

National Aeronautics and Space Administration



Juno

Mission to Jupiter



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www.nasa.gov





Important questions

How did Jupiter form?

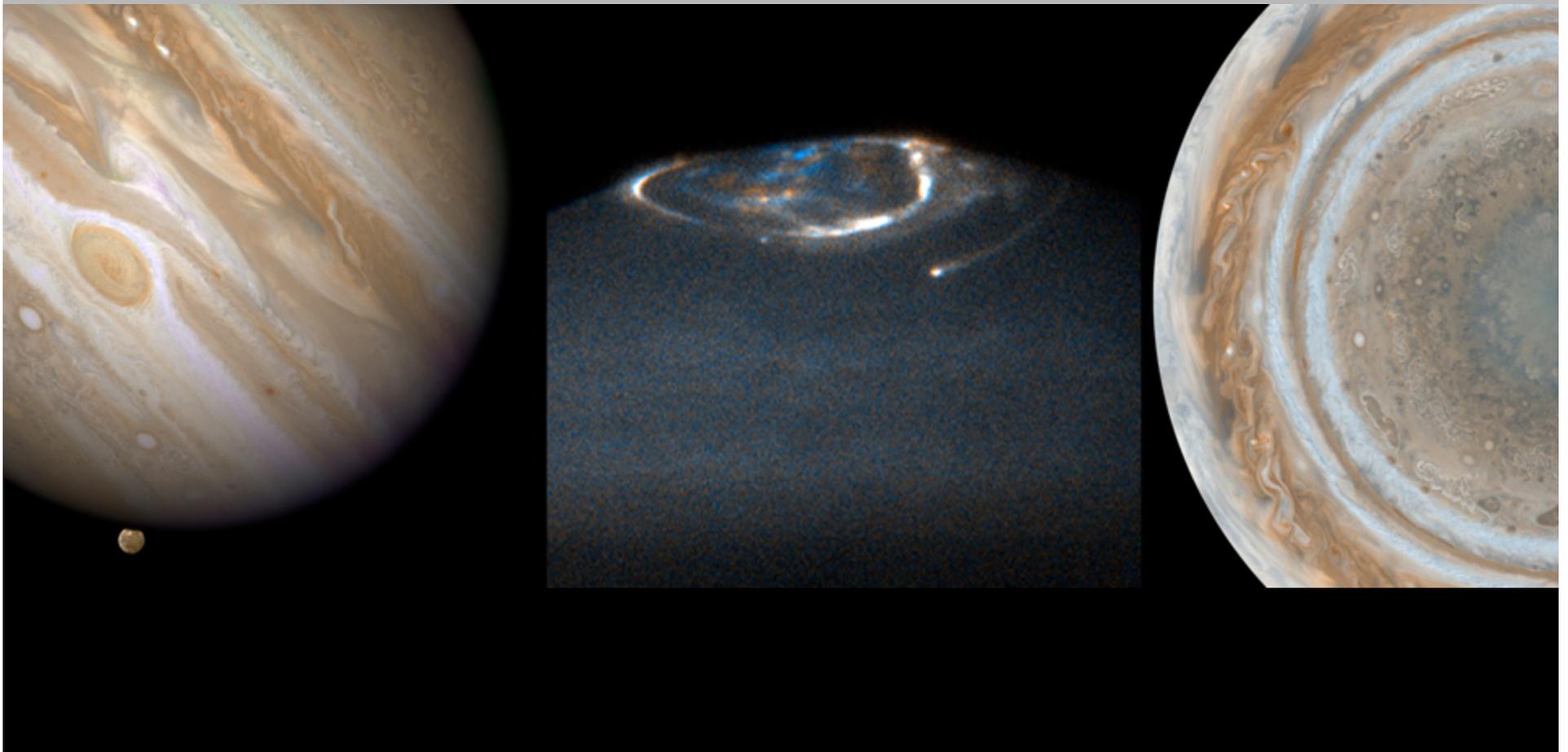
What is Jupiter's internal structure and composition?

Is there a solid core, and if so, how massive is it?

How are atmospheric features related to the deep interior?

How is its vast magnetic field generated?

What are the physical processes that power the auroras?





The history of the solar system

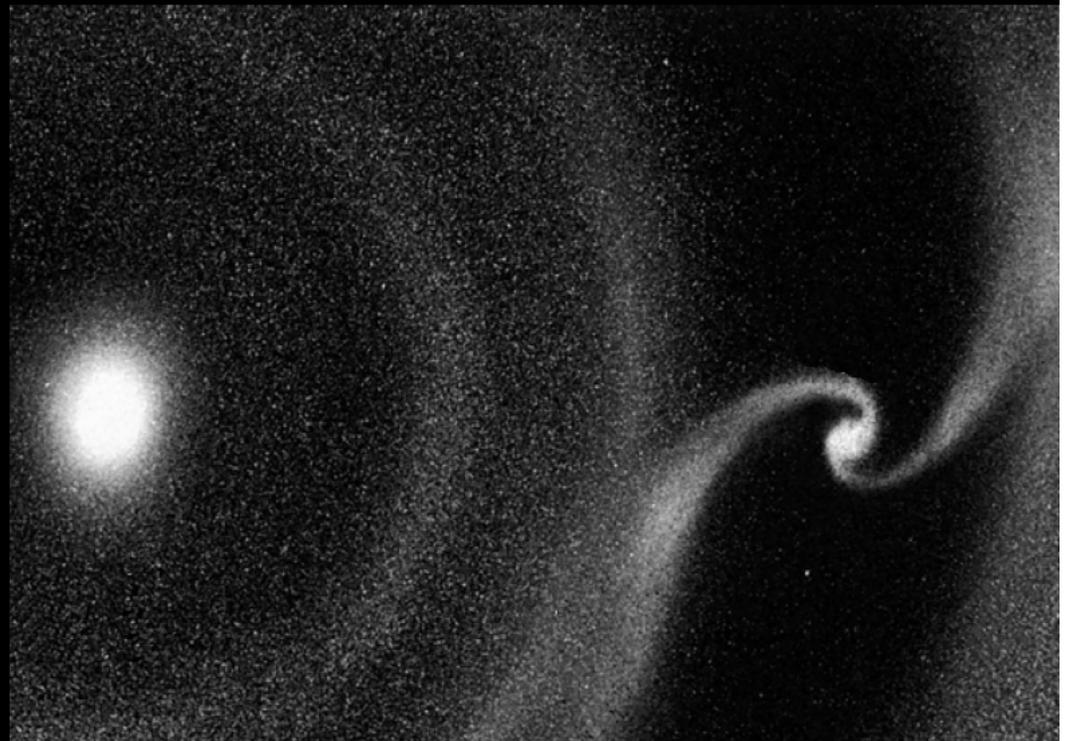
Understand solar system formation and evolution

