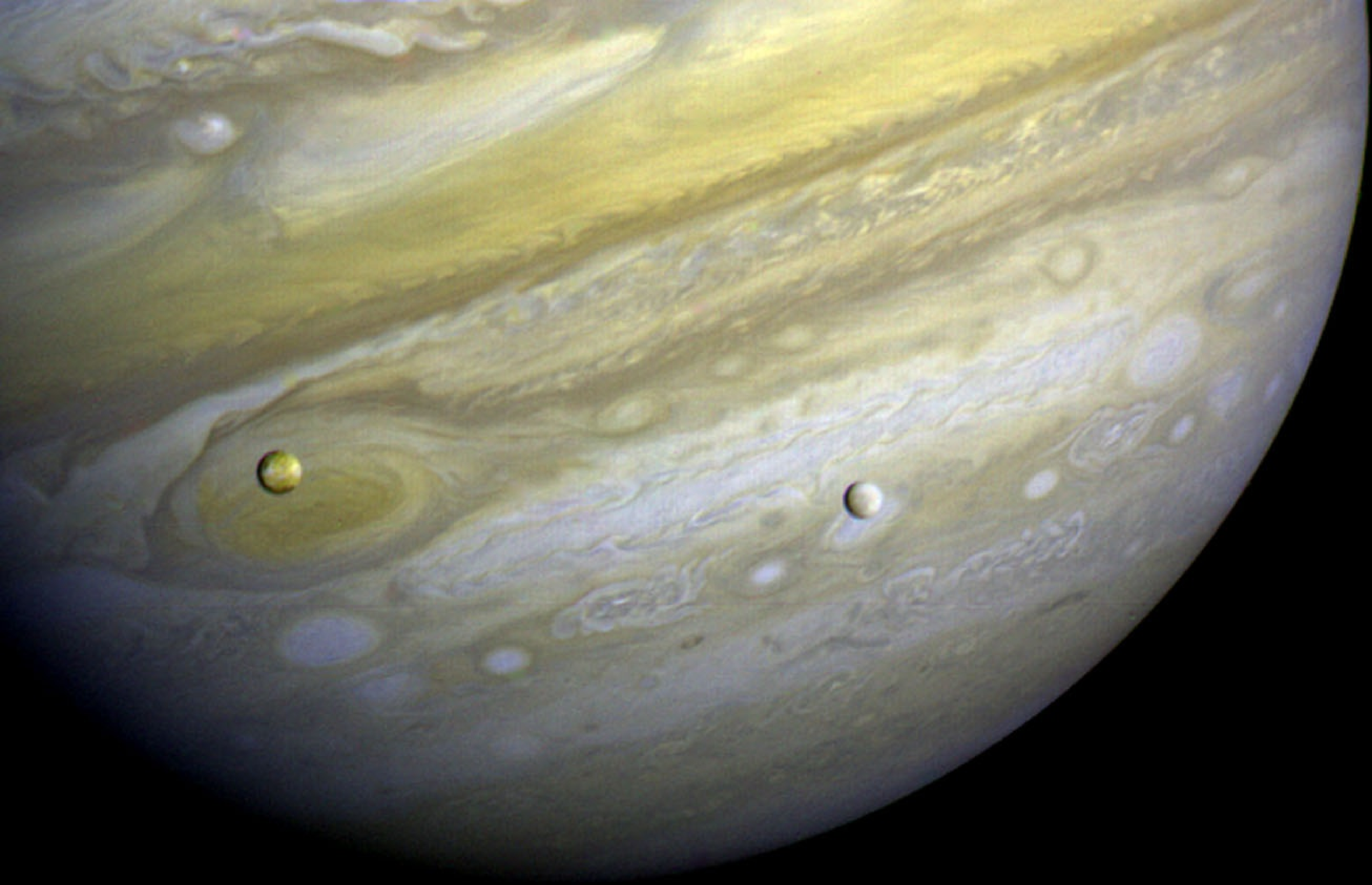
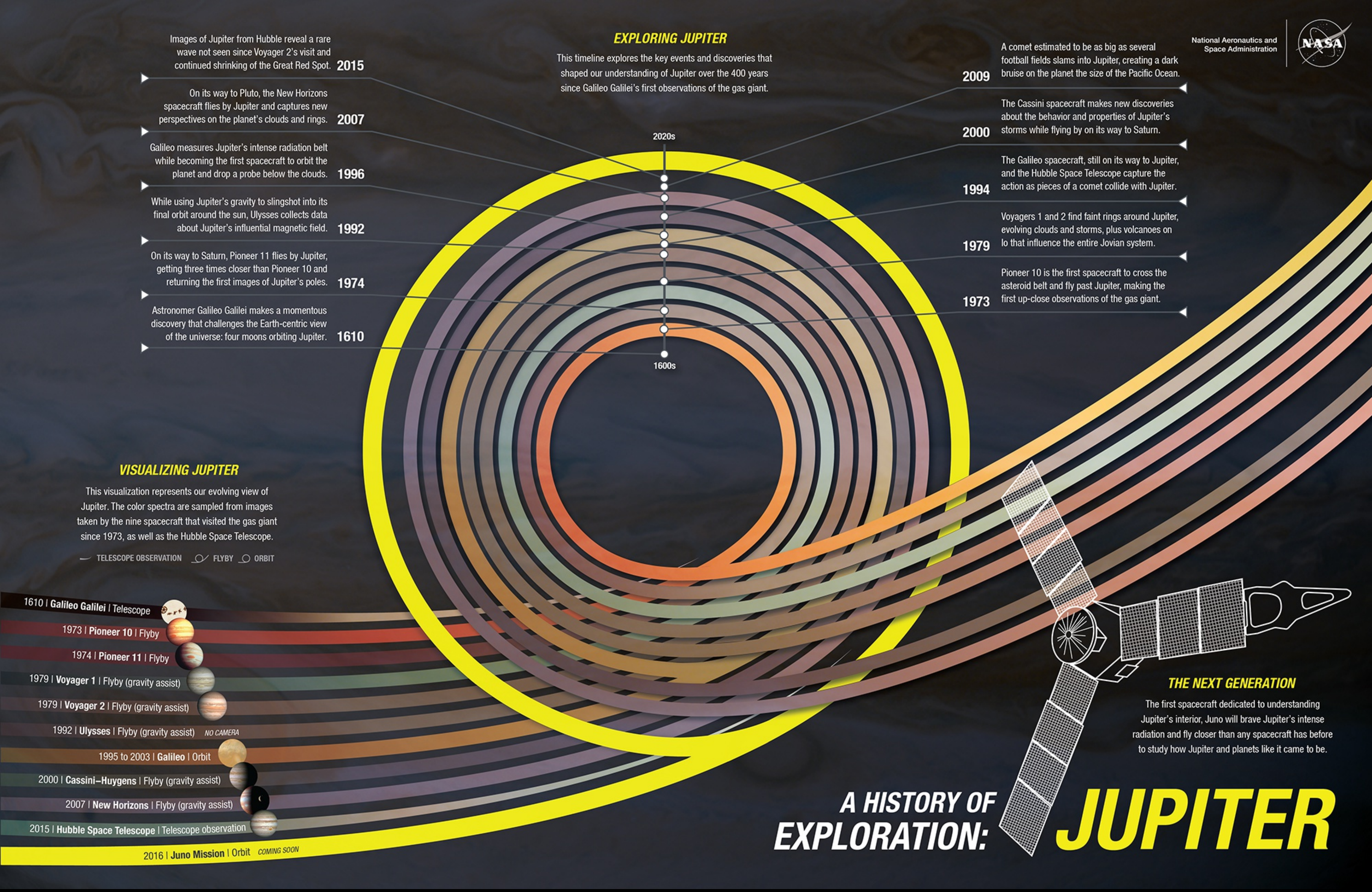
Juno
Mission to Jupiter

