



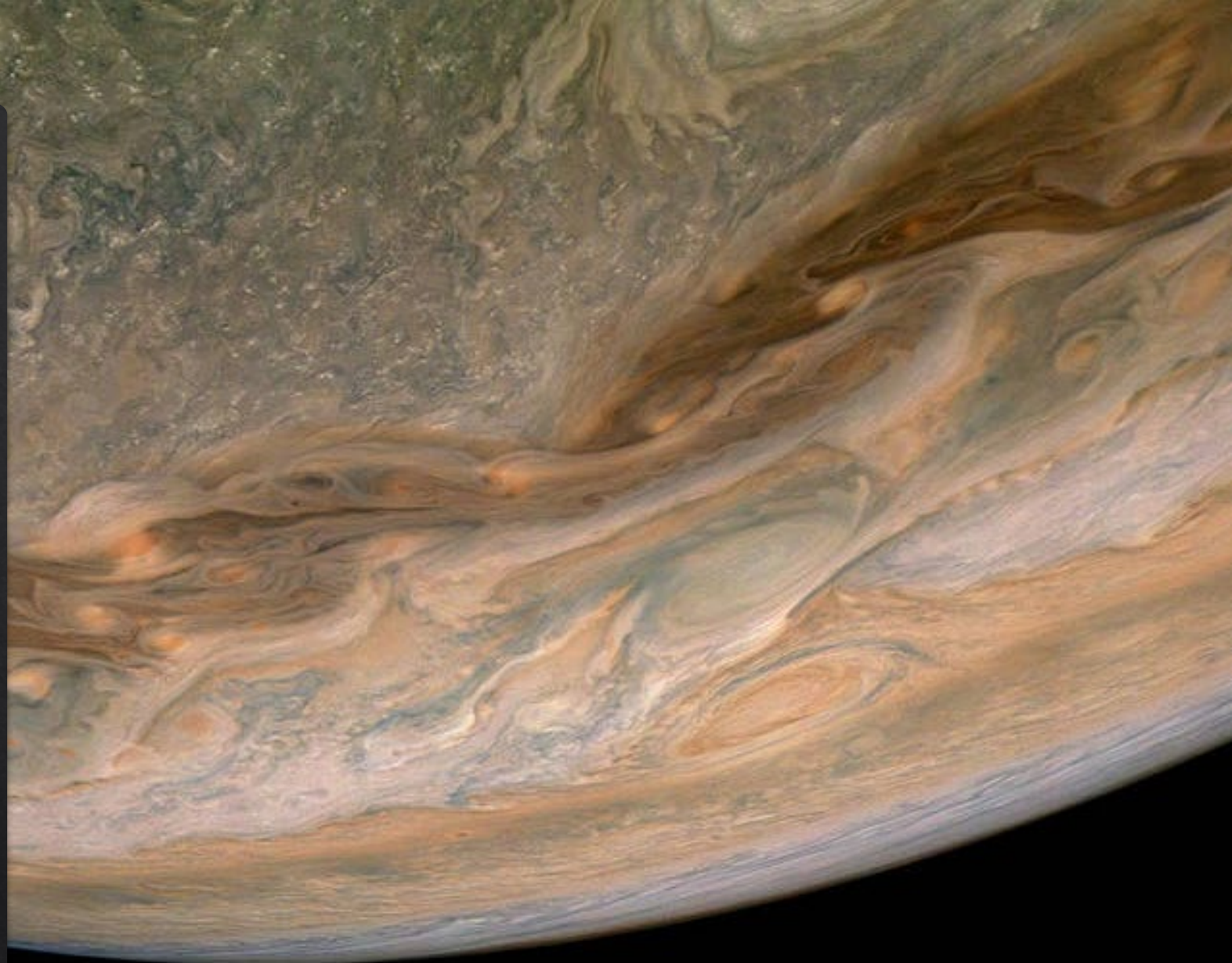
Jupiter

and its magnetic field

Felipe Tampier Jara

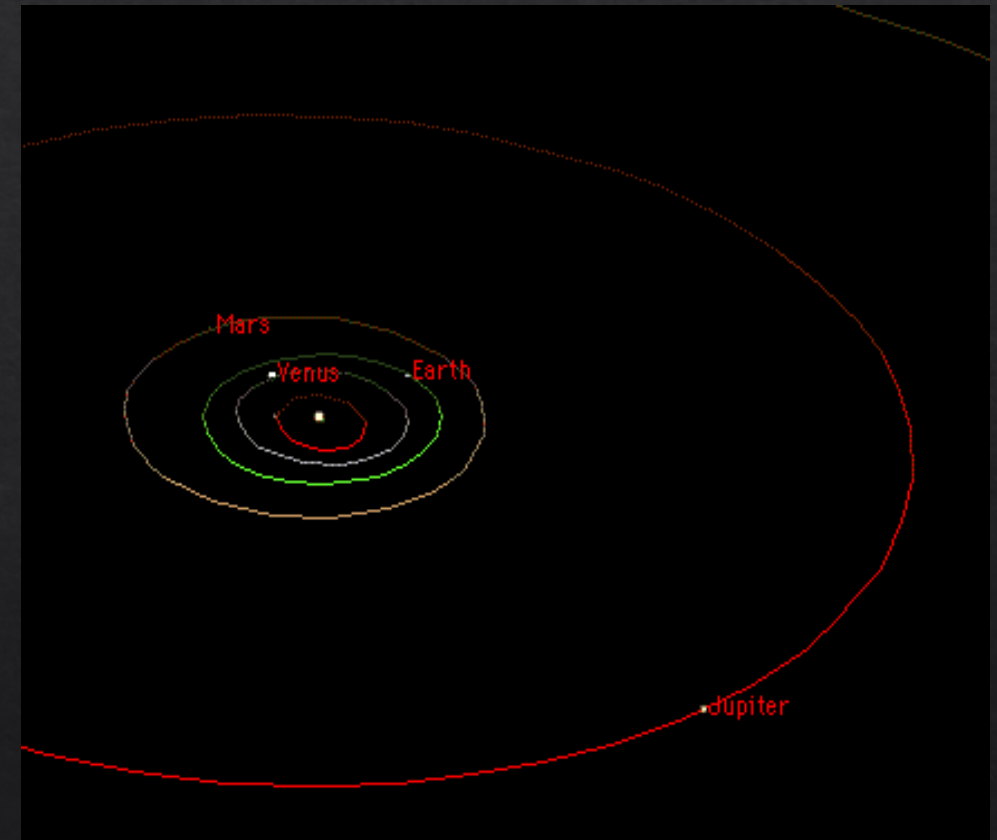
Outline

- ◇ Basic information about Jupiter
- ◇ How Jupiter's magnetic field is formed
- ◇ Io's effect on Jupiter
- ◇ The properties of the magnetic field
- ◇ How the magnetic field is measured
- ◇ Results from JUNO mission



