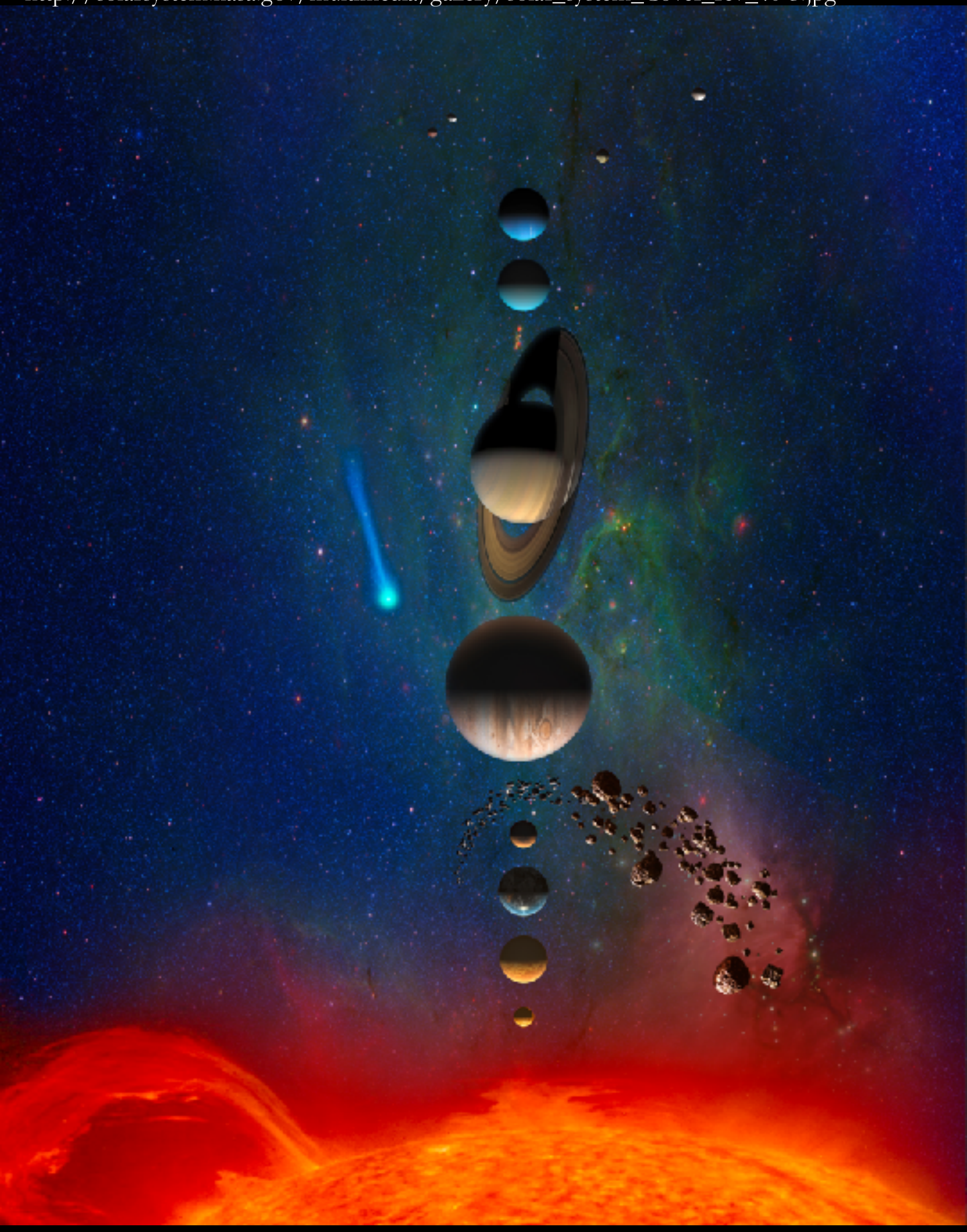
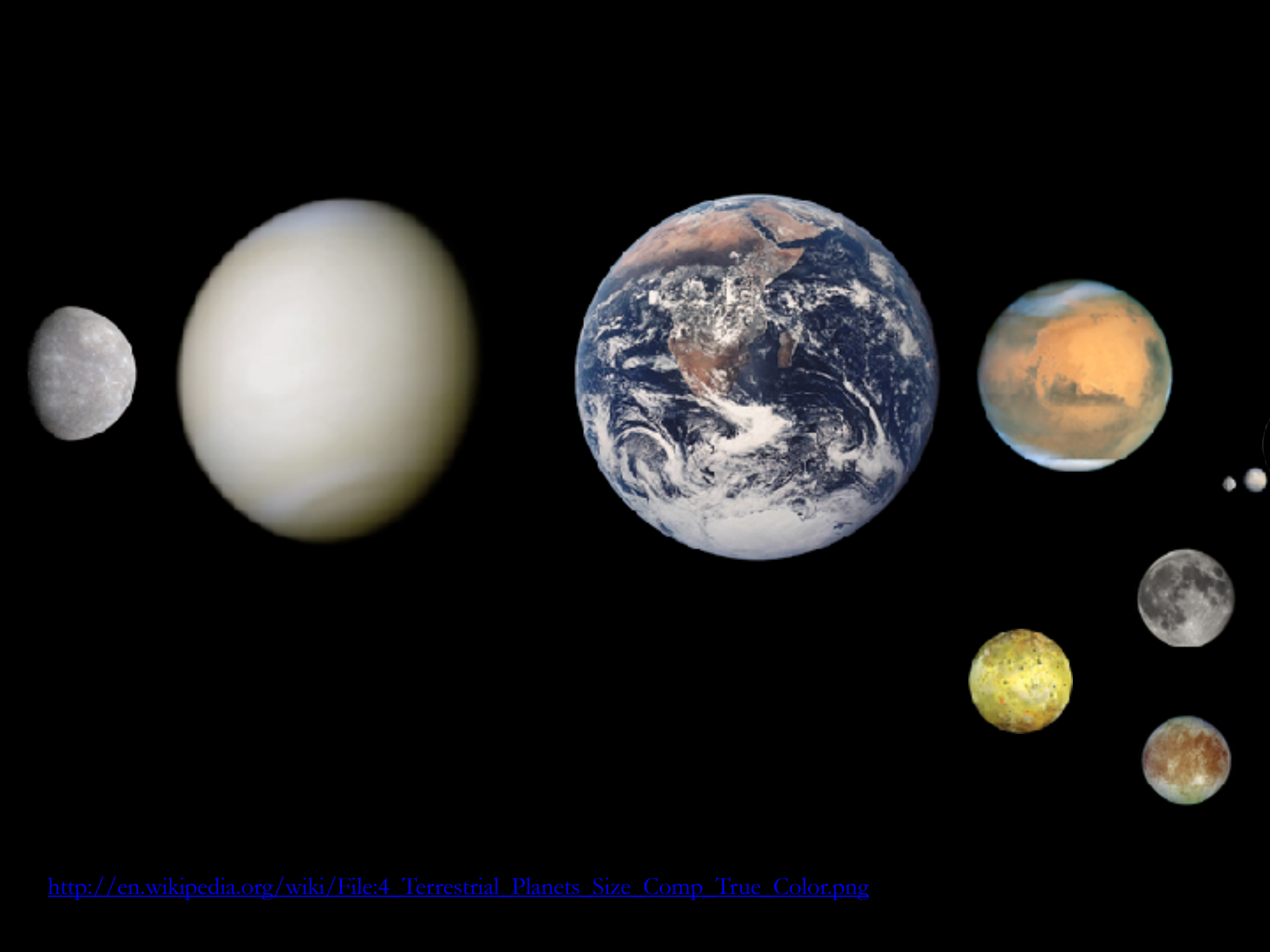
Chapter 04 — Overview of the Solar System

- terrestrial planets
- asteroids and giant planets
- major moons, medium moons
- Pluto & dwarf planets, Centaurs, TNOs
- comets, dust, meteorites

http://solarsystem.nasa.gov/multimedia/gallery/solar_system_Cover_rev_40-3.jpg