Jupiter is the key

We cannot explain Jupiter's enrichment in heavy elements

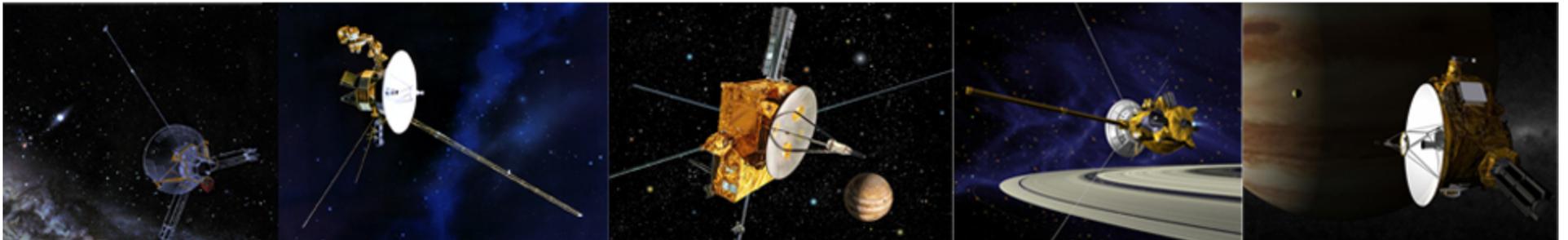
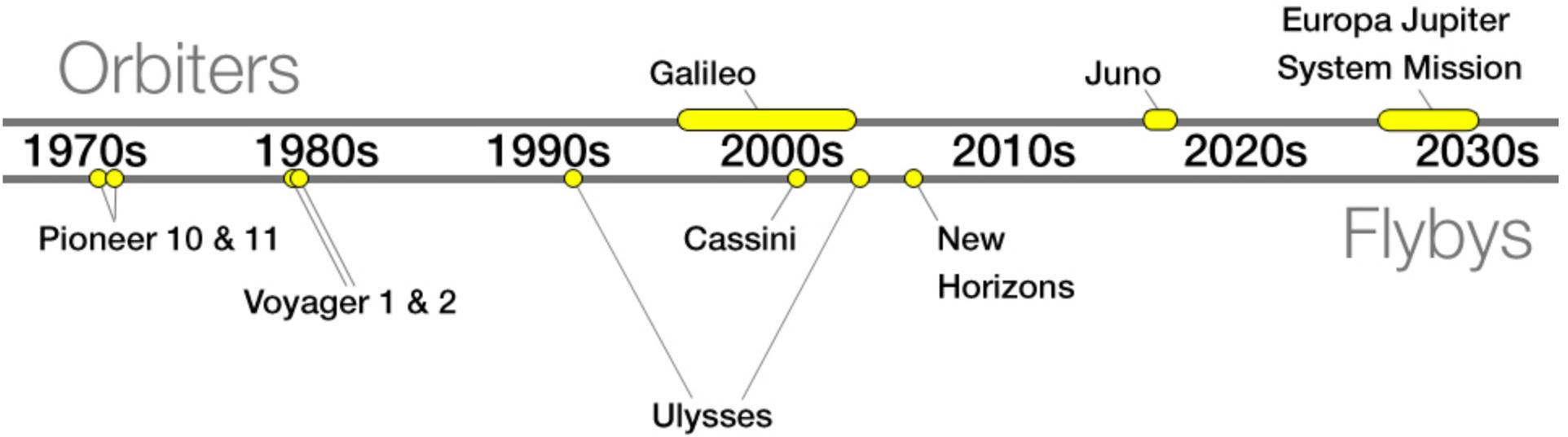
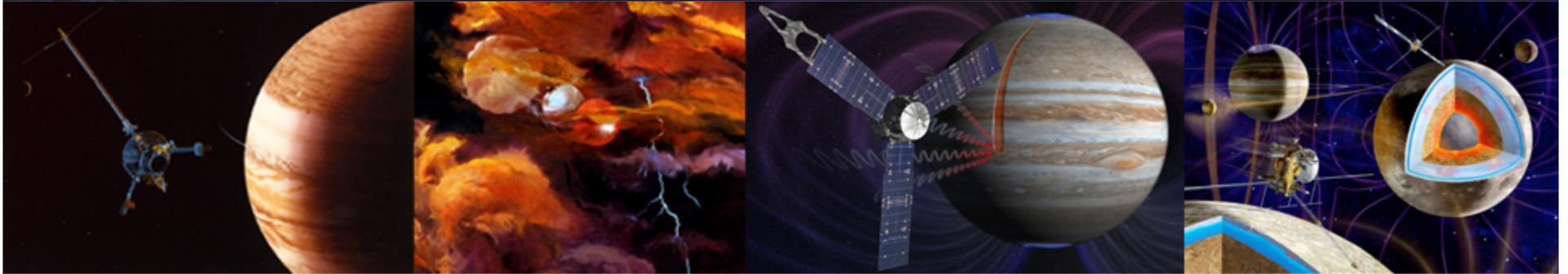
These heavy elements are the seeds for other planets in our solar system including Earth.

Jupiter's formation:
how, when, where, and
how long?





Where Does Juno Fit?





