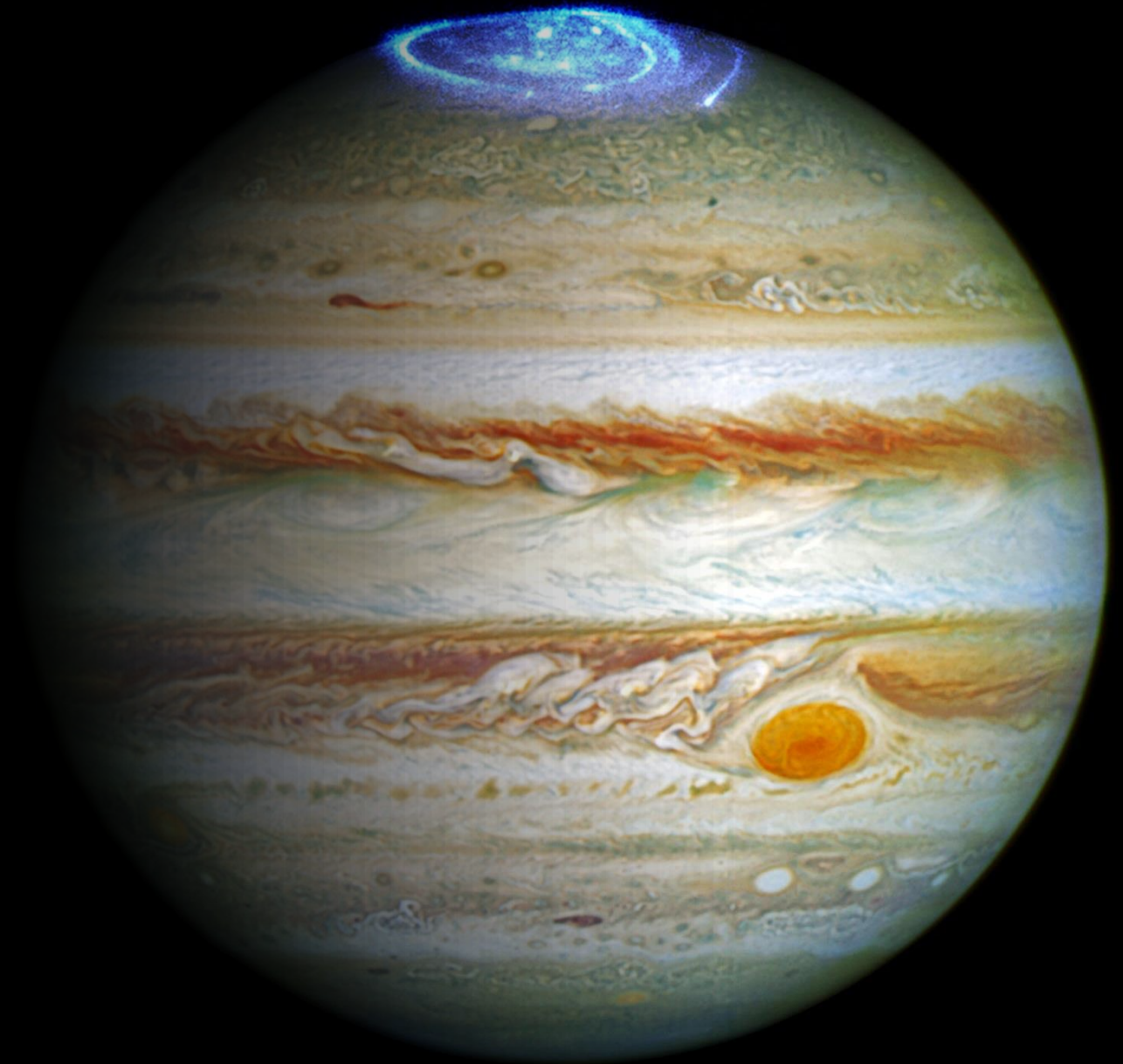


Auroras at other planets

Lena Mielke



Content

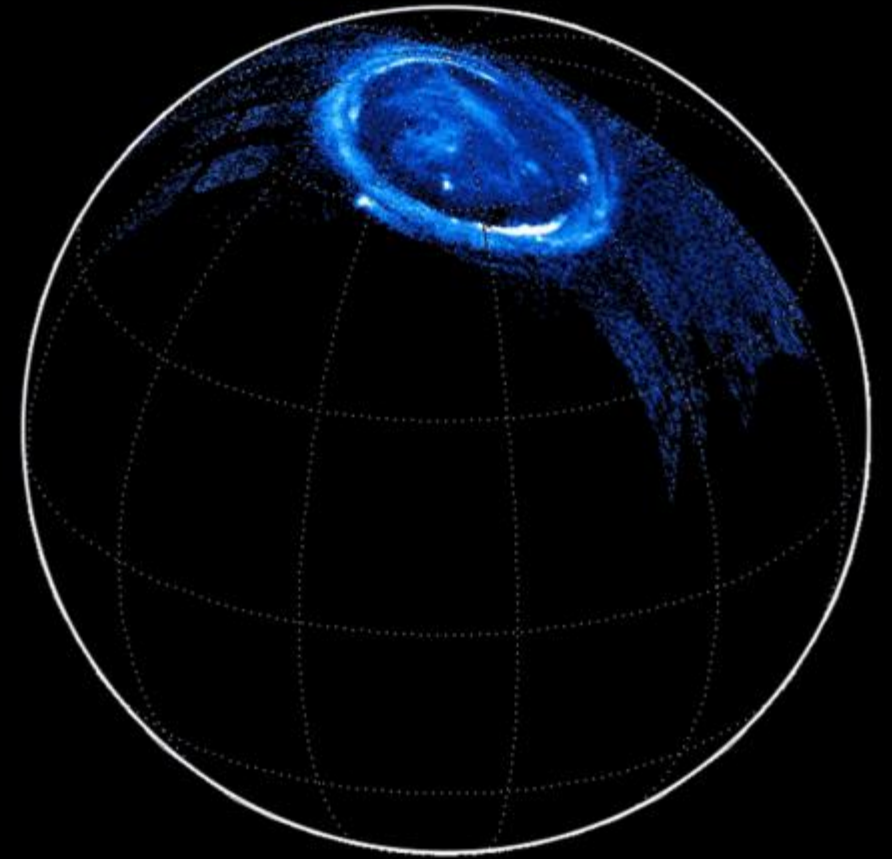
- Background
- Jupiter
- Saturn
- Uranus
- Special Case – Mars
- Ganymede
- Outside our solar system
- References

Background

- Auroras occur on all planets with a strong intrinsic magnetic field and an atmosphere
- Atmosphere needed so that charged particles can interact
- Magnetic field needed for leading charged particles to the atmosphere

Jupiter

- Jupiter's auroras are permanent
- Intensity varies
- Up to 30 times more powerful than on Earth
- Magnetic field