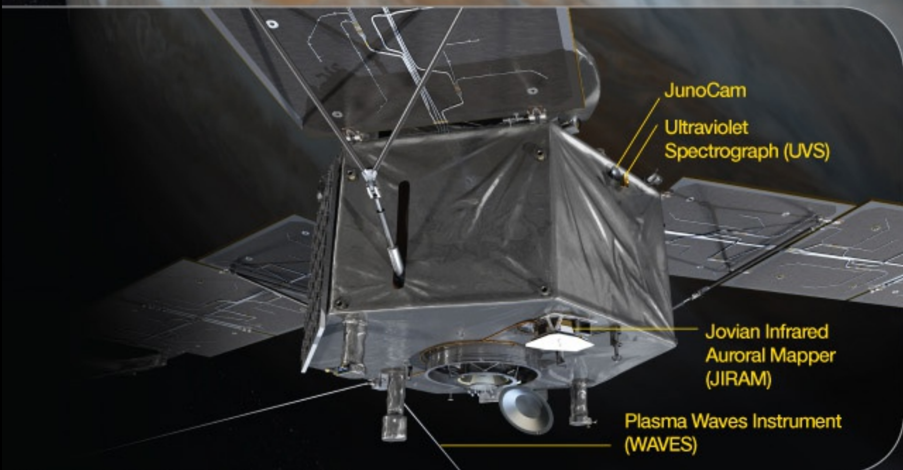


NASA Voyager 1


EXPLORING JUPITER
This timeline explores the key events and discoveries that shaped our understanding of Jupiter over the 400 years since Galileo Galilei's first observations of the gas giant.
National Aeronautics and Space Administration
NASA
2015 Images of Jupiter from Hubble reveal a rare wave not seen since Voyager 2's visit and continued shrinking of the Great Red Spot.
2007 On its way to Pluto, the New Horizons spacecraft flies by Jupiter and captures new perspectives on the planet's clouds and rings.
1996 Galileo measures Jupiter's intense radiation belt while becoming the first spacecraft to orbit the planet and drop a probe below the clouds.
1992 While using Jupiter's gravity to slingshot into its final orbit around the sun, Ulysses collects data about Jupiter's influential magnetic field.
1974 On its way to Saturn, Pioneer 11 flies by Jupiter, getting three times closer than Pioneer 10 and returning the first images of Jupiter's poles.
1610 Astronomer Galileo Galilei makes a momentous discovery that challenges the Earth-centric view of the universe: four moons orbiting Jupiter.
2009 A comet estimated to be as big as several football fields slams into Jupiter, creating a dark bruise on the planet the size of the Pacific Ocean.
2000 The Cassini spacecraft makes new discoveries about the behavior and properties of Jupiter's storms while flying by on its way to Saturn.
1994 The Galileo spacecraft, still on its way to Jupiter, and the Hubble Space Telescope capture the action as pieces of a comet collide with Jupiter.
1979 Voyagers 1 and 2 find faint rings around Jupiter, evolving clouds and storms, plus volcanoes on Io that influence the entire Jovian system.
1973 Pioneer 10 is the first spacecraft to cross the asteroid belt and fly past Jupiter, making the first up-close observations of the gas giant.
2020s
1600s
VISUALIZING JUPITER
This visualization represents our evolving view of Jupiter. The color spectra are sampled from images taken by the nine spacecraft that visited the gas giant since 1973, as well as the Hubble Space Telescope.
TELESCOPE OBSERVATION FLYBY ORBIT
1610 | Galileo Galilei | Telescope
1973 | Pioneer 10 | Flyby
1974 | Pioneer 11 | Flyby
1979 | Voyager 1 | Flyby (gravity assist)
1979 | Voyager 2 | Flyby (gravity assist)
1992 | Ulysses | Flyby (gravity assist) NO CAMERA
1995 to 2003 | Galileo | Orbit
2000 | Cassini–Huygens | Flyby (gravity assist)
2007 | New Horizons | Flyby (gravity assist)
2015 | Hubble Space Telescope | Telescope observation
2016 | Juno Mission | Orbit COMING SOON
THE NEXT GENERATION
The first spacecraft dedicated to understanding Jupiter's interior, Juno will brave Jupiter's intense radiation and fly closer than any spacecraft has before to study how Jupiter and planets like it came to be.
A HISTORY OF EXPLORATION: JUPITER

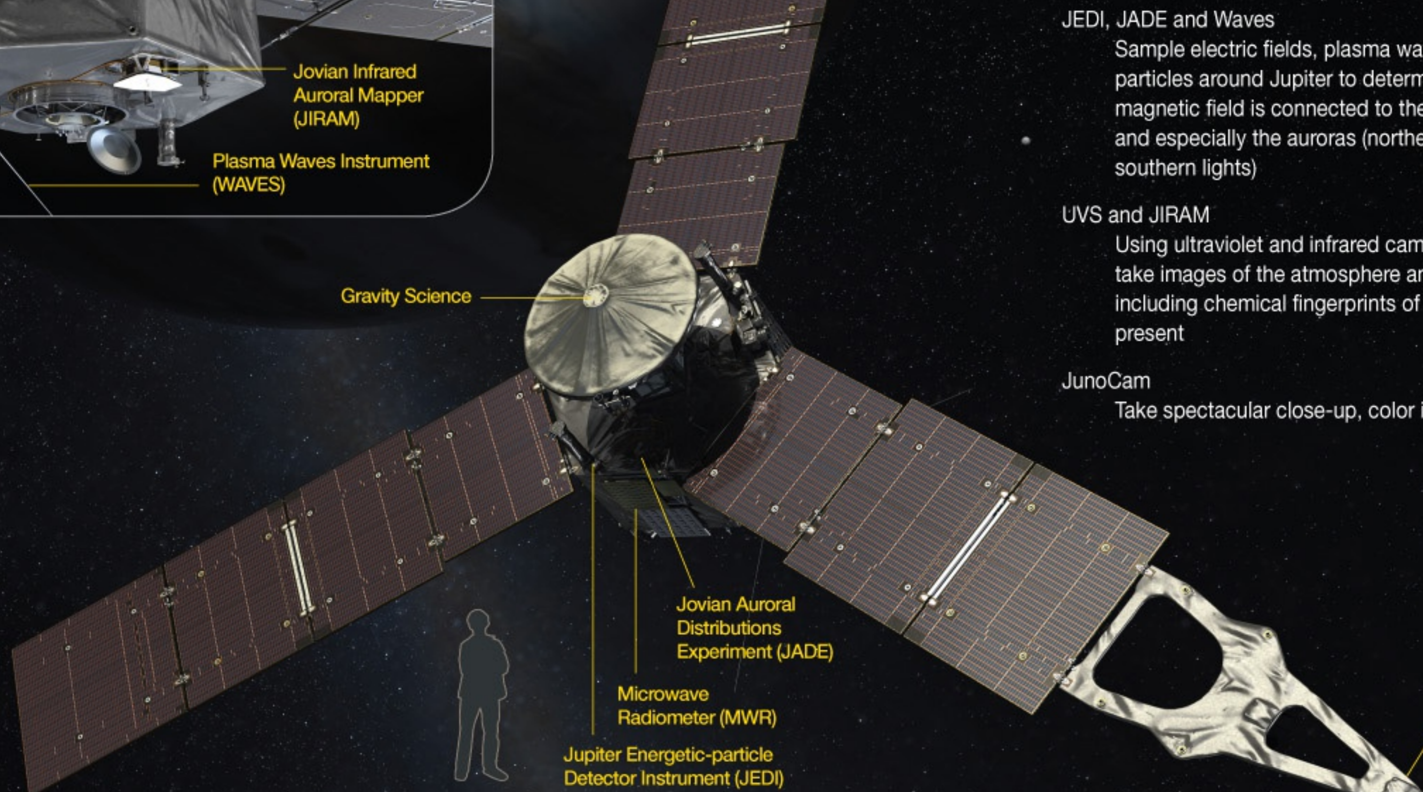
Juno Spacecraft

National Aeronautics and
Space Administration



SPACECRAFT DIMENSIONS

Diameter: 66 feet (20 meters)
Height: 15 feet (4.5 meters)