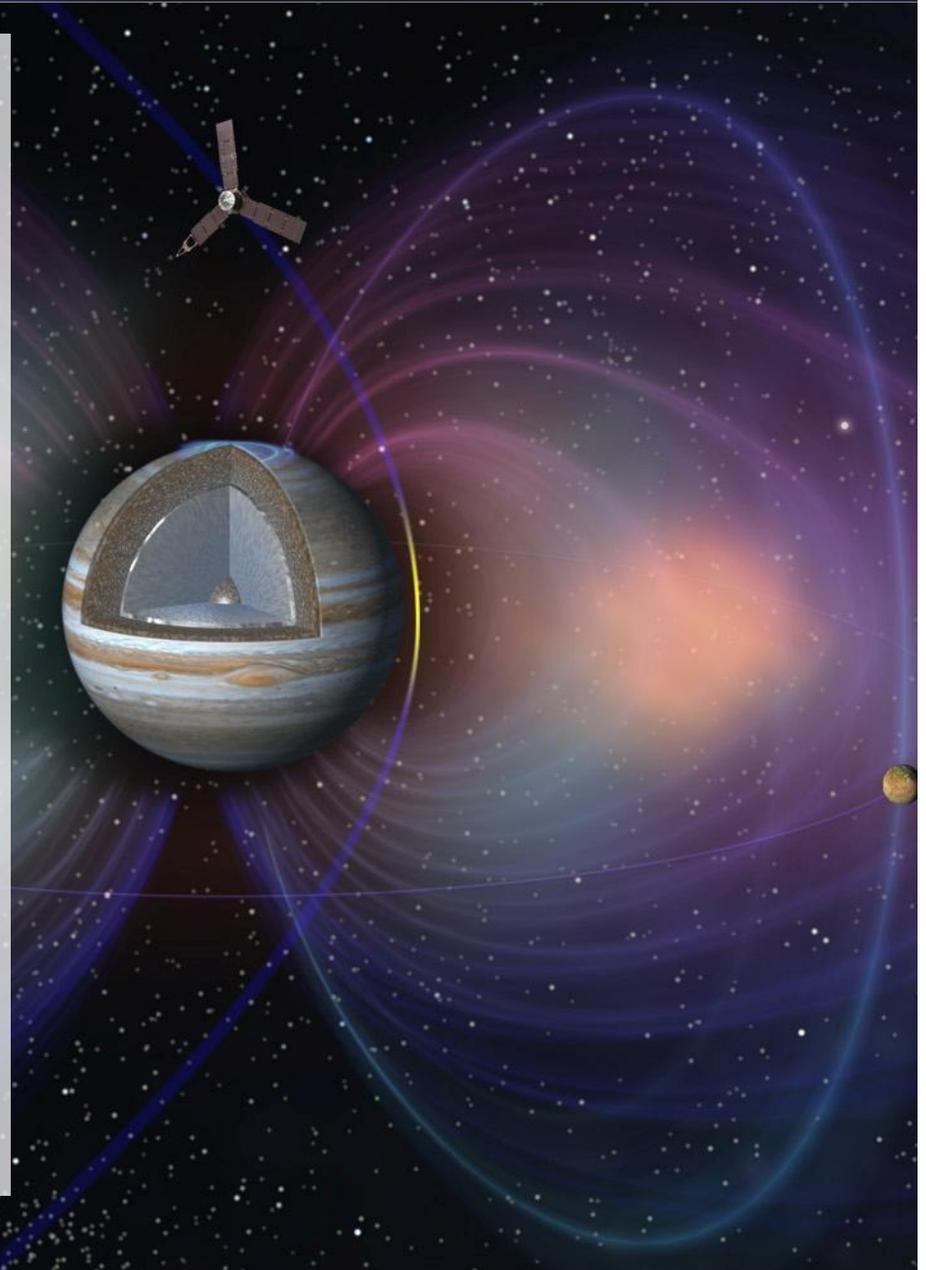
Juno Project Overview

Spacecraft:

- Spinning, polar orbiter spacecraft launches in August 2011
 - 5-year cruise to Jupiter, JOI in July 2016
 - 1 year operations, EOM via de-orbit into Jupiter in 2017
- Elliptical 11-day orbit swings below radiation belts to minimize radiation exposure
- 2nd mission in NASA's New Frontiers Program
First solar-powered mission to Jupiter
- Payload of eight science instruments to conduct gravity, magnetic and atmospheric investigations, plus a camera for E/PO

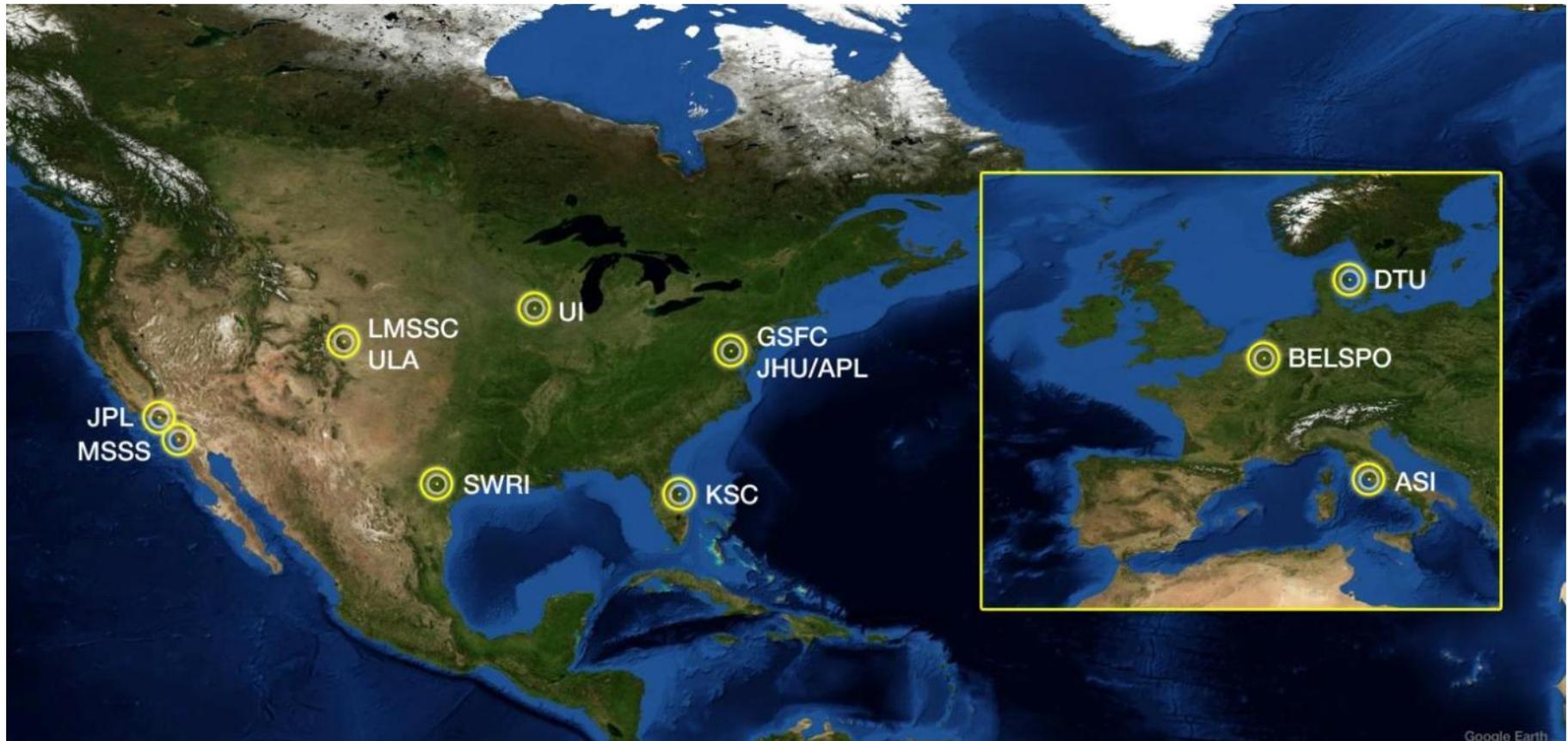
Science Objective: Improve our understanding of giant planet formation and evolution by studying Jupiter's origin, interior structure, atmospheric composition and dynamics, and magnetosphere

Principal Investigator: Dr. Scott Bolton
Southwest Research Institute





Partner Institutions



Southwest Institute Research Institute (SwRI),
San Antonio, TX

NASA Jet Propulsion Laboratory (JPL), Pasadena, CA

NASA Goddard Space Flight Center (GSFC), Greenbelt, MD

Lockheed Martin Space Systems Company (LMSSC),
Denver, CO

University of Iowa (UI), Iowa City, IA

**Johns Hopkins University Applied Physics Laboratory (JHU/
APL),** Laurel, MD

Malin Space Science Systems (MSSS), San Diego, CA

NASA Kennedy Space Center (KSC), Cape Canaveral, FL

United Launch Alliance (ULA), Denver, CO

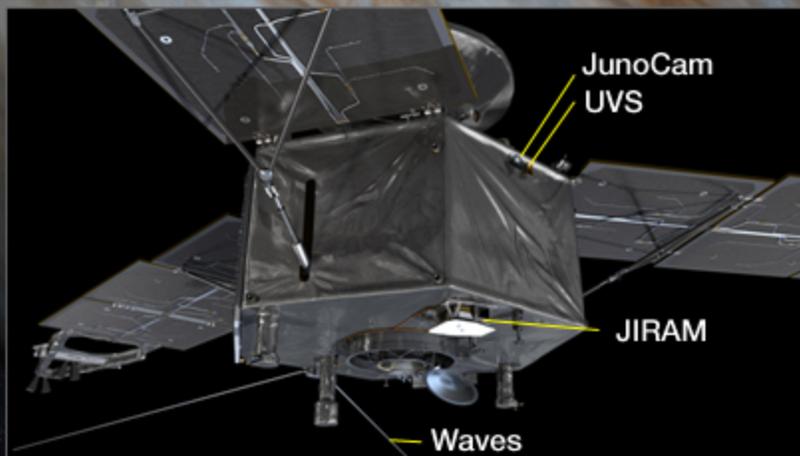
Danish Technical University (DTU), Lyngby