Jupiter is significantly larger than earth

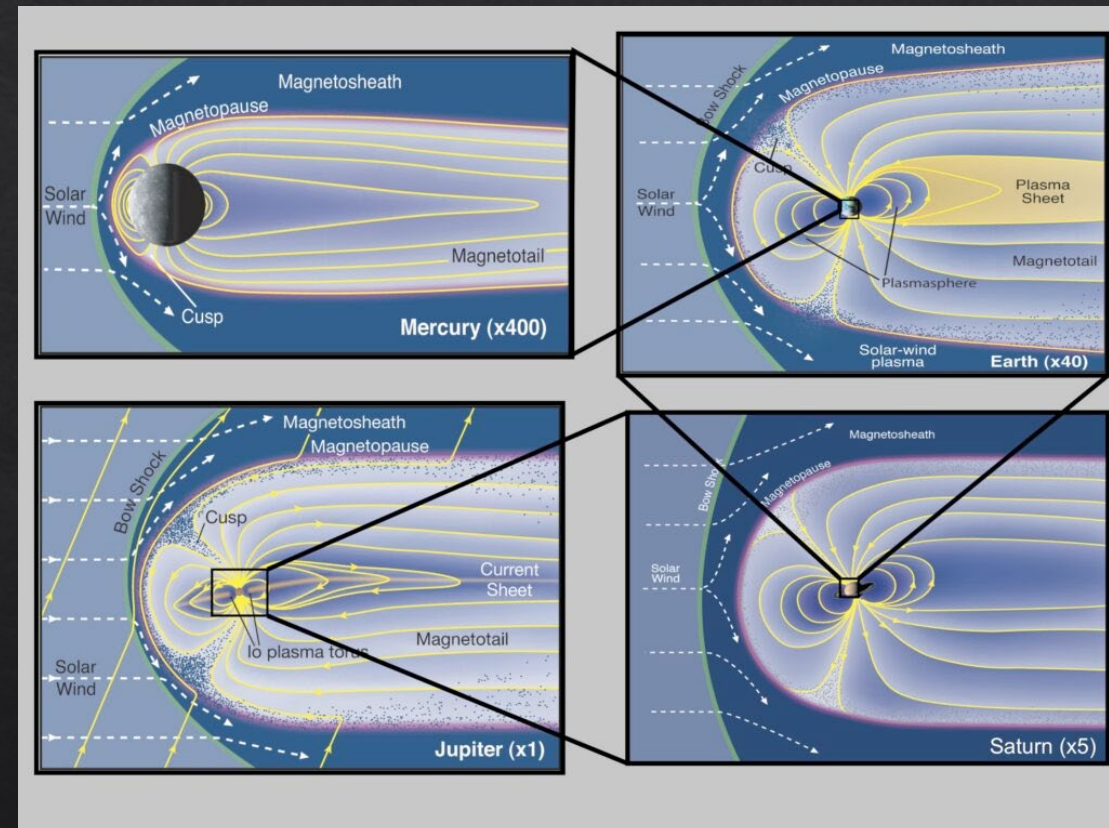
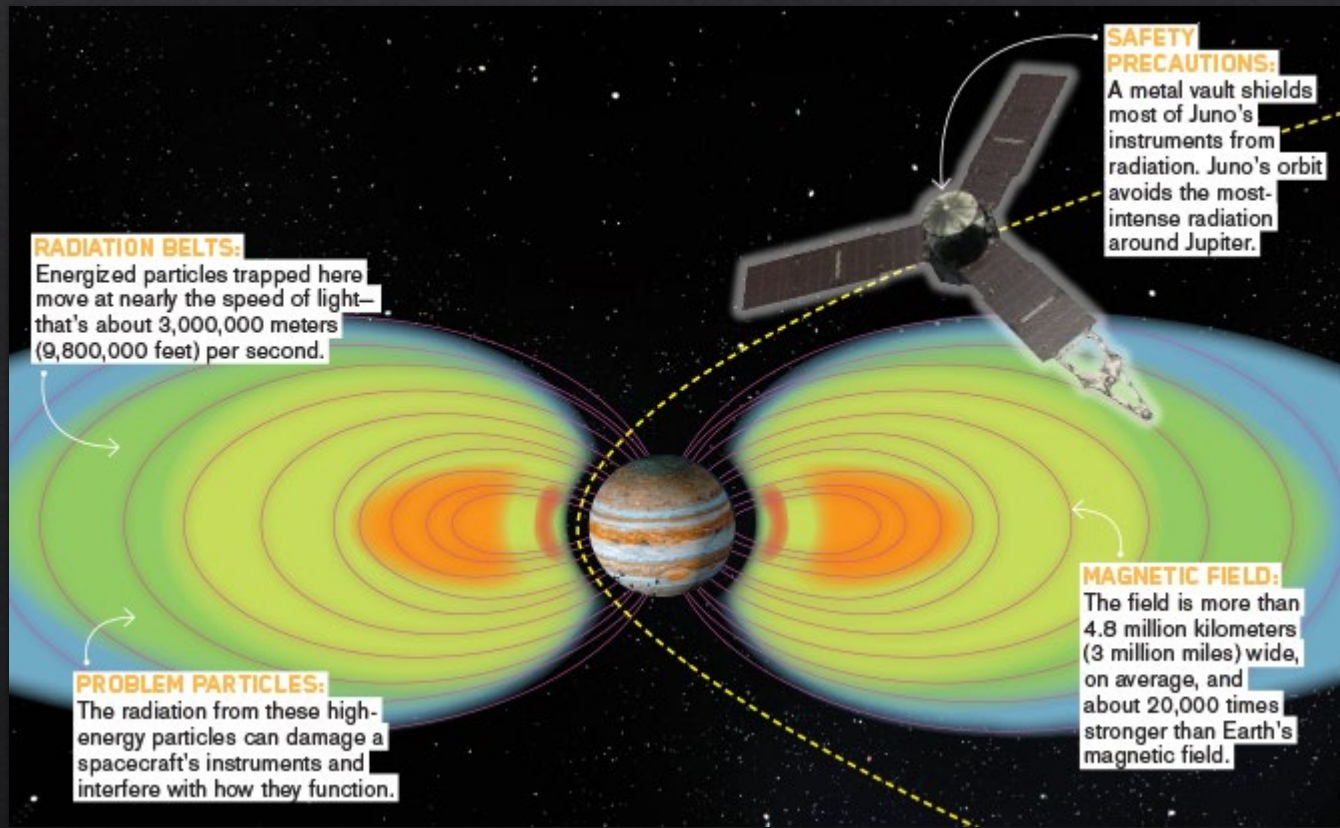
Parameter	Earth	Jupiter
Distance from the Sun	1 AU	5.2 AU
Radius	$1 R_e = 6328 \text{ km}$	$11.2 R_e$
Mass	$1 m_e = 6 \times 10^{24} \text{ kg}$	$317.8 m_e$
Volume	$1 V_e = 10^{12} \text{ km}^3$	$1321 V_e$
Density	$1 \rho_e = 1326 \text{ kg/m}^3$	$0.24 \rho_e$