Juno's Instruments

Gravity Science and Magnetometers
: Study Jupiter's deep structure by mapping the planet's gravity field and magnetic field

Microwave Radiometer
: Probe Jupiter's deep atmosphere and measure how much water (and hence oxygen) is there

JEDI, JADE and Waves
: Sample electric fields, plasma waves and particles around Jupiter to determine how the magnetic field is connected to the atmosphere, and especially the auroras (northern and southern lights)

UVS and JIRAM
: Using ultraviolet and infrared cameras, take images of the atmosphere and auroras, including chemical fingerprints of the gases present

JunoCam
: Take spectacular close-up, color images

For more information:
missionjuno.swri.edu & www.nasa.gov/juno

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

Juno Science Objectives

magnetosphere that connect the giant, fast-rotating planet's exterior with its deep interior. (Background image from Cassini; top inset: Jupiter auroras from the Hubble Space Telescope; bottom inset: Cassini at Saturn) Credit NASA/JPL-Caltech

The primary science objectives of the mission are as follows:

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

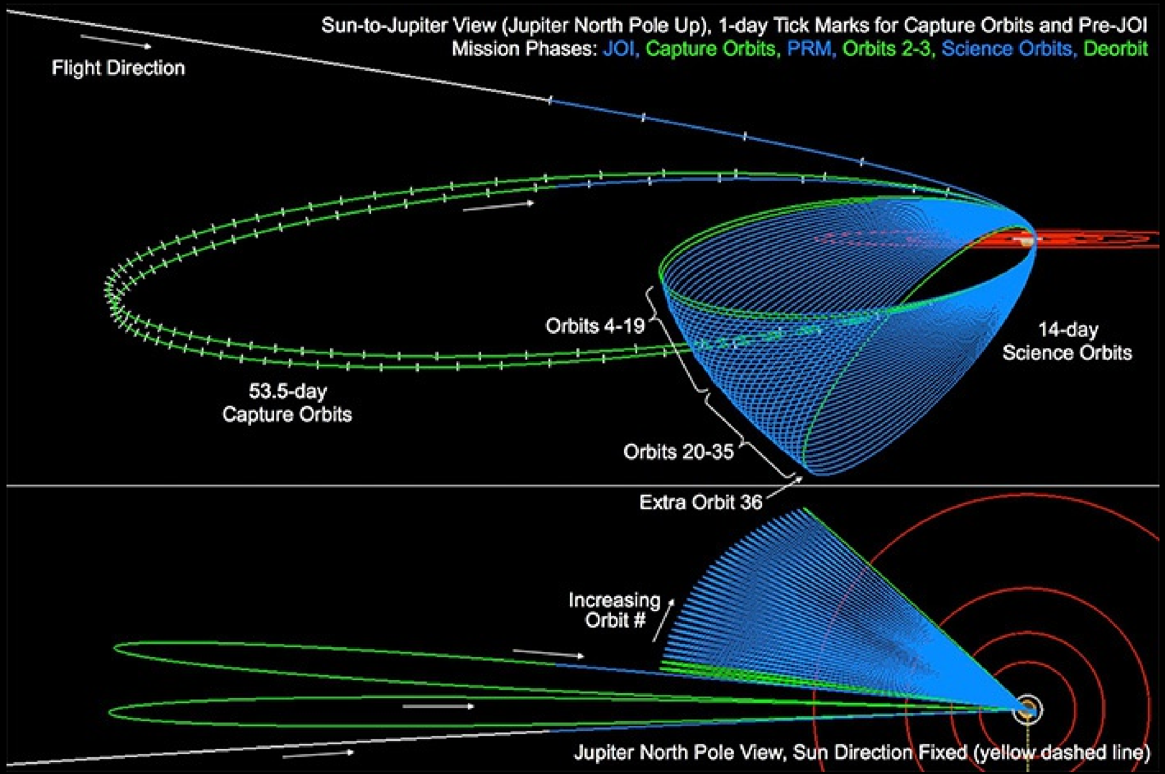
Interior
Understand Jupiter's interior structure and how material moves deep within the planet by mapping its gravitational and magnetic fields

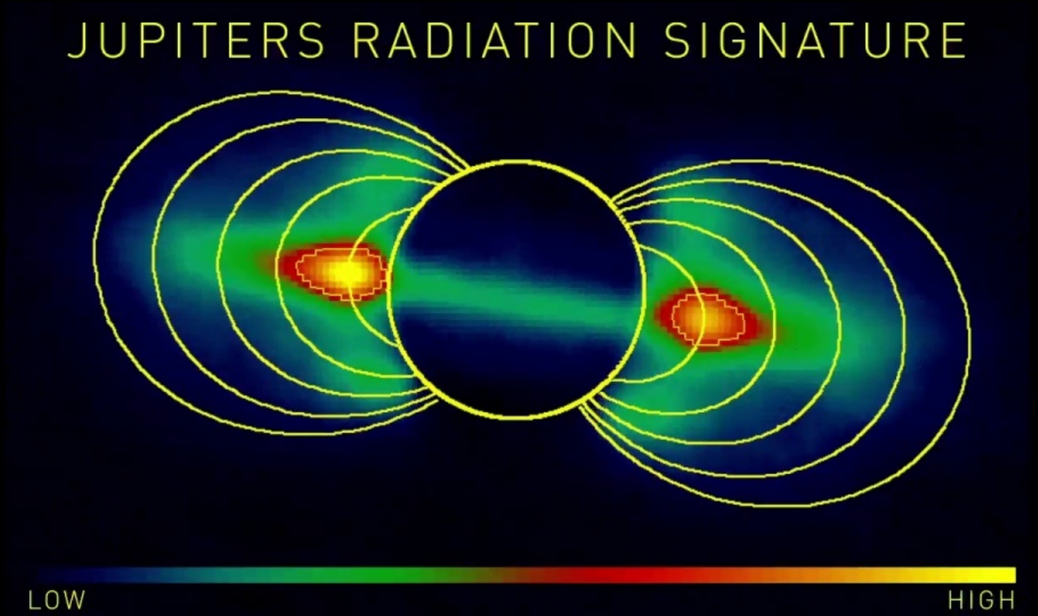
Atmosphere
Map variations in atmospheric composition, temperature, cloud opacity and dynamics to depths greater than 100 bars at all latitudes.

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

The overall goal of the Juno mission is to improve our understanding of the solar system by understanding the origin and evolution of Jupiter. It addresses science objectives central to three NASA Science divisions: Solar System (Planetary), Earth–Sun System (Heliophysics), and Universe (Astrophysics).

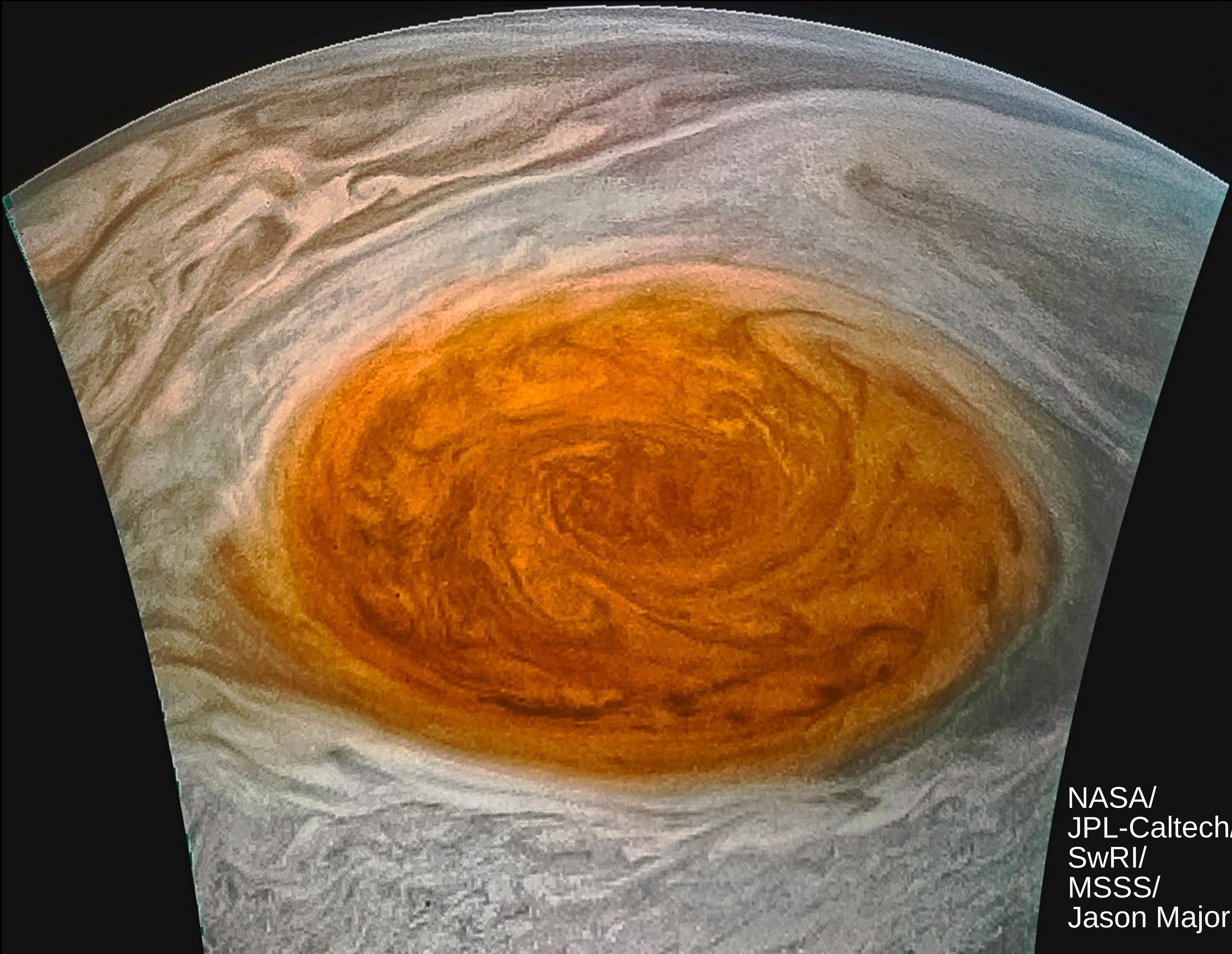
Juno's primary science goal of understanding the formation, evolution, and structure of Jupiter is directly related to the conditions in the early solar system, which led to the formation of our planetary system. The mass of Jupiter's possible solid core and the abundance of heavy elements in the atmosphere discriminate among models for giant planet formation. Juno constrains the core mass by mapping the gravitational field, and measures through microwave sounding the global abundances of oxygen (water) and nitrogen (ammonia).


Sun-to-Jupiter View (Jupiter North Pole Up), 1-day Tick Marks for Capture Orbits and Pre-JOI
Mission Phases: JOI, Capture Orbits, PRM, Orbits 2-3, Science Orbits, Deorbit
Flight Direction
Orbits 4-19
14-day
Science Orbits
53.5-day
Capture Orbits
Orbits 20-35
Extra Orbit 36
Increasing
Orbit #
Jupiter North Pole View, Sun Direction Fixed (yellow dashed line)