Italian Space Agency (ASI), Rome

Belgian Science Policy Office (BELSPO), Brussels



Spacecraft & Payload



Juno's Science Instruments

Gravity Science & Magnetometers

Study Jupiter's deep structure by mapping the planet's gravity field & magnetic field

Microwave Radiometer (MWR)

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

JEDI, JADE & Waves

Sample electric fields, radio waves and particles around Jupiter to determine how the magnetic field inside the planet is connected to the atmosphere and magnetosphere, and especially the auroras (northern and southern lights)

UVS & JIRAM

Take images of the atmosphere and auroras, along with the chemical fingerprints of gases there, with ultraviolet & infrared cameras

JunoCam

Take spectacular close-up, color images

Gravity Science

Spacecraft dimensions:

Diameter: 20 meters (66 feet)

Height: 4.5 meters (15 feet)

JEDI

JADE

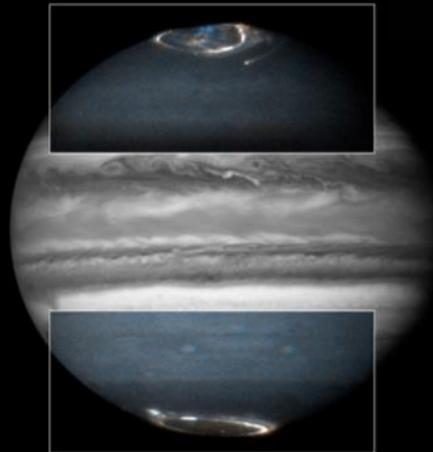
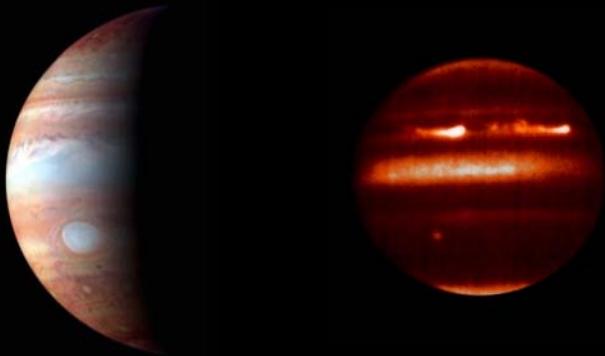
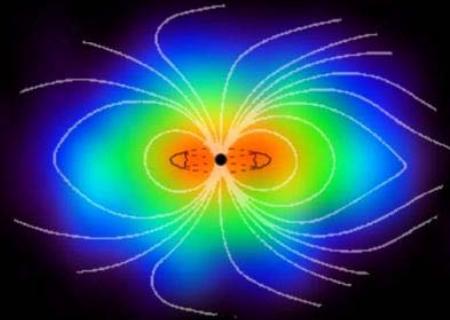
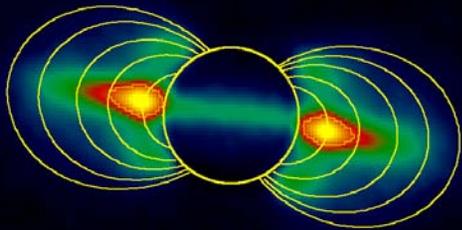
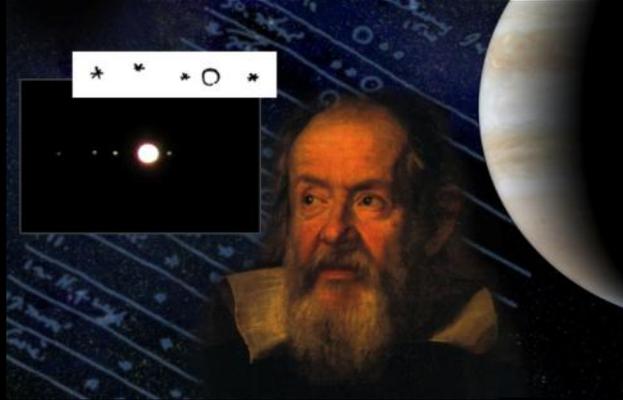
MWR

Magnetometer





Many ways of seeing Jupiter





Juno Science

Origin

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

Interior

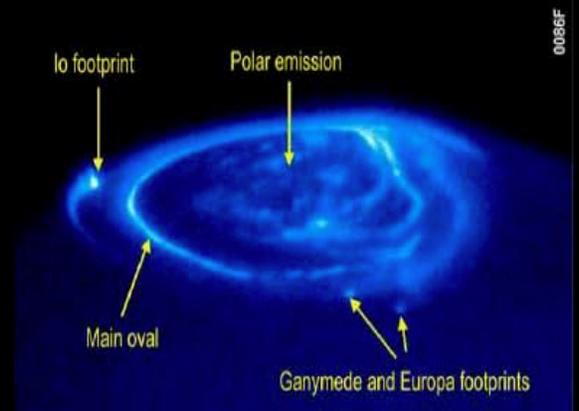
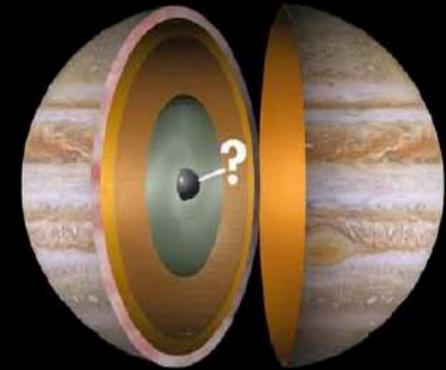
Understand Jupiter's interior structure and dynamical properties by mapping its gravitational and magnetic fields.

Atmosphere

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

Polar Magnetosphere

Explore the three-dimensional structure of Jupiter's polar magnetosphere and aurorae.



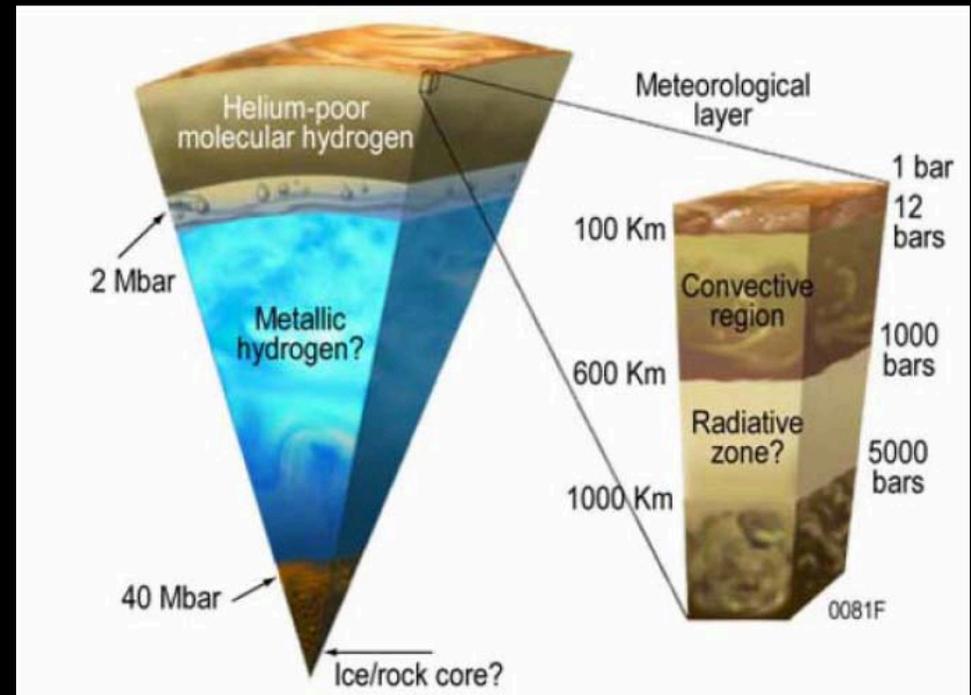


Jupiter's interior and deep atmosphere

Radiometry probes deep into meteorological layer

Magnetic fields probe into dynamo region of metallic hydrogen layer

Gravity fields probe all the way to the planetary center





Juno Science – my connection

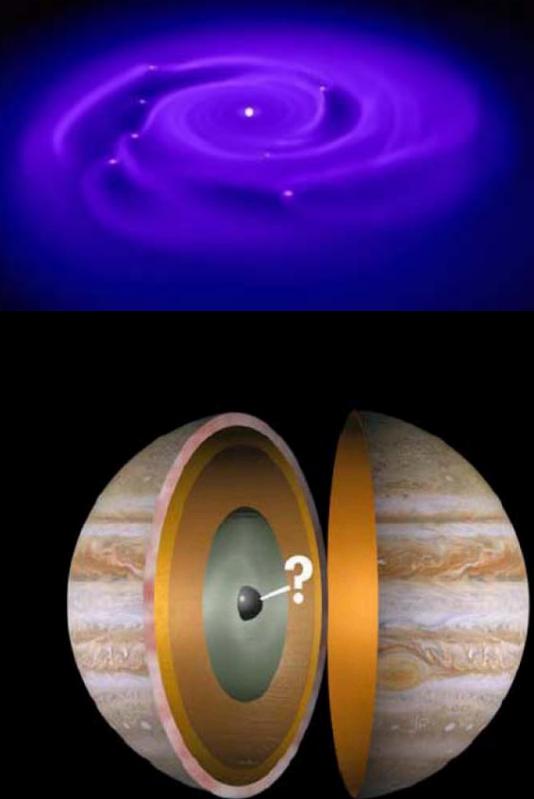
Planet Formation

Jupiter is the most massive planet in the solar system and the first to form. How do giant planets form?

We observed over 500 planets outside the solar-system –young planetary systems and planet formation in general

Jupiter's Interior

What is Jupiter made of? How is the material distributed? What is the water abundance? What is Jupiter's internal dynamics?

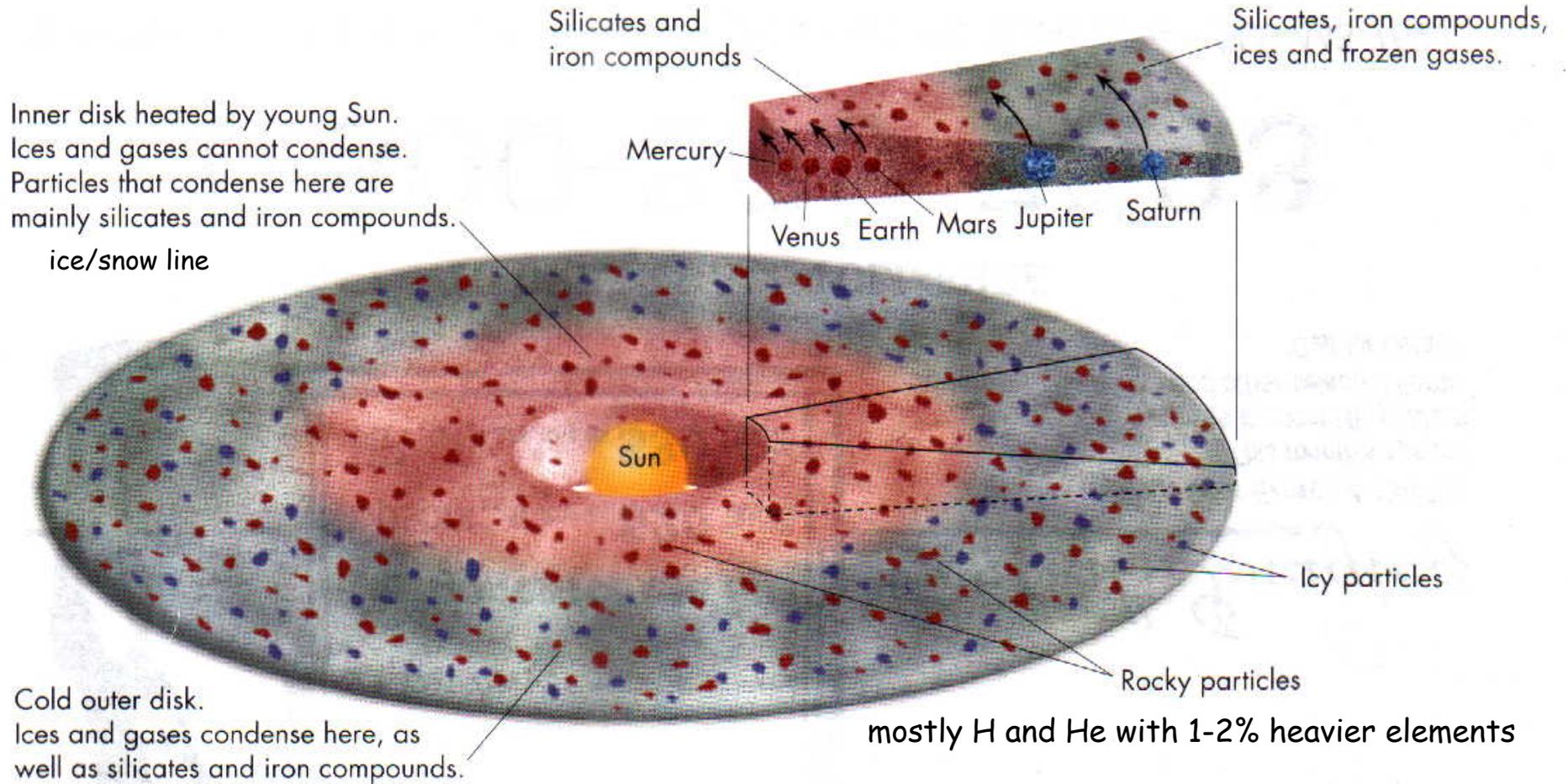




Juno Science

Jupiter is the first planet to form in our solar system

Jupiter's Composition: Information on the protoplanetary disk' material (water!)





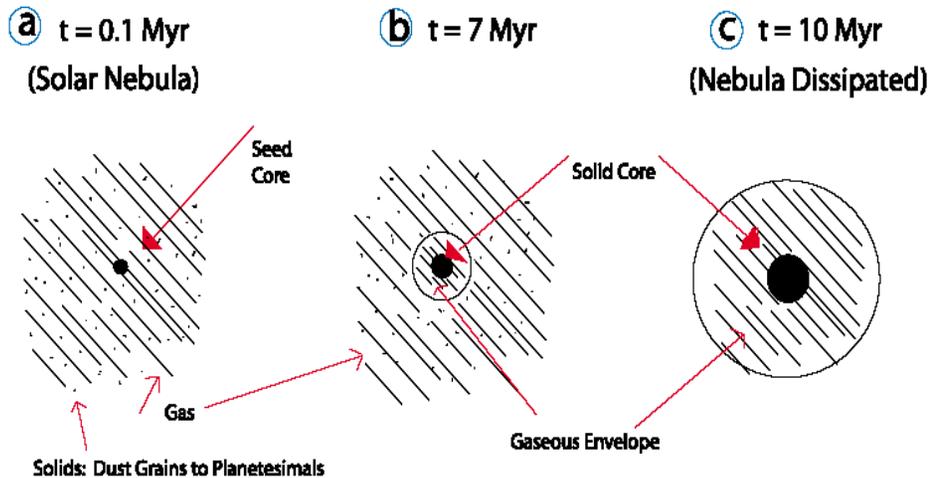
Juno Science

Giant Planet Formation

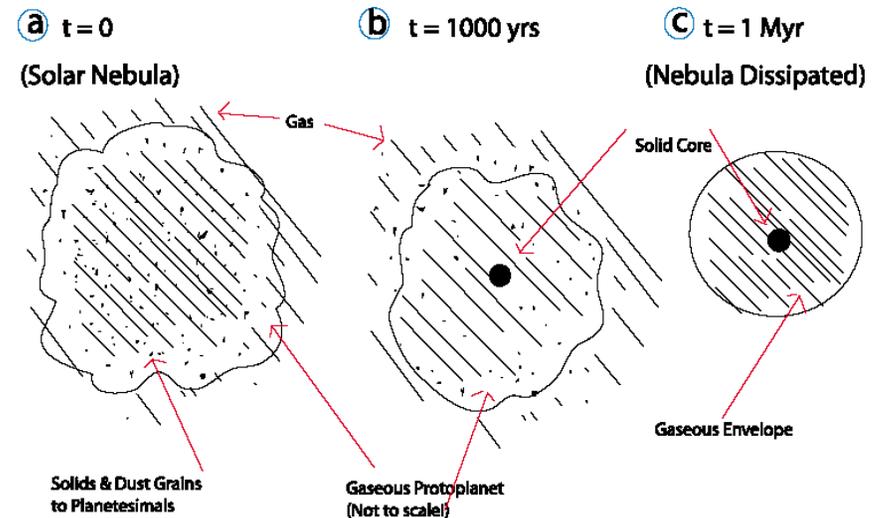
Two Models for Giant Planet Formation: **Core Accretion** and **Disk Instability**

Predict different formation timescales, different internal structures (core masses), etc.
How do giant planets form in other system?

Core Accretion



Disk Instability





Juno – almost there...





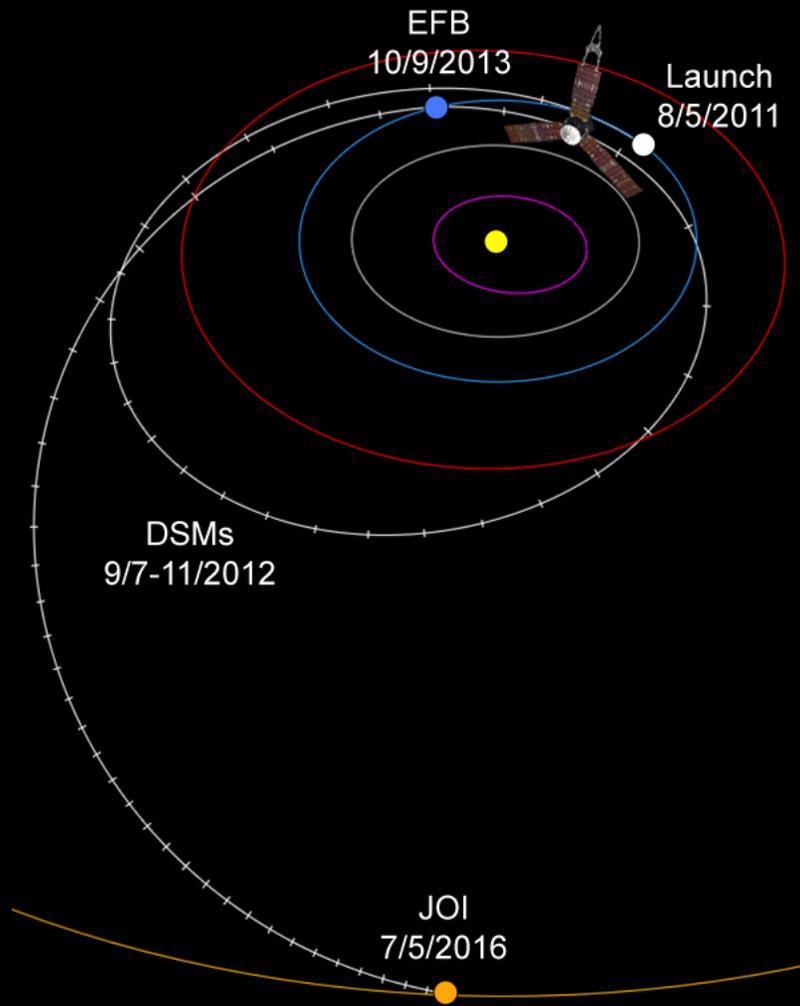
Launch Profile

Atlas V 551 from Kennedy Space Center
Launch period: Aug. 5 – 26, 2011
Mass at launch: 3625 kg

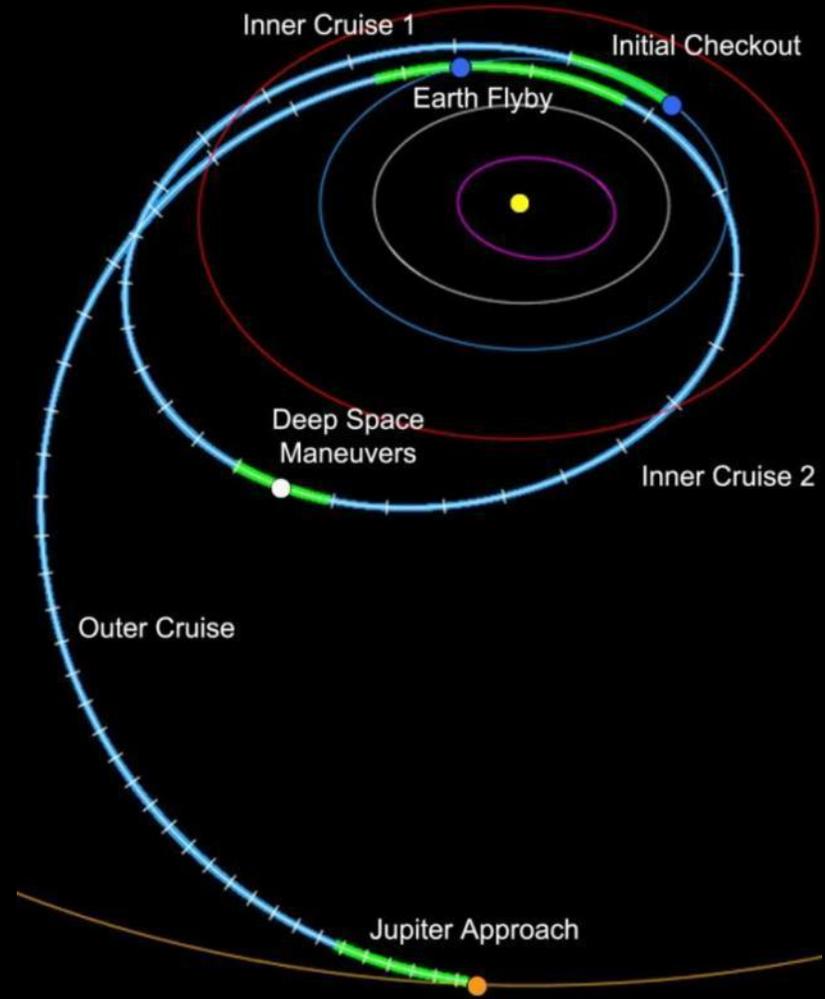




Trajectory



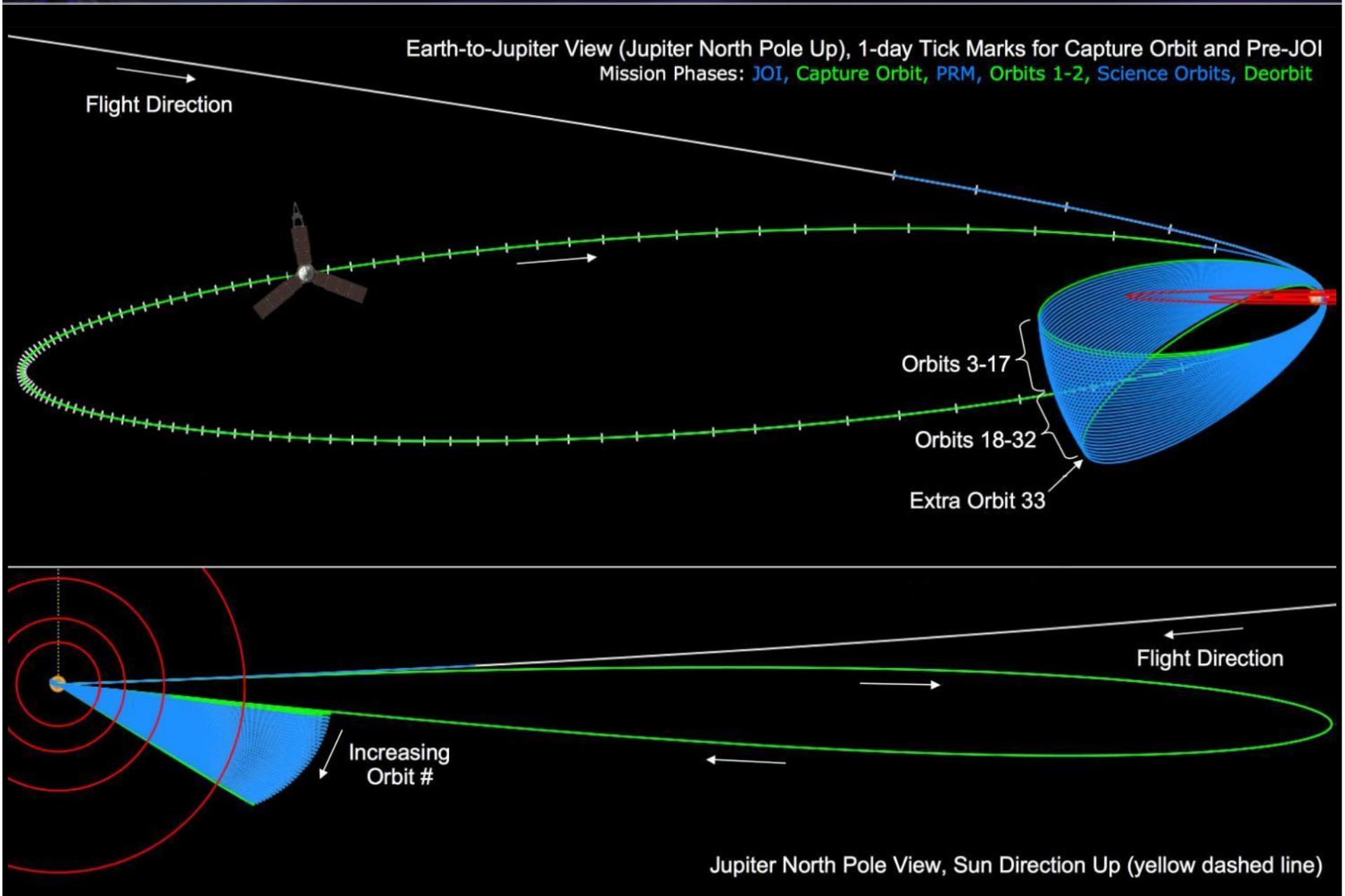
Key dates



Mission phases

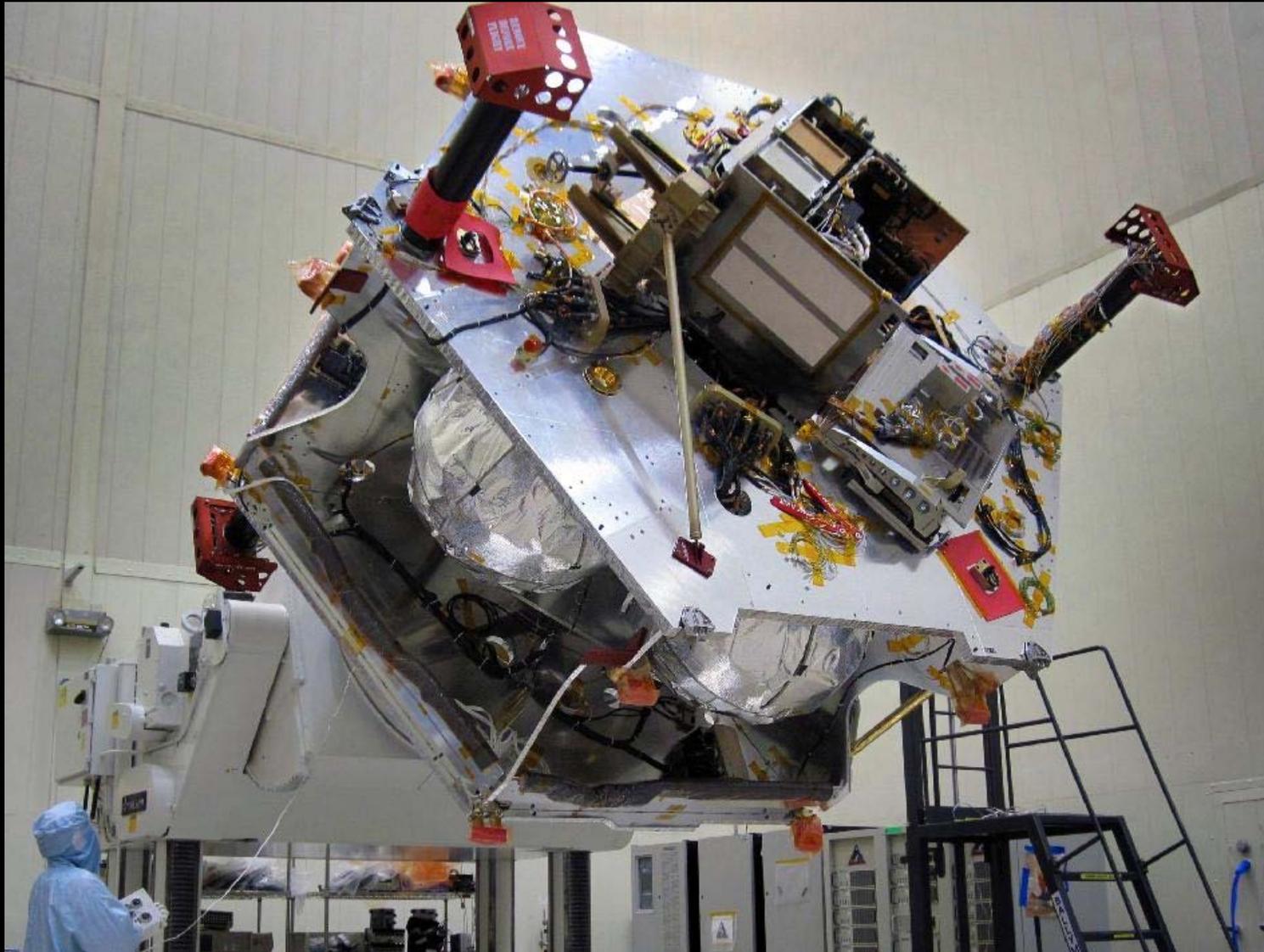


Orbit at Jupiter





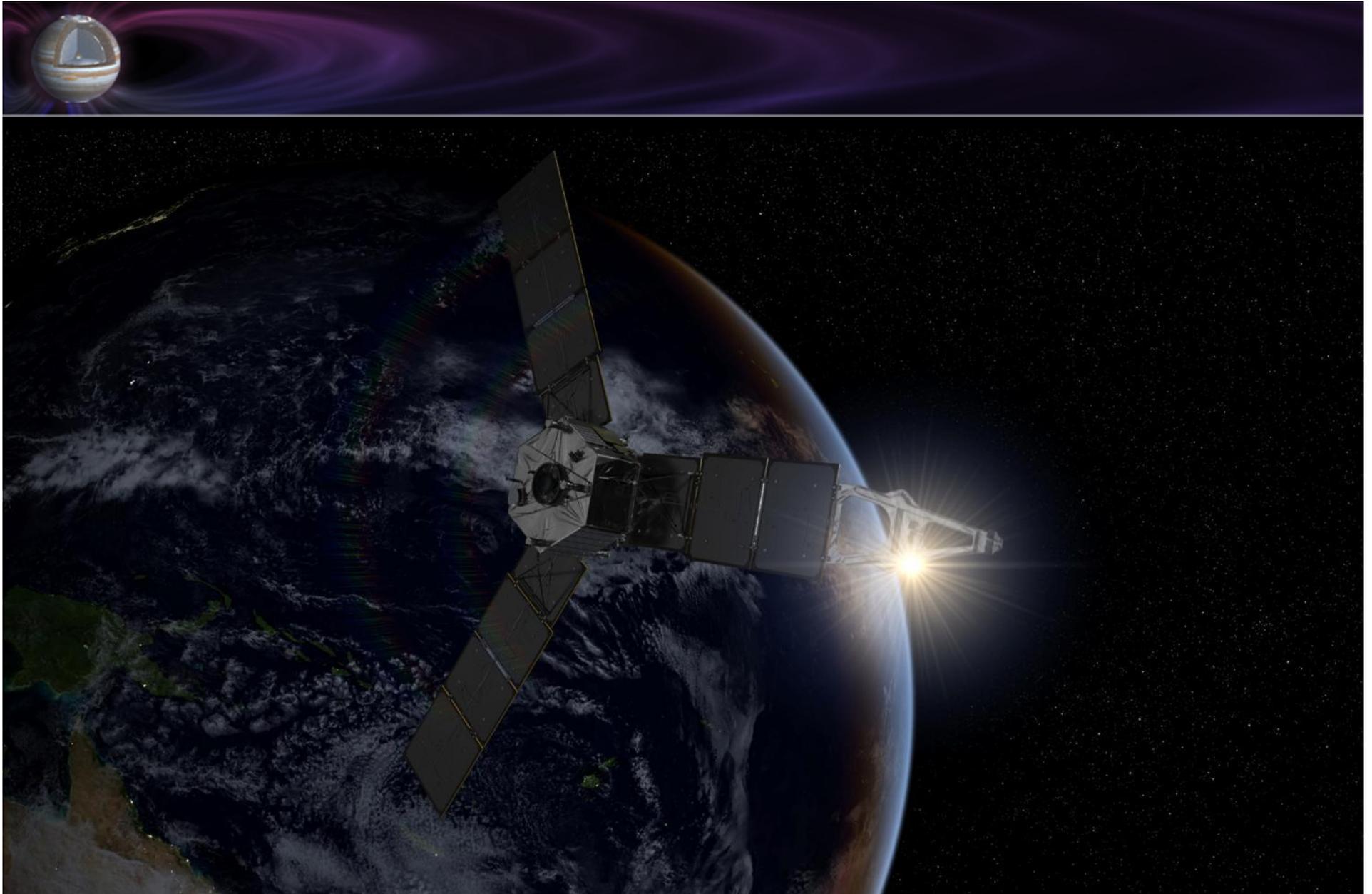
Juno in ATLO





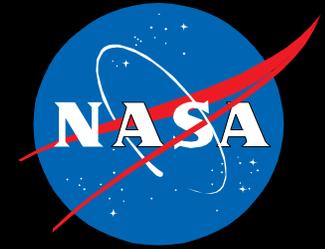
Launch this coming August





Artist rendering shows Juno above Earth just after launch, as the Sun rises and sunlight hits the solar arrays for the first time





Thank you