Properties of Jupiter

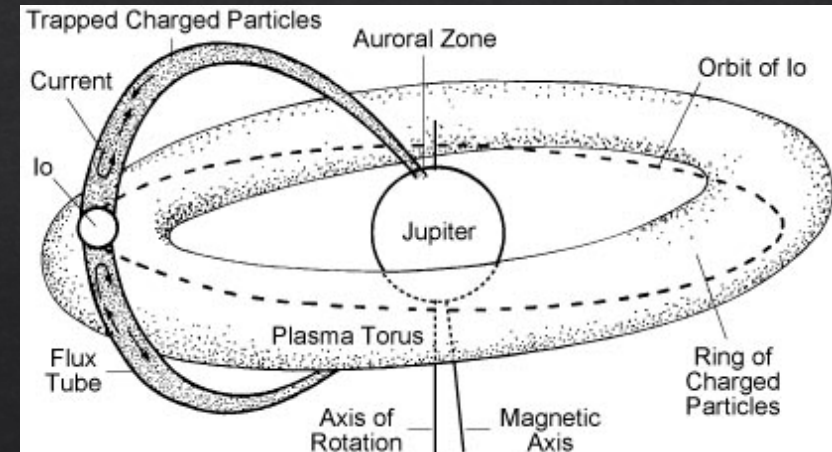
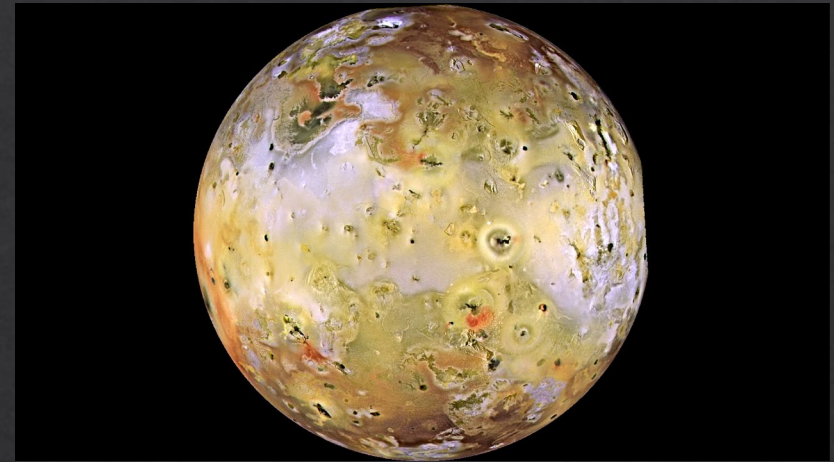
- ◇ Jupiter is primarily made out of Hydrogen
 - ◇ And Helium (25% by mass)
- ◇ Jupiter was theorized to have a rocky core
 - ◇ Thanks to the Juno mission it seems to be more of a fuzzy-metal core
- ◇ A day in Jupiter is 10 hours long
 - ◇ It's the fastest rotating planet in the solar system