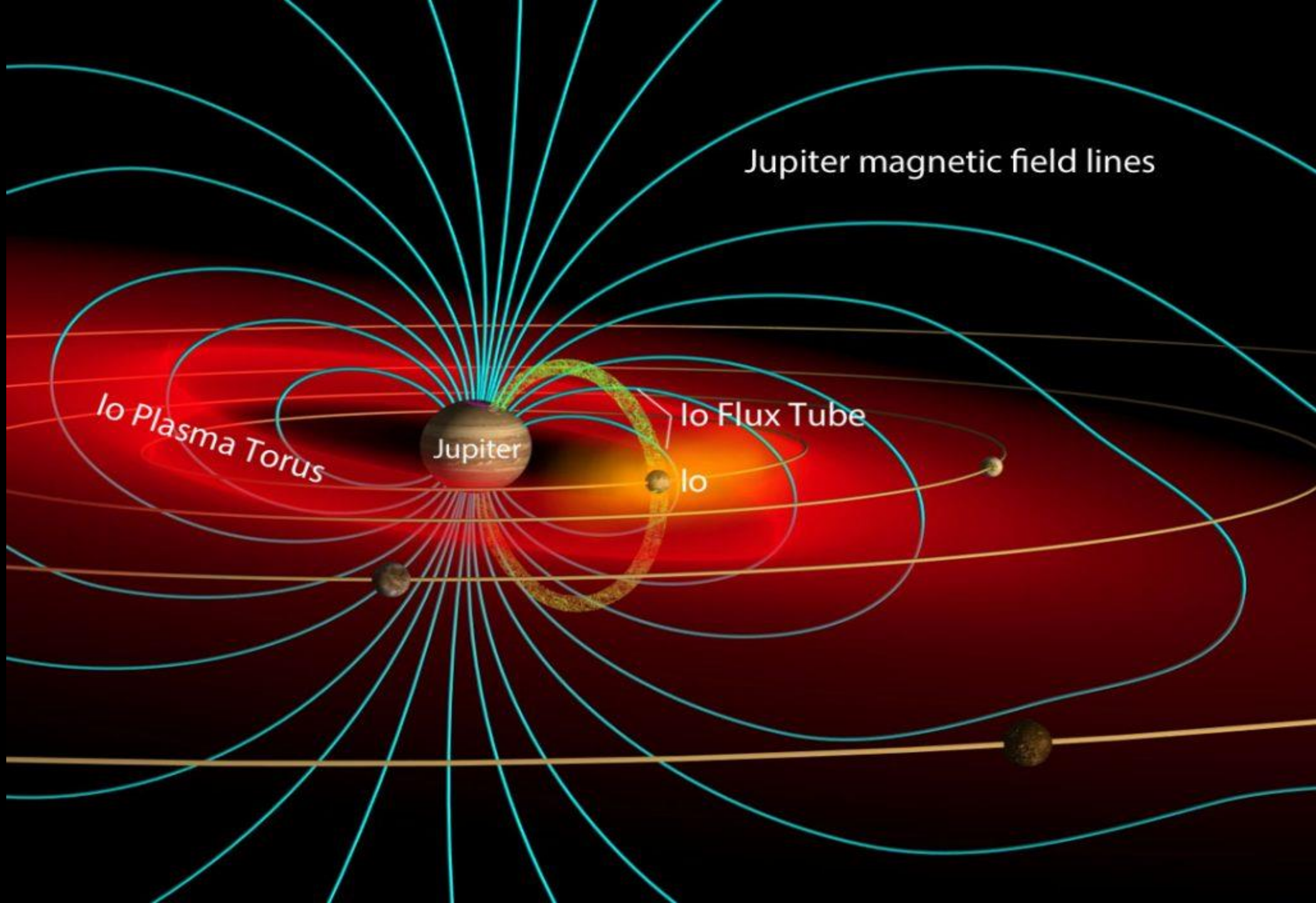
Jupiter magnetic field lines

Io Plasma Torus

Jupiter

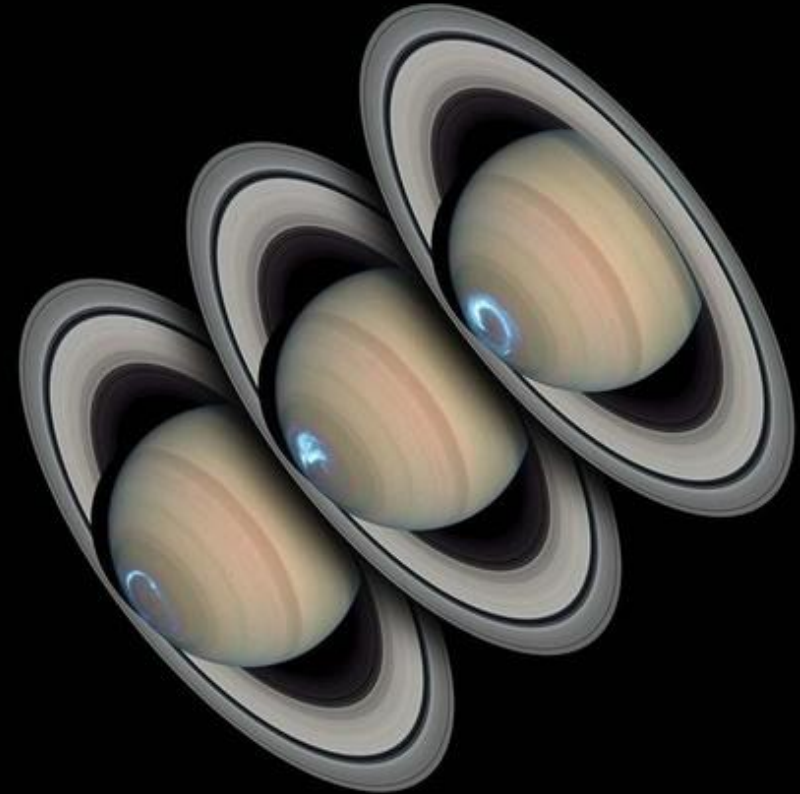
Io Flux Tube

Io



Saturn

- Saturn emits radio waves every 11 hours from the poles
 - Timing changed
 - What is causing that?
 - Radio wave emissions are linked to auroras
- Influence of Sun