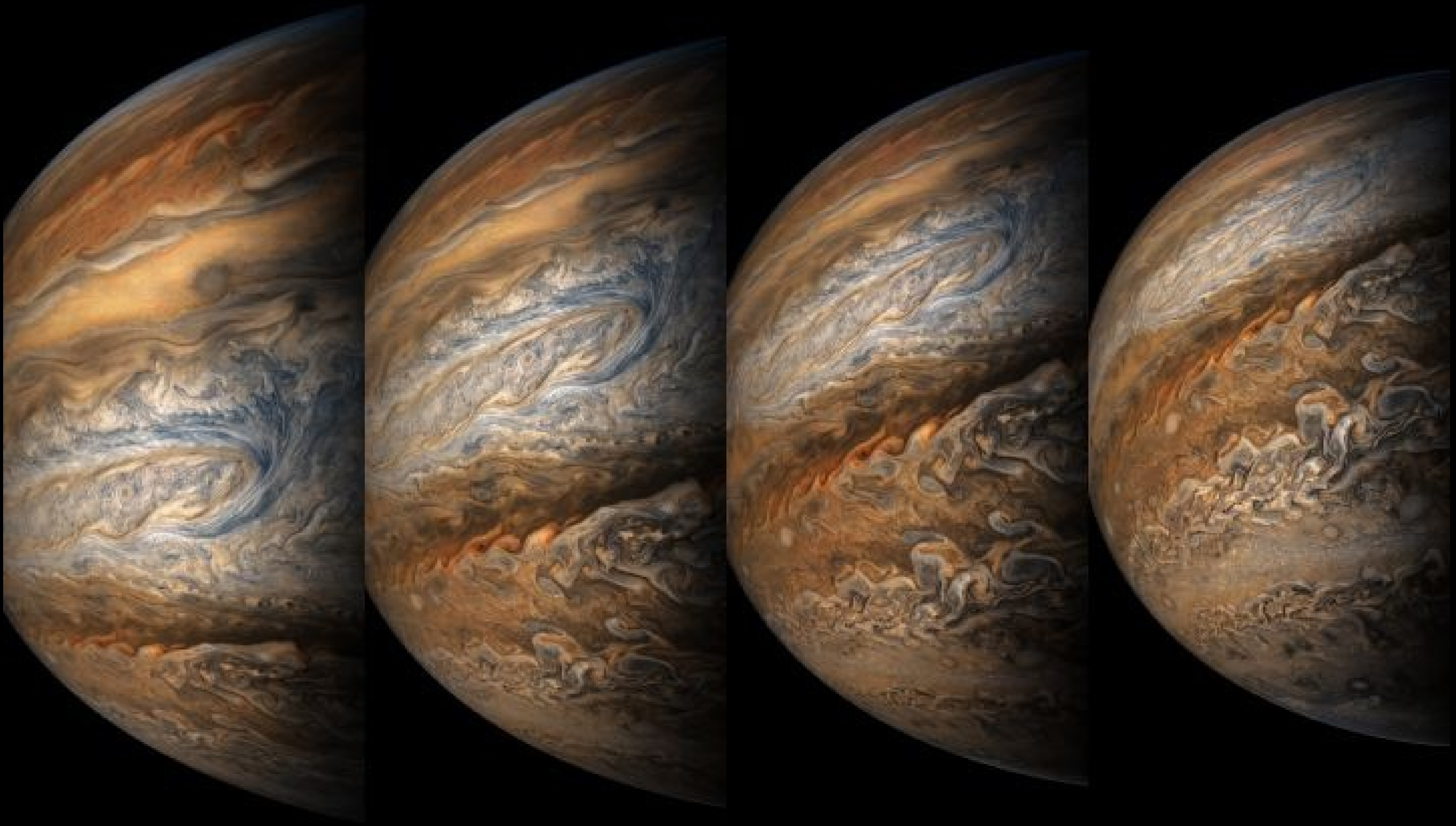

JUPITERS RADIATION SIGNATURE
LOW
HIGH

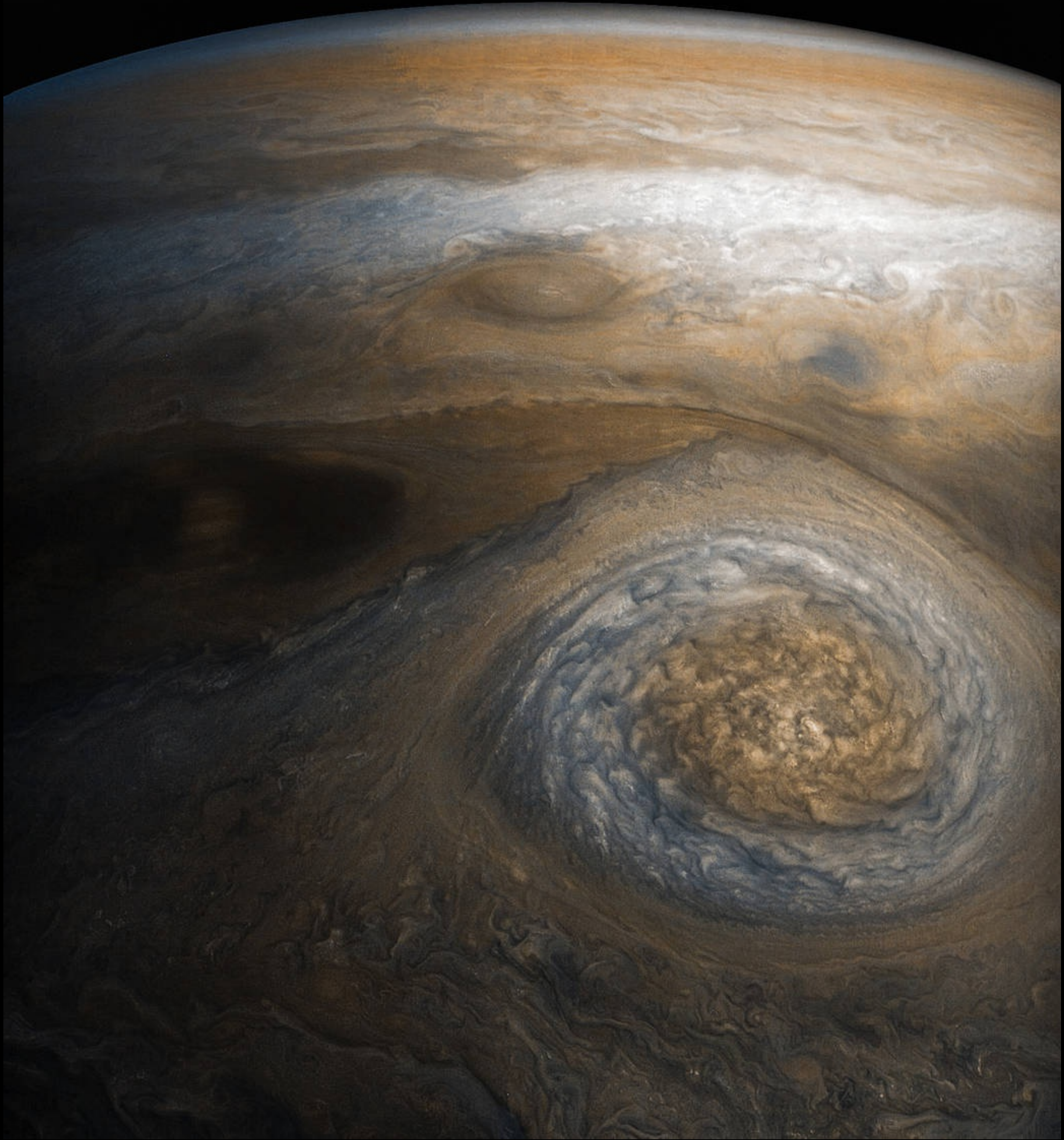
NASA/JPL-Caltech/SwRI/MSSS/John Landino

NASA/JPL-Caltech/SwRI/MSSS /Roman Tkachenko

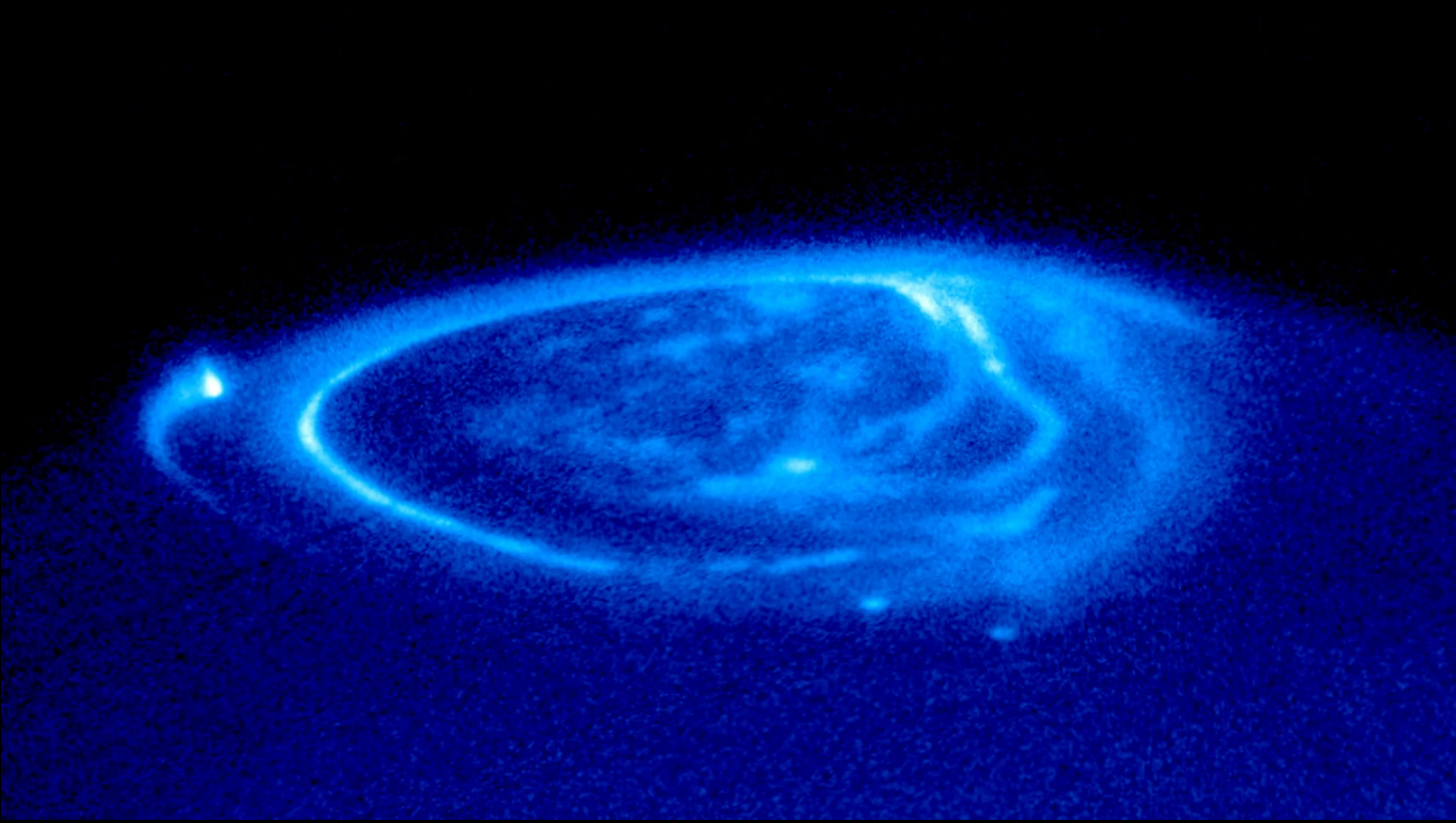


NASA/
JPL-Caltech/
SwRI/
MSSS/
Jason Major

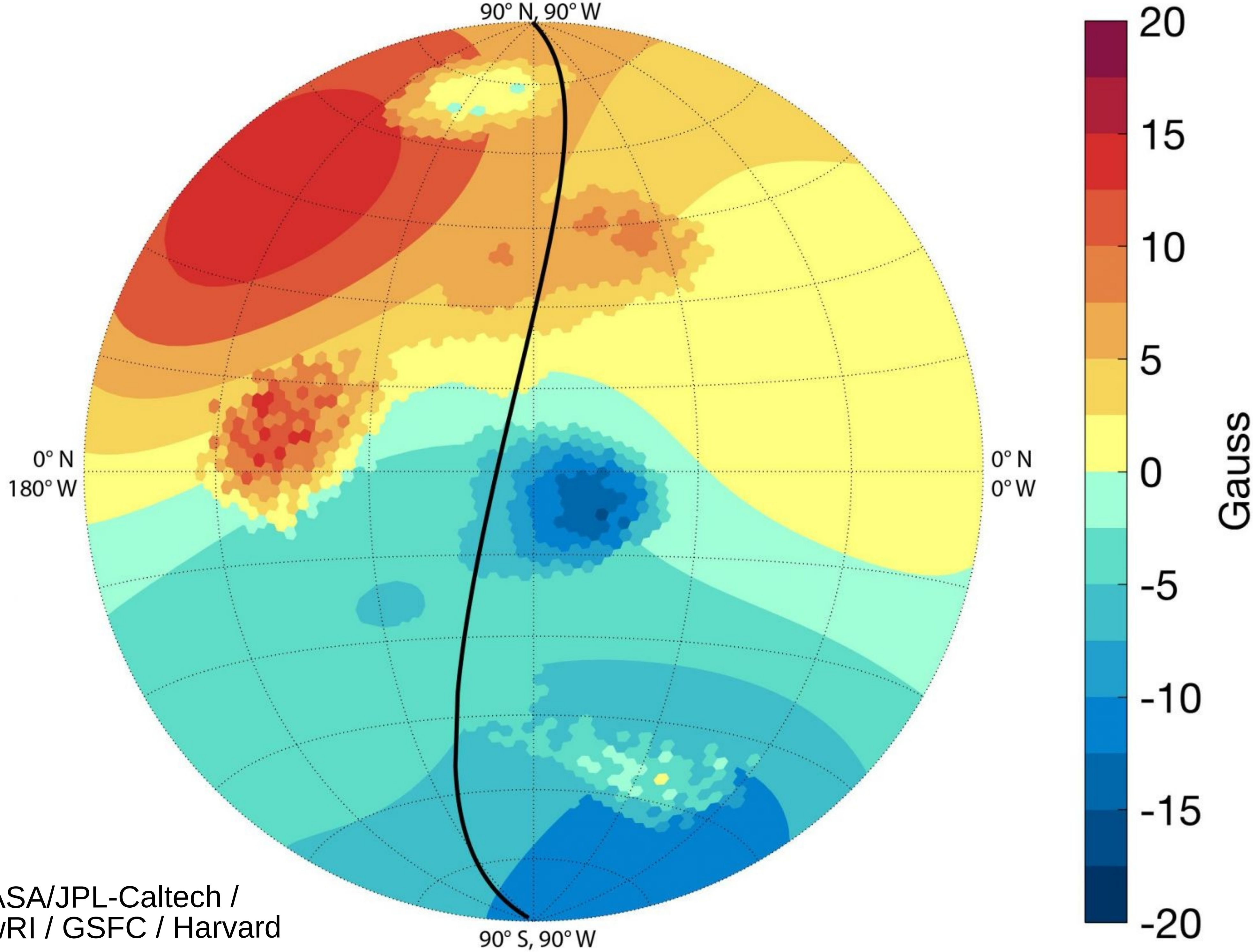

NASA/JPL-Caltech/SwRI/MSSS/ Gerald Eichstädt/Sean Doran



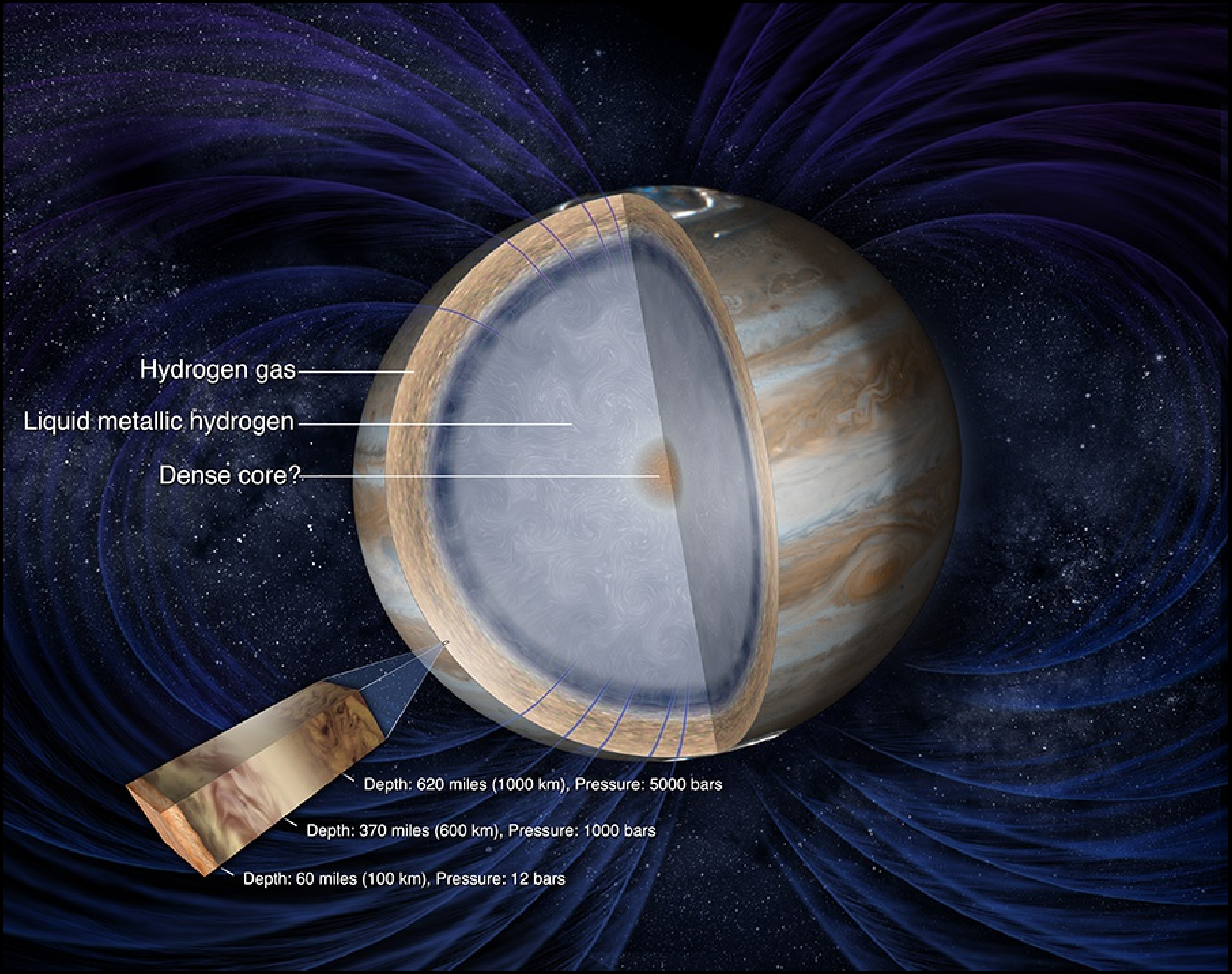
NASA/
JPL-Caltech/
SwRI/
MSSS/
Gerald Eichstädt/
Seán Doran



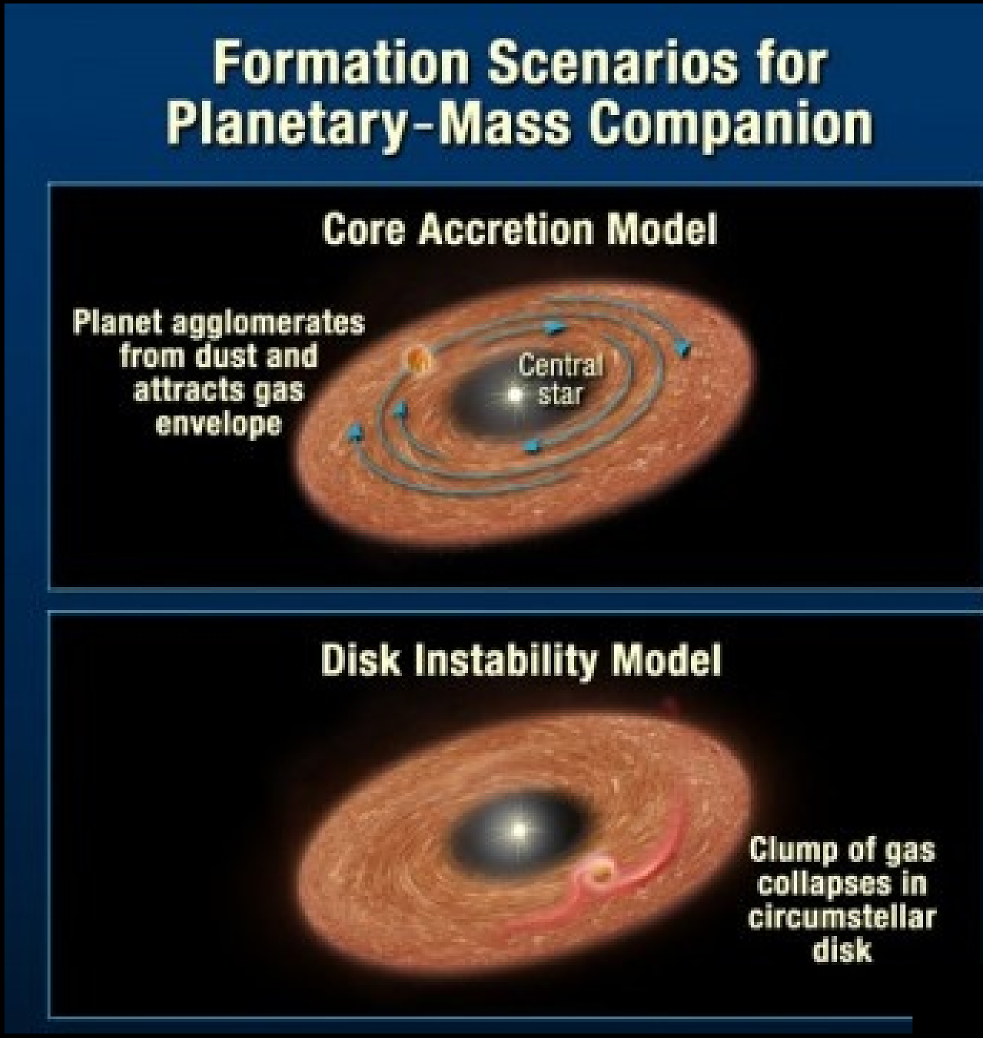
NASA/ESA, John Clarke (University of Michigan)
Hubble, Ultraviolet



NASA/JPL-Caltech /
SwRI / GSFC / Harvard

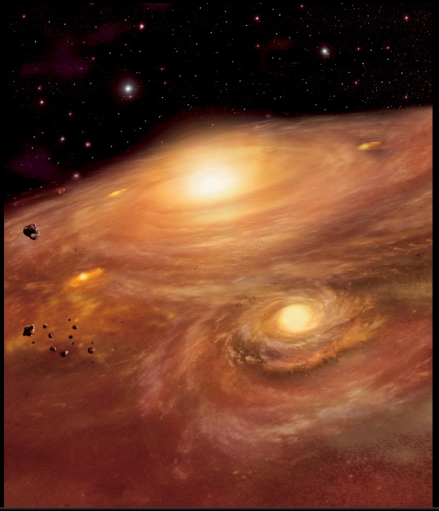

Hydrogen gas
Liquid metallic hydrogen
Dense core?
Depth: 620 miles (1000 km), Pressure: 5000 bars
Depth: 370 miles (600 km), Pressure: 1000 bars
Depth: 60 miles (100 km), Pressure: 12 bars

NASA/JPL

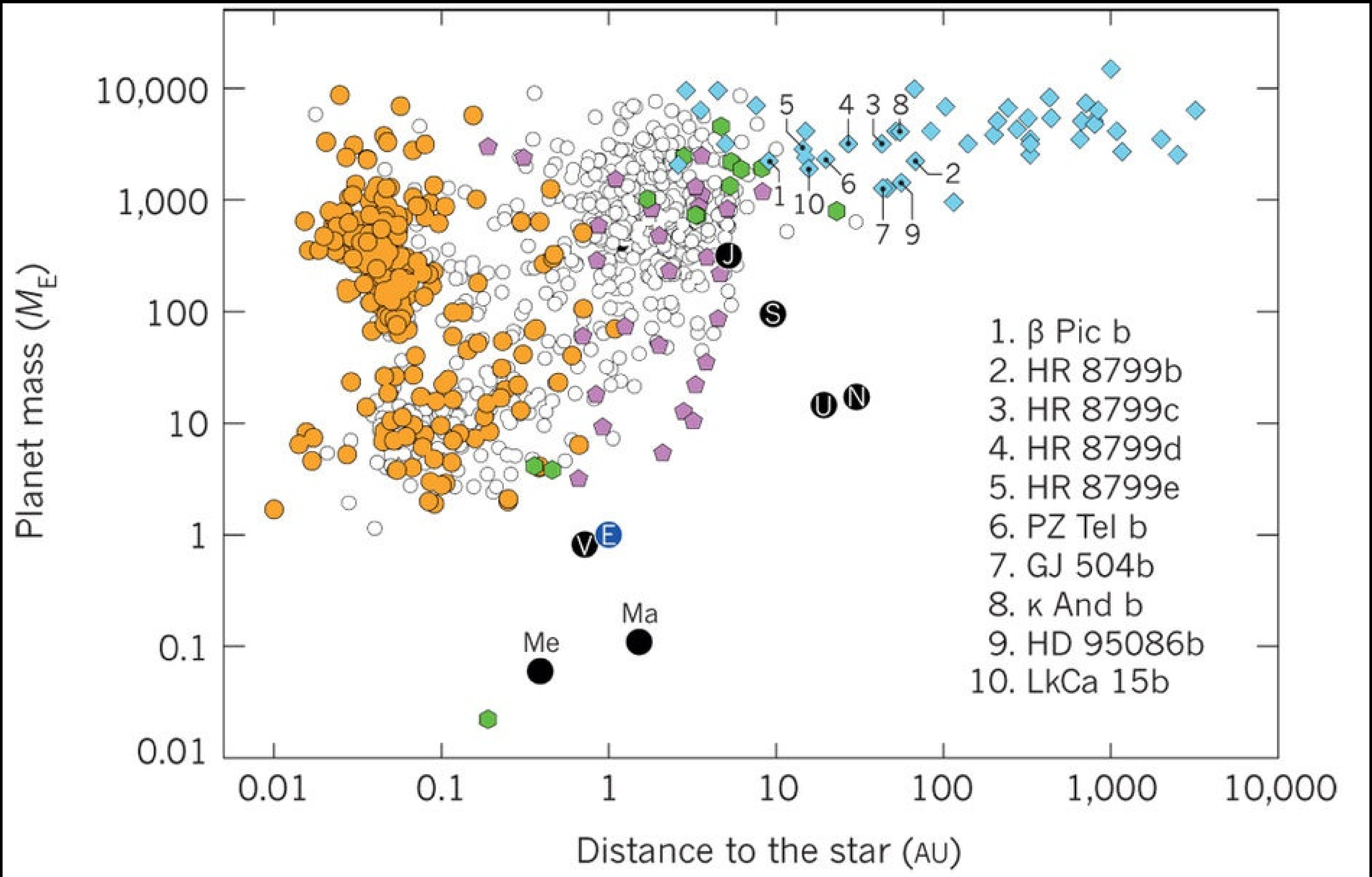


Sky & Telescope

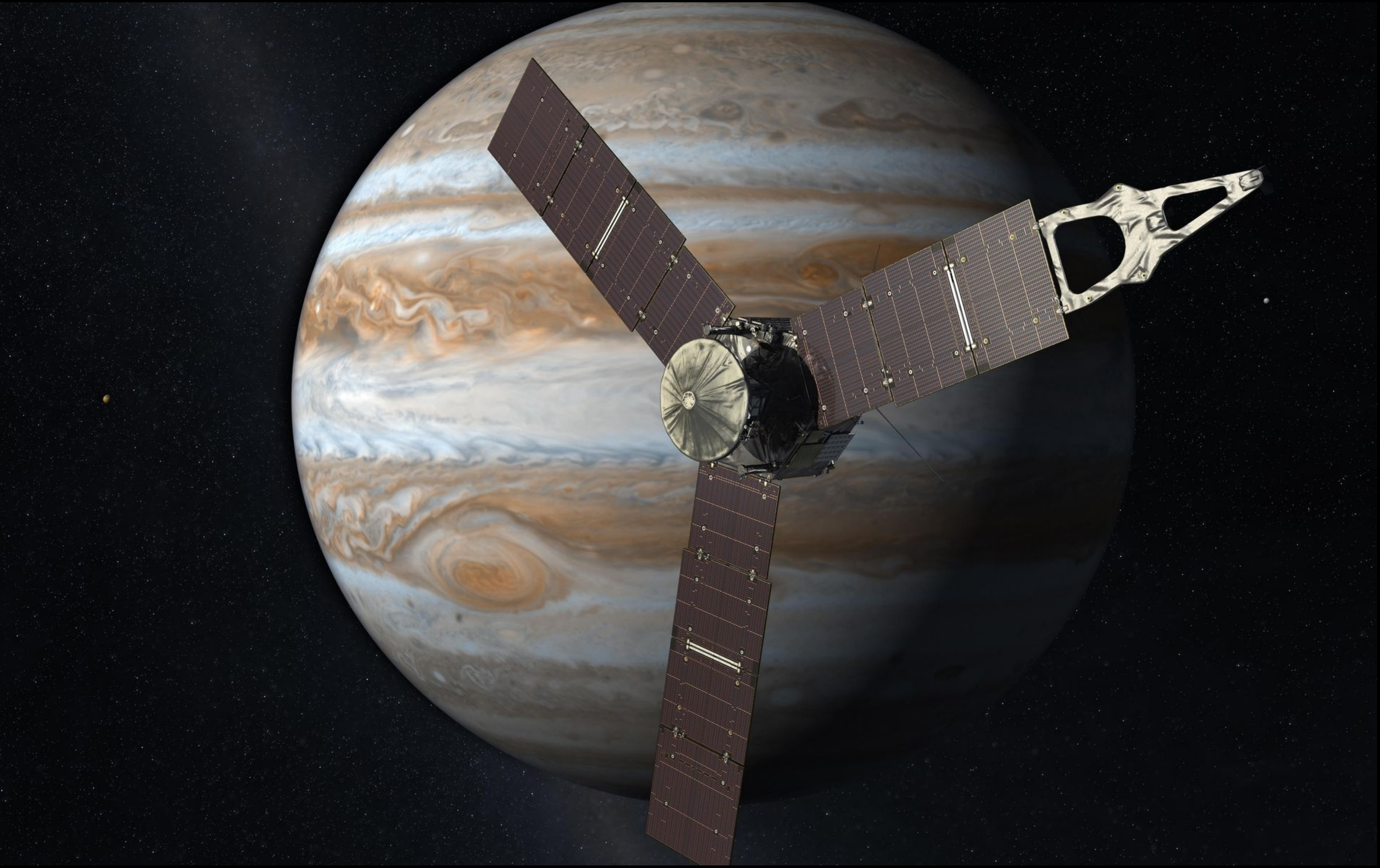
Universe Today



Artwork depicting one theory of how gas-giant planets form
Artwork courtesy Moonrunner Design



Pepe, Ehrenreich, & Meyer 2014



NASA/JPL