Jupiter's magnetic field, strong and dangerous

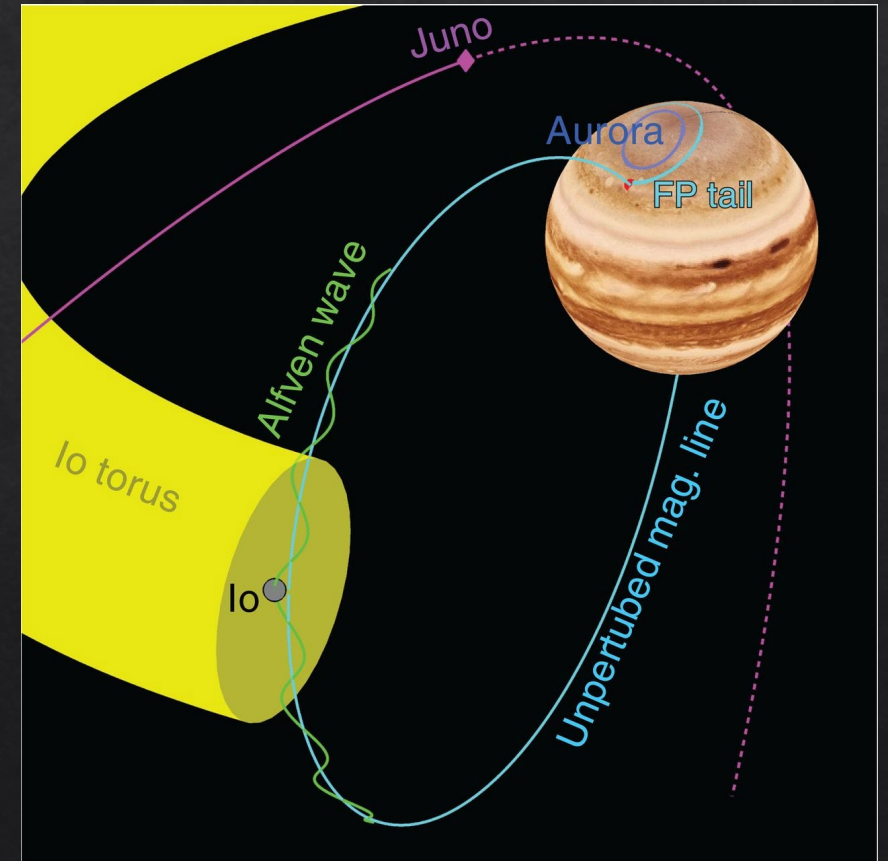
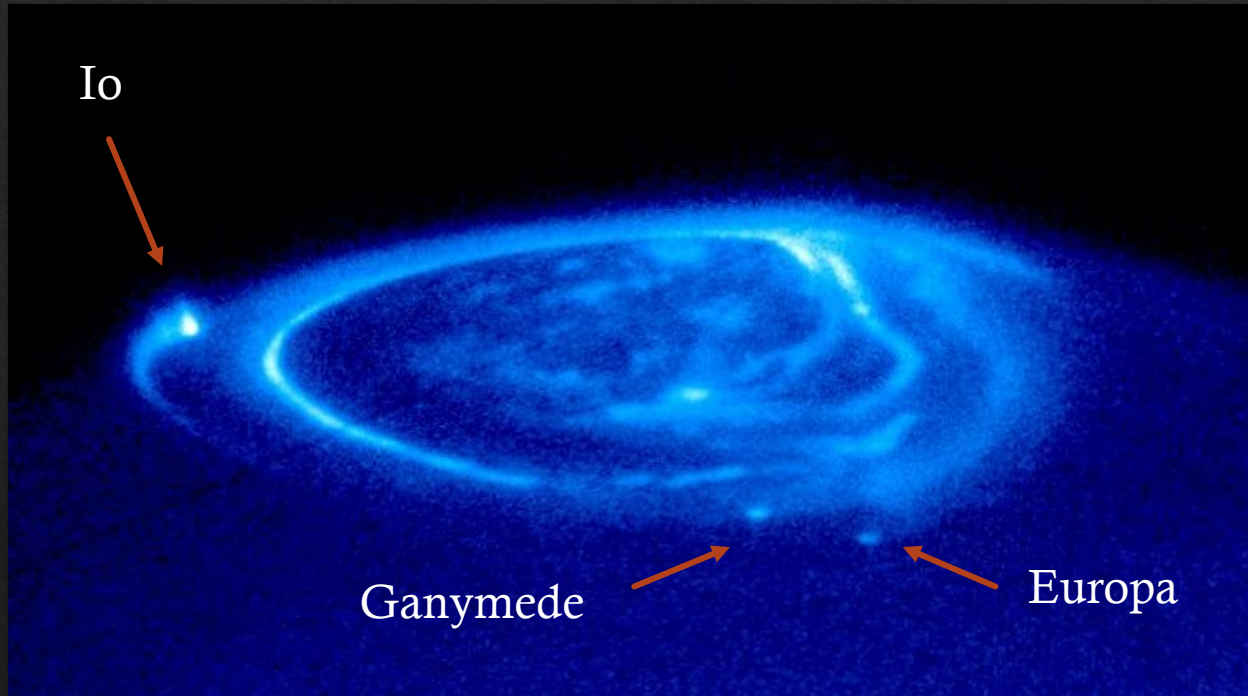


Io's flux tube and plasma torus

- ◆ Jupiter's radiation belt (plasma torus) is formed mainly by Io's particles
 - ◆ Io is the solar system's most volcanically active object (releasing ~1 ton of particles per second)
- ◆ This flux tube carries millions of Amps
- ◆ The plasma torus is about as thick as Jupiter's diameter