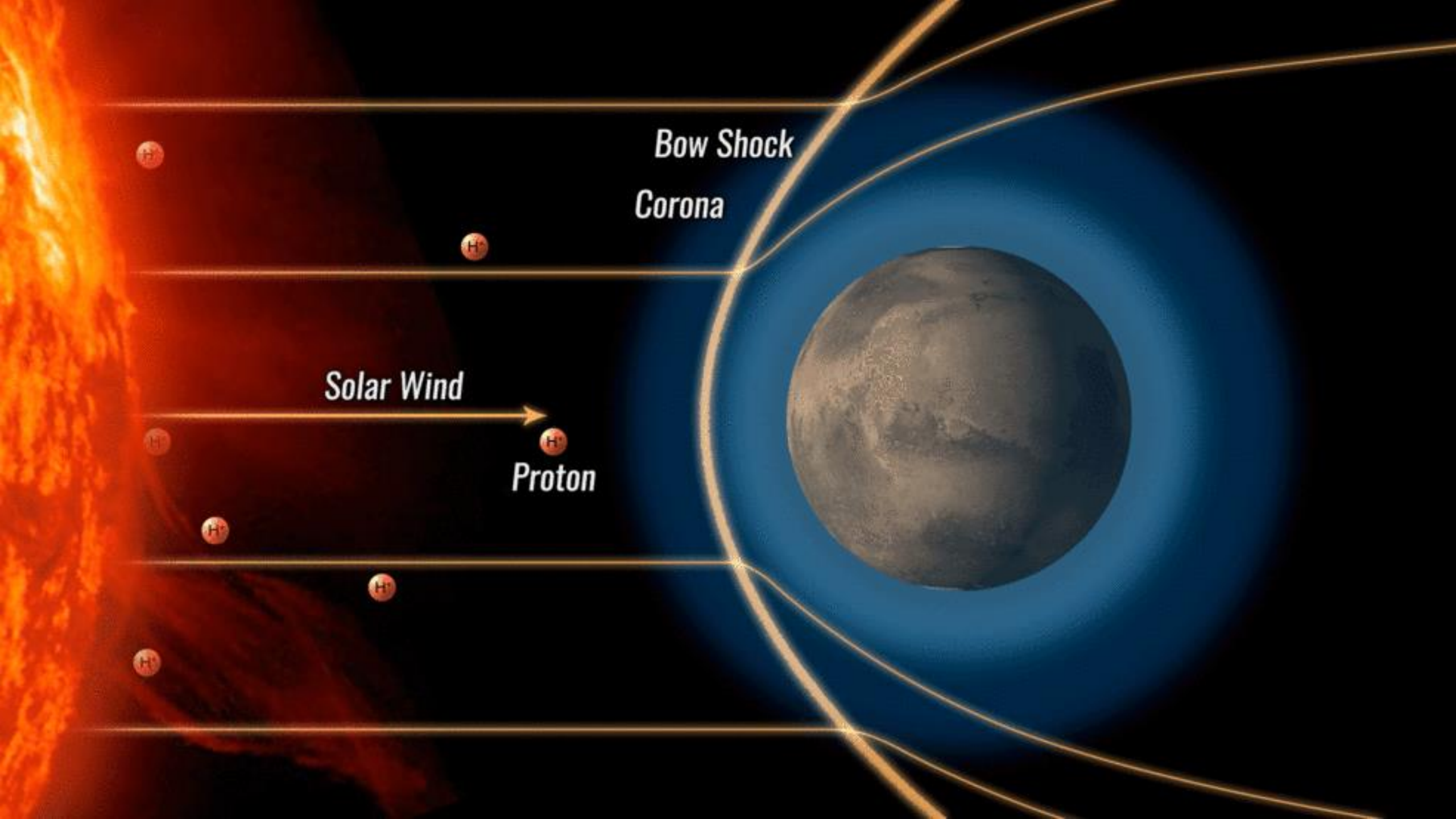
Uranus

- Magnetic axis is 60 degrees off from spin axis
- Spin axis is tilted by 98 degrees relative to solar systems plane
→ Uranus rolls on its orbit
- Auroras are from short duration



Special Case – Mars

- No intrinsic magnetic field
- Interaction of solar wind with atmosphere
→ Magnetosphere
- Charge Exchange is causing proton aurora on dayside of Mars



Bow Shock

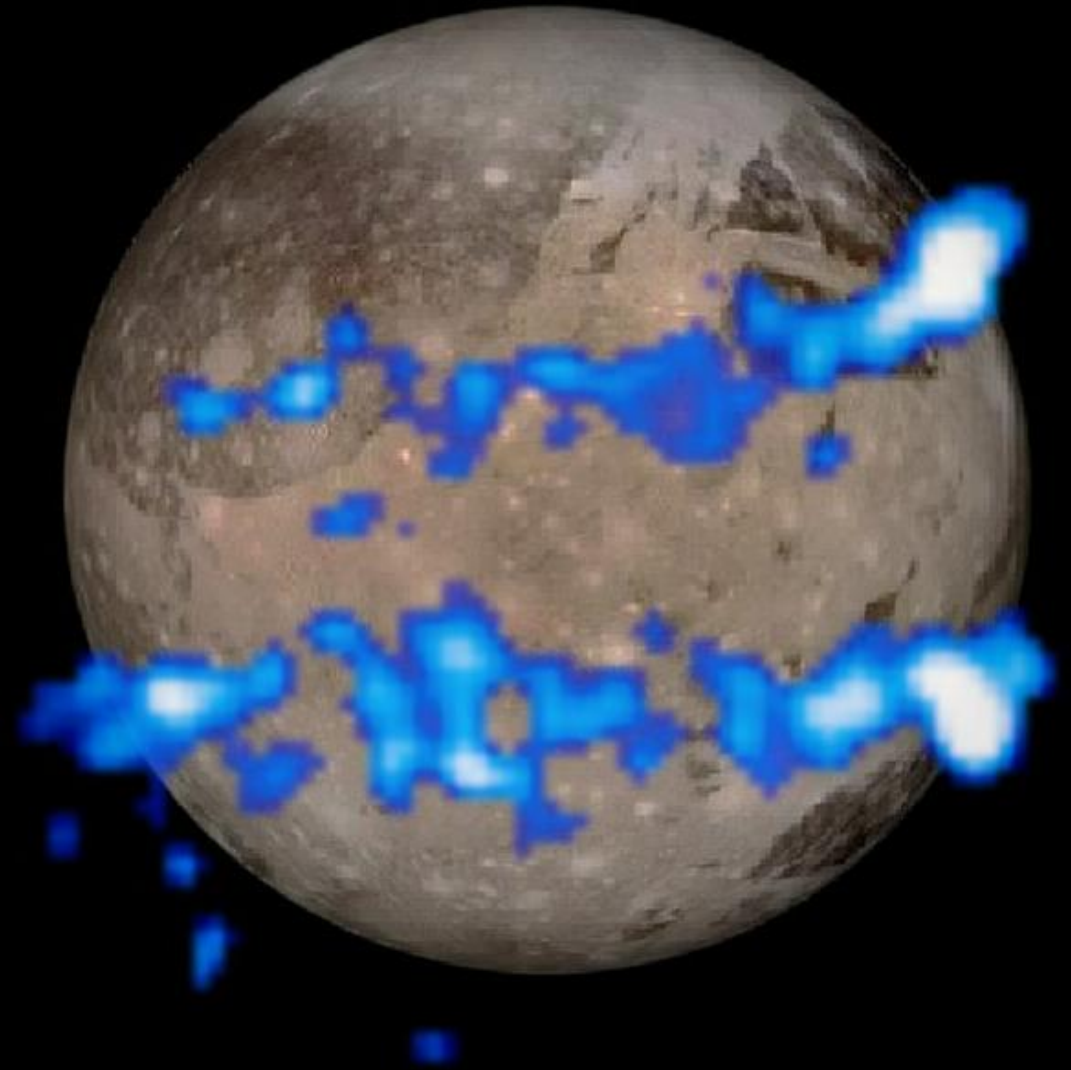
Corona

Solar Wind

Proton

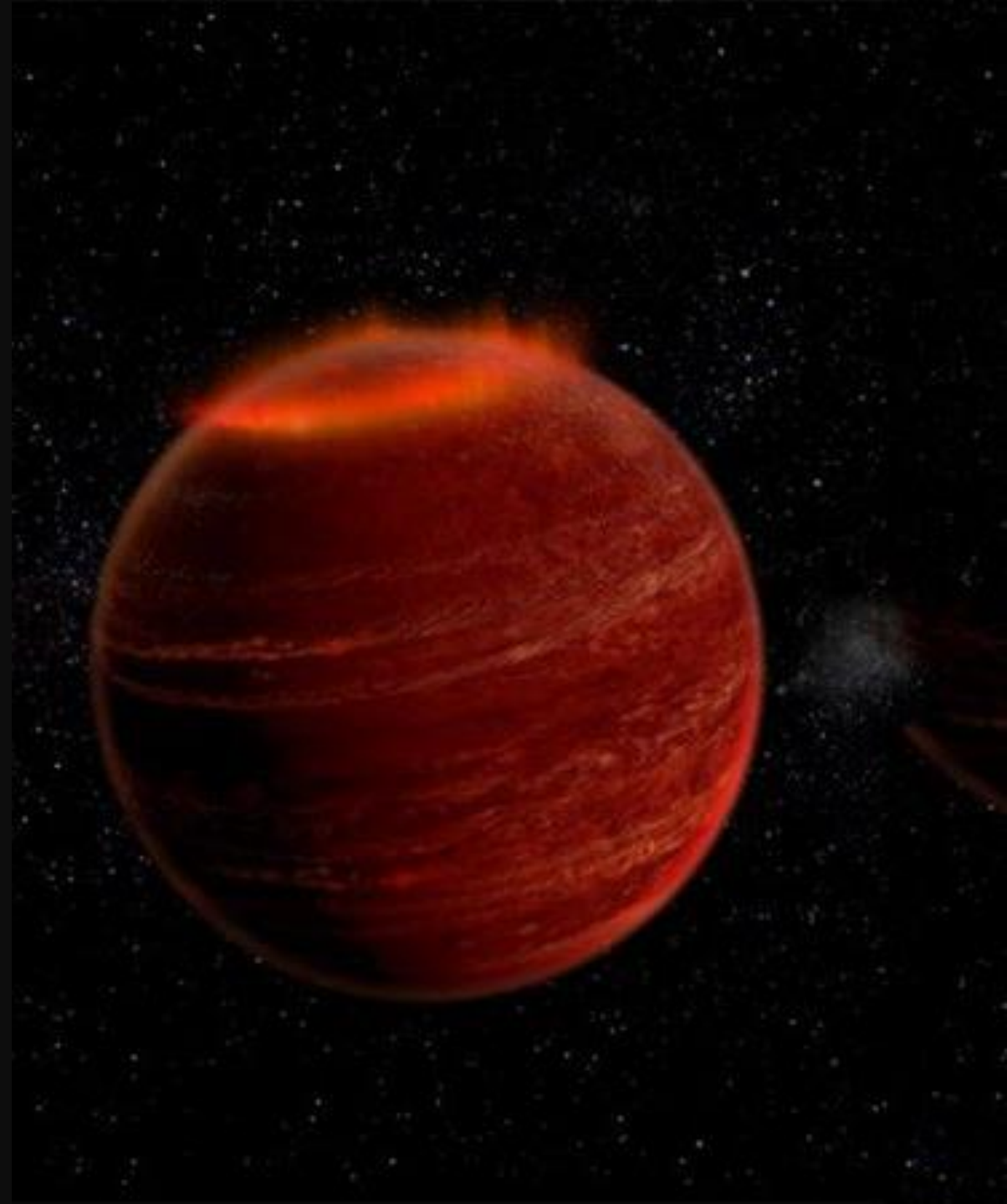
Ganymede

- Largest moon in our solar system
- Ice crust, iron core
- Own Magnetic field
- Auroras in UV and red
- Studying the auroras revealed evidence about the ocean



Brown dwarf

- First time auroras were found outside our solar system
- Not planet and not star
- J1835:
 - size of Jupiter
 - 80 times its mass
- Powerful red auroras
- Not caused by solar wind



Summary

- Auroras are occurring also on other planets
- Process is mostly like Earth
- But there are also differences
- A lot of potential for future investigations

References [1]

- https://en.wikipedia.org/wiki/Magnetosphere_of_Jupiter#Aurorae
- <https://www.wired.com/story/jupiters-auroras-defy-the-laws-of-earthly-physics/amp>
- <https://solarsystem.nasa.gov/moons/jupiter-moons/ganymede/in-depth/#:~:text=Ganymede%20is%20the%20largest%20moon%20in%20our%20solar,and%20grooves%20that%20slice%20across%20older%20C%20darker%20terrains>
- <https://www.nasa.gov/press-release/goddard/2018/mars-proton-aurora>
- https://aurorareykjavik.is/2020/07/13/auroras_on_other_planets/
- <https://www.nasa.gov/jpl/powerful-auroras-found-at-brown-dwarf>
- <https://www.skyatnightmagazine.com/news/aurora-discovered-over-brown-dwarf/>
- <https://www.pbs.org/wgbh/nova/article/vivid-extrasolar-aurora-solves-astronomical-mystery/>
- <https://www.nationalgeographic.com/science/article/hubble-auroras-buried-ocean-ganymede>

References [2]

- <https://www.skyatnightmagazine.com/space-science/what-do-aurora-look-like-on-other-planets/>
- <https://www.nationalgeographic.com/science/article/120413-uranus-auroras-science-space-hubble>
- <https://www.space.com/8882-saturn-aurora-heartbeat-discovered.html>
- <https://www.space.com/11205-saturn-strange-radio-signals-cassini.html>
- <https://www.nasa.gov/feature/jpl/jupiter-s-aurora-presents-a-powerful-mystery>
- <https://futurism.com/a-new-job-for-juno-astronomers-want-to-explore-ios-volcanoes>

Thank You!

