Kg]
A1	0.6	5.0	20.6	5 x 5 Patch array	160x160x13.1	13.83
A2	1.25	5.0	21.0	5 x 5 Patch array	76.8x76.8x9.8	4.89
A3	2.6	4.6	12.1	8 x 8 Slot array	77.1x67.3x8.9	7.25
A4	5.2	6.0	12.1	8 x 8 Slot array	38.6x34.0x5.7	1.46
A5	10.0	4.6	12.0	8 x 8 Slot array	20.1x17.9x4.4	0.51
A6	22.0	>5	10.8	Corrugated Horn	15.3x15.3x34	0.75

MWR Instrumentation





MWR Weighting Functions

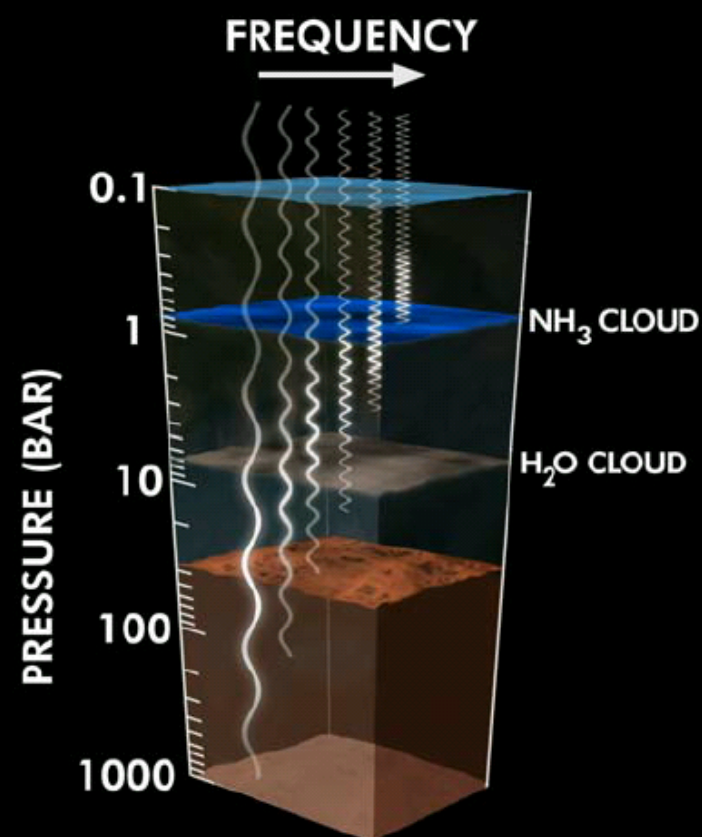
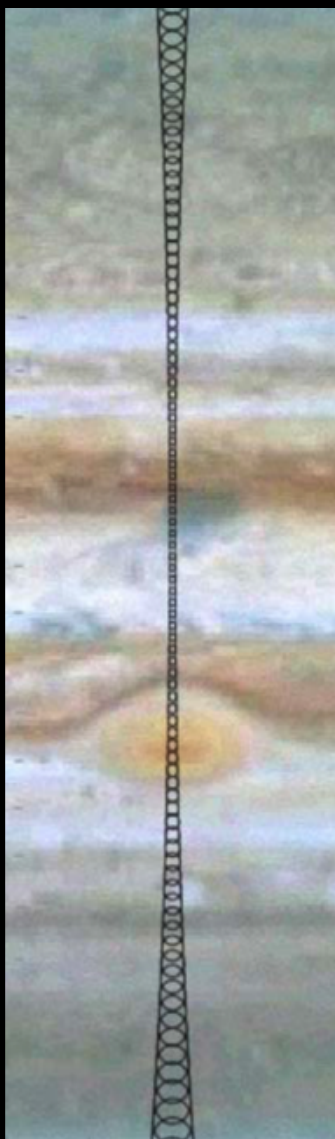


Sensing the deep atmosphere

Juno's Microwave Radiometer measures thermal radiation from the atmosphere

1000 atmospheres pressure (~500-600km below the visible cloud tops).

Determines water and ammonia abundances in the atmosphere all over the planet



Abundance of Water on Jupiter: Implications

Oxygen is the remaining key element abundance
“unknown” from Galileo Probe

Discriminates among theories on how Jupiter heavy
element enrichment occurred.

Constrains mass of Jupiter’s molecular envelope

Implications for giant planet formation : how, when
and where?



For more information...



<http://missionjuno.swri.edu>



<http://www.nasa.gov/juno>

Earth and Moon

http://www.youtube.com/watch?v=_CzBlSXgzqI