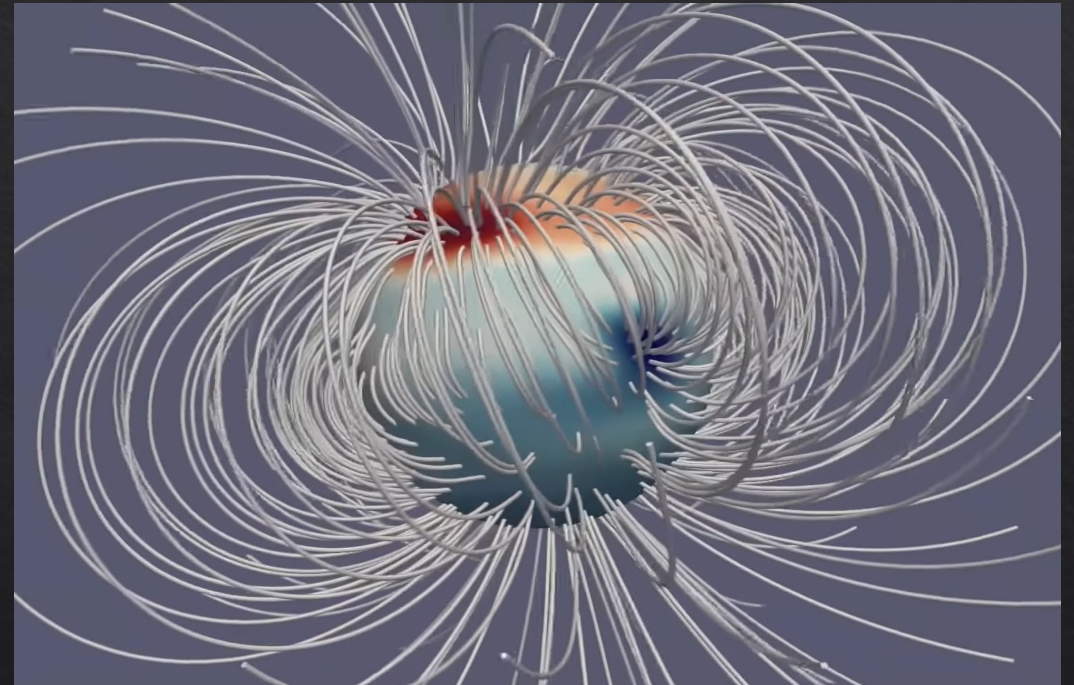


Jupiter's permanent aurorae are mainly caused by AC currents



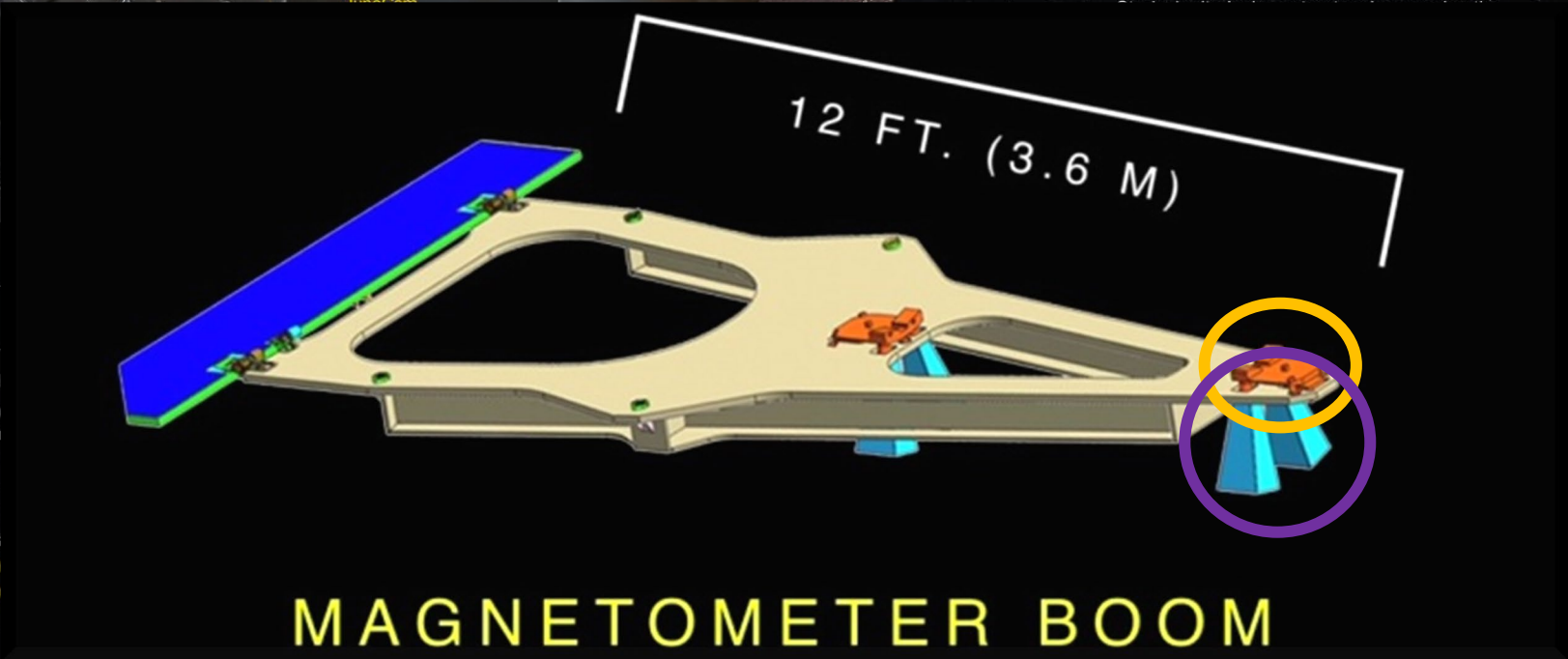
The magnetic field

- ◇ Jupiter's magnetic field is the strongest in the solar system
 - ◇ Only second to the Sun
- ◇ Its magnetosphere may extend past Saturn
- ◇ Its magnetic field strength can be up to $2000 \mu\text{T}$
- ◇ It behaves mainly like a dipole but is much more complex



How the magnetic field is measured

Juno's Instruments
Gravity Science and Magnetometers

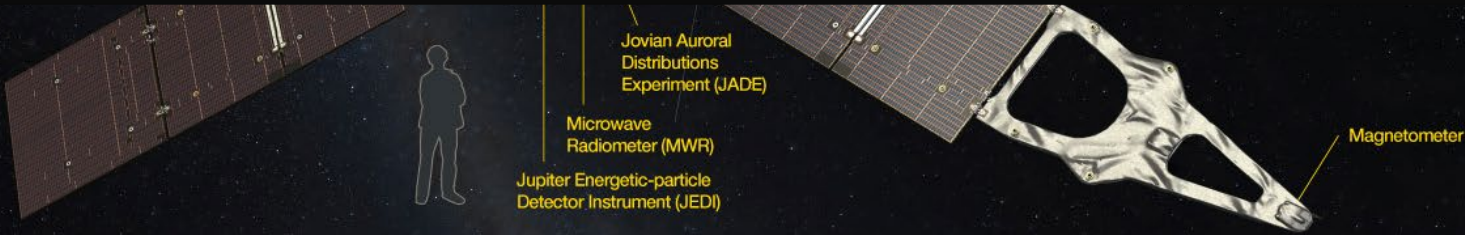


12 FT. (3.6 M)

SPACECRAFT DIM
Diameter: 66 feet (20 m)
Height: 15 feet (4.5 m)

For more information:
missionjuno.nasa.gov
www.nasa.gov

MAGNETOMETER BOOM

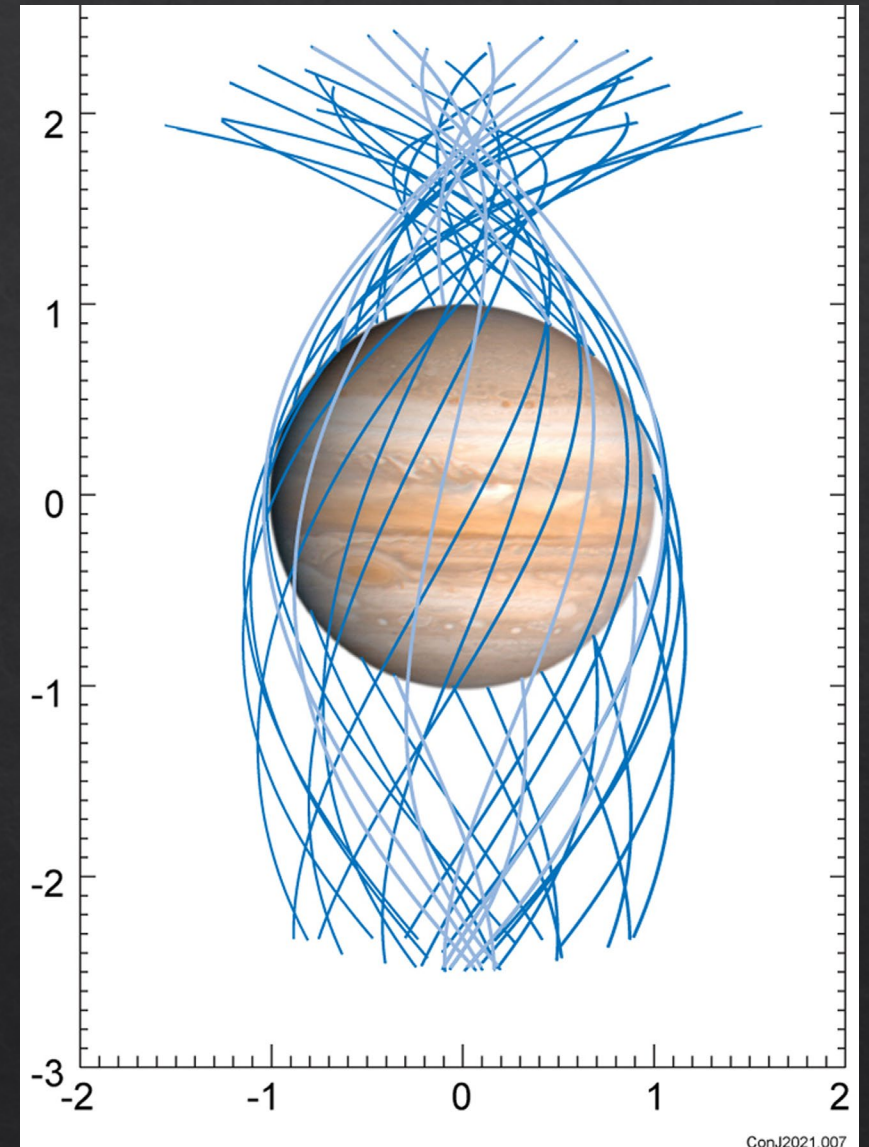


Jovian Auroral Distributions Experiment (JADE)
Microwave Radiometer (MWR)
Jupiter Energetic-particle Detector Instrument (JEDI)
Magnetometer

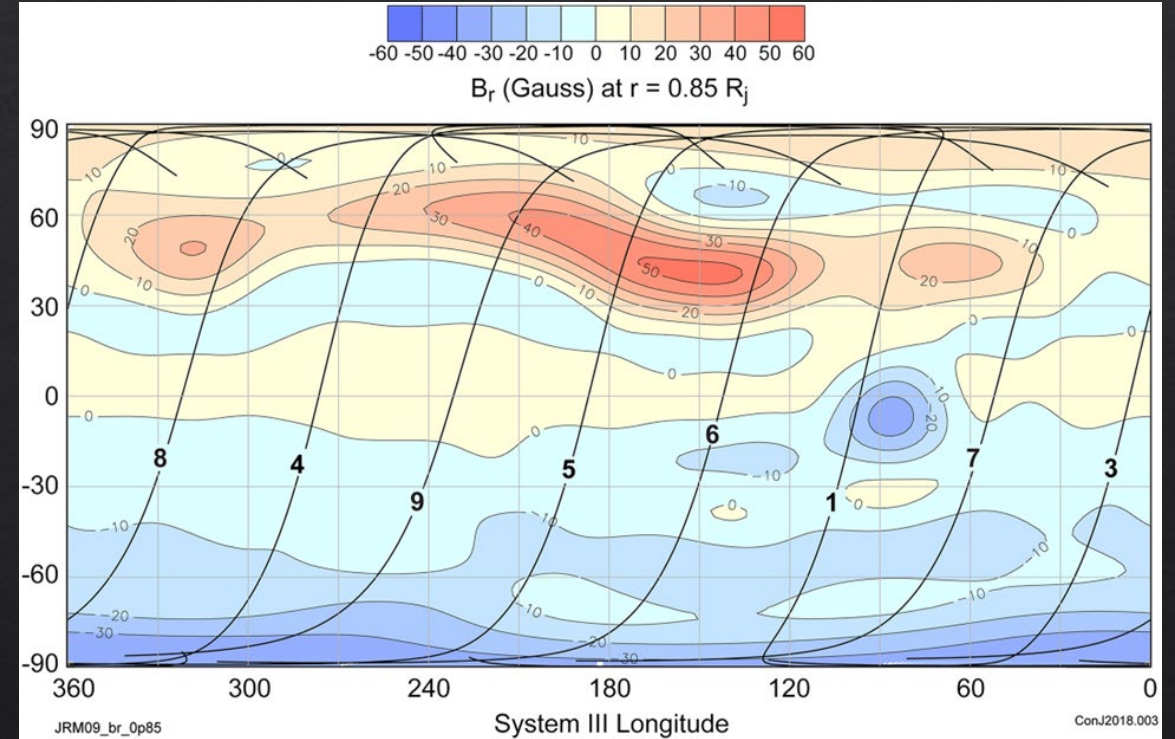
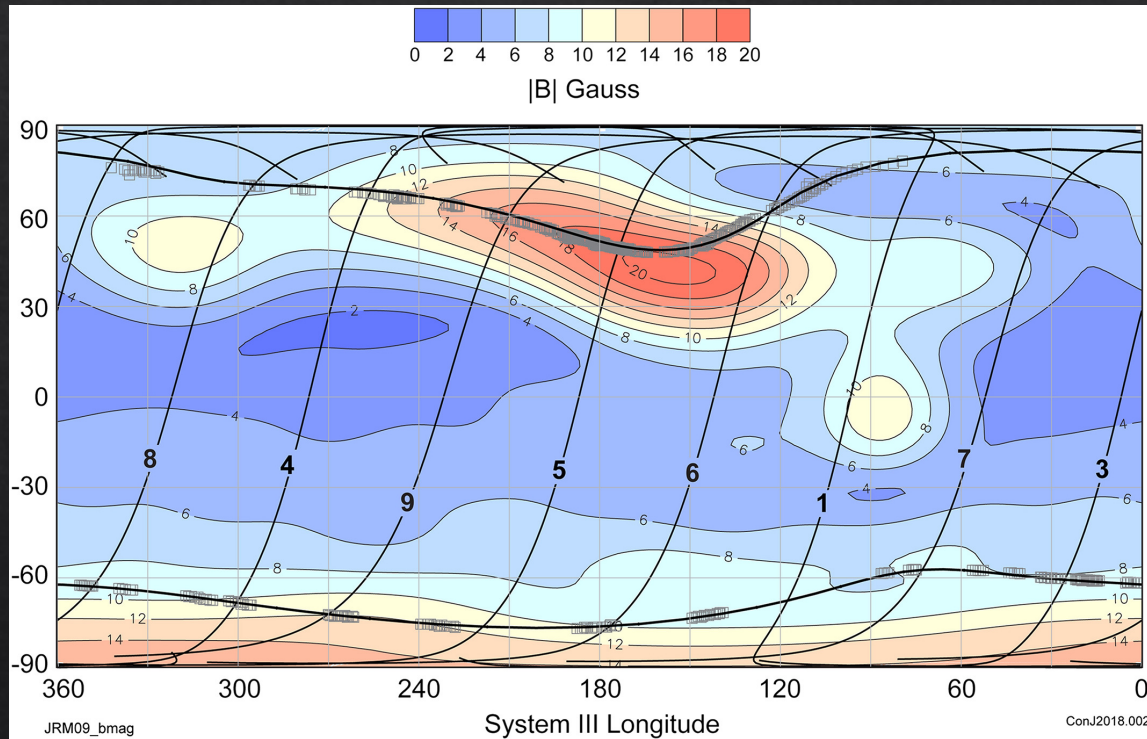
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California
www.nasa.gov

Juno's orbits

- ◇ The highly elliptic orbit allows for a very close approach
 - ◇ To get a good look at everything under the surface
- ◇ Every orbit pass is ~ 11 degrees apart from each other
 - ◇ For a total of 34 orbits

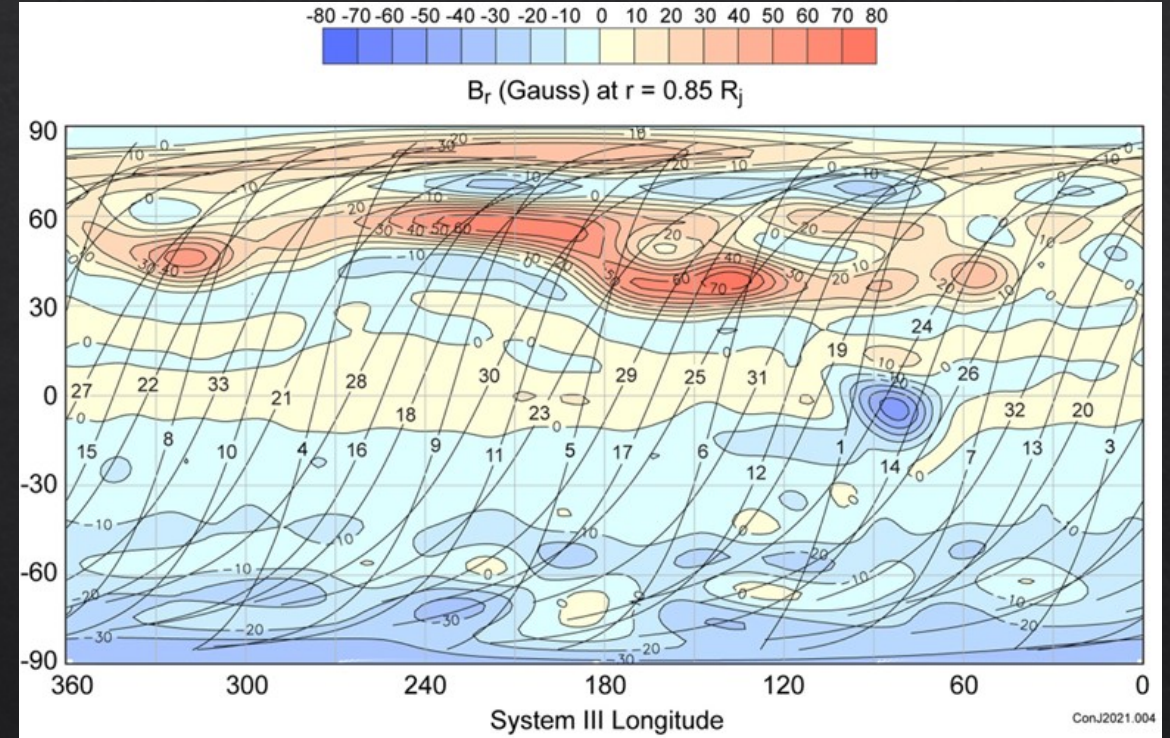
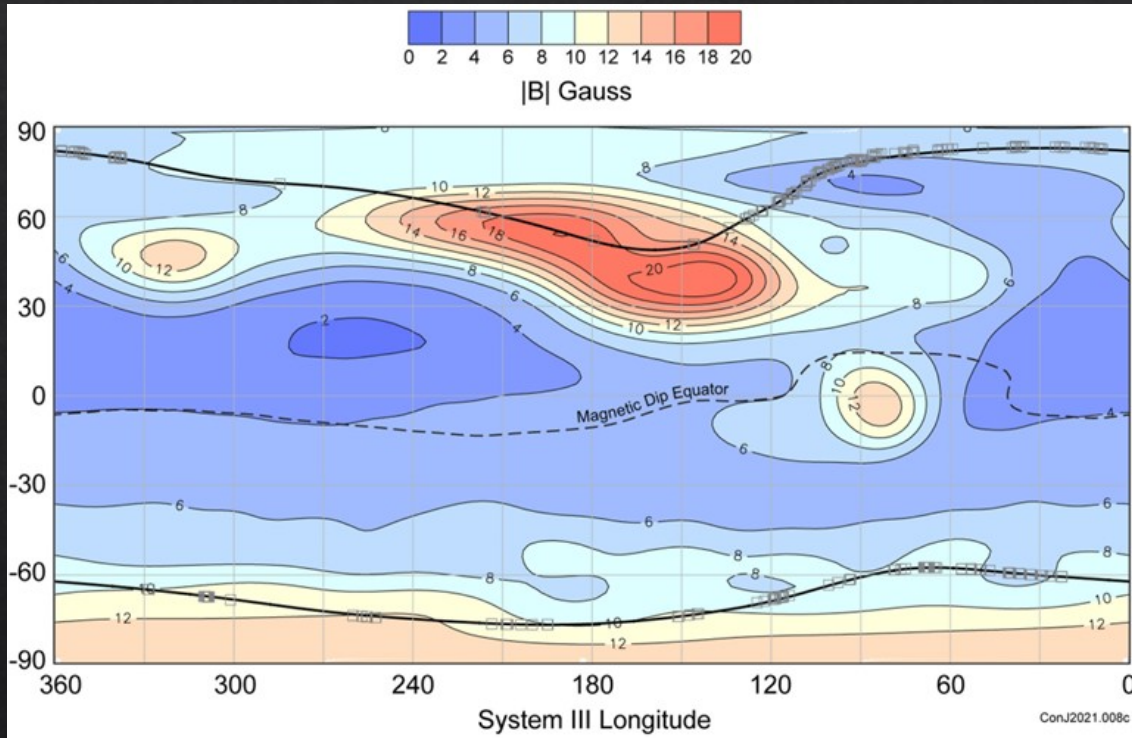


Magnetic field measurements by JUNO (2018)

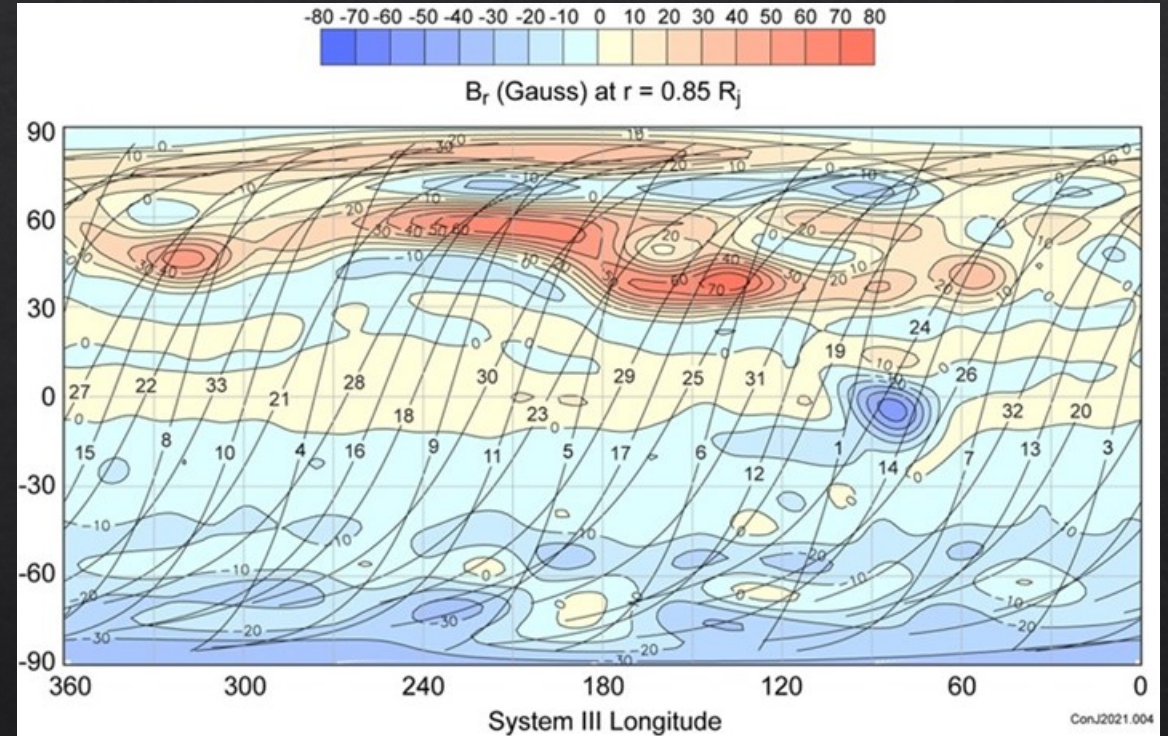
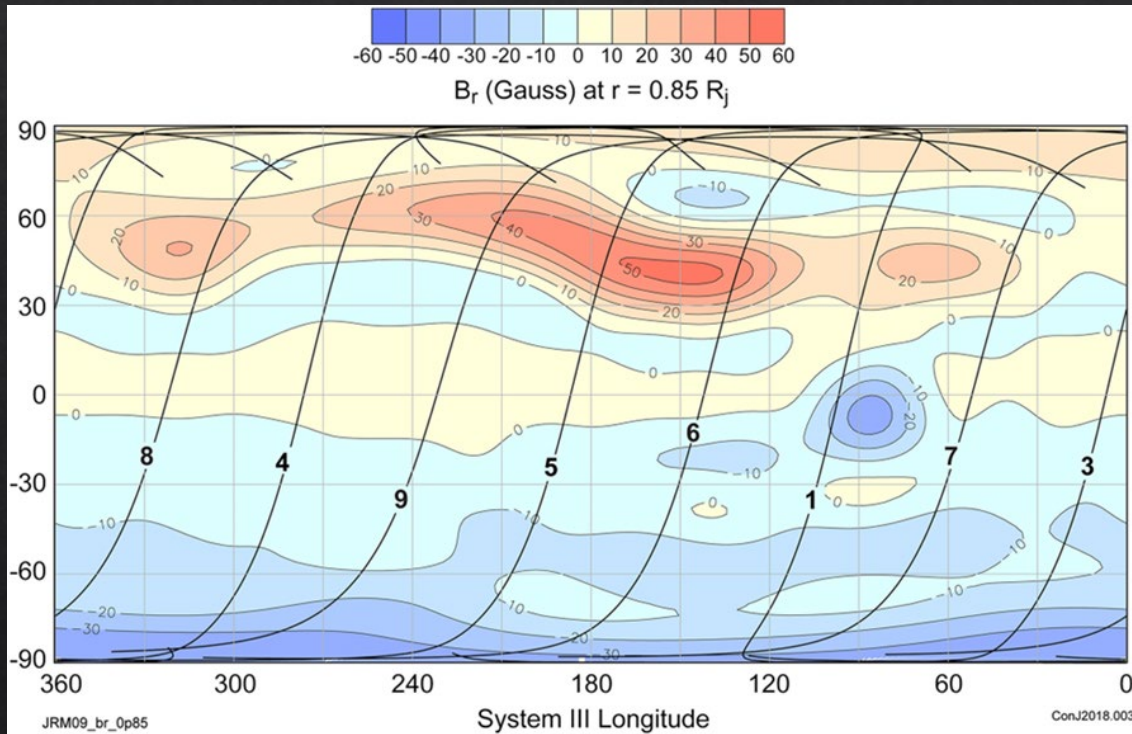


1 Gauss = 100 μT

Magnetic field measurements by JUNO (2021)



Measurement comparison (2018 vs 2021)



Conclusion

- ◇ Jupiter and its magnetic field are very large structures
- ◇ Io is a great contributor to Jupiter's magnetic field strength
- ◇ Higher resolution measurements allow for proper mapping of the field



Sources

- ◇ [A New Model of Jupiter's Magnetic Field From Juno's First Nine Orbits](#)
(J. E. P. Connerney - 2018)
- ◇ [A New Model of Jupiter's Magnetic Field at the Completion of Juno's Prime Mission](#)
(J. E. P. Connerney - 2021)
- ◇ [NASA images from JUNO](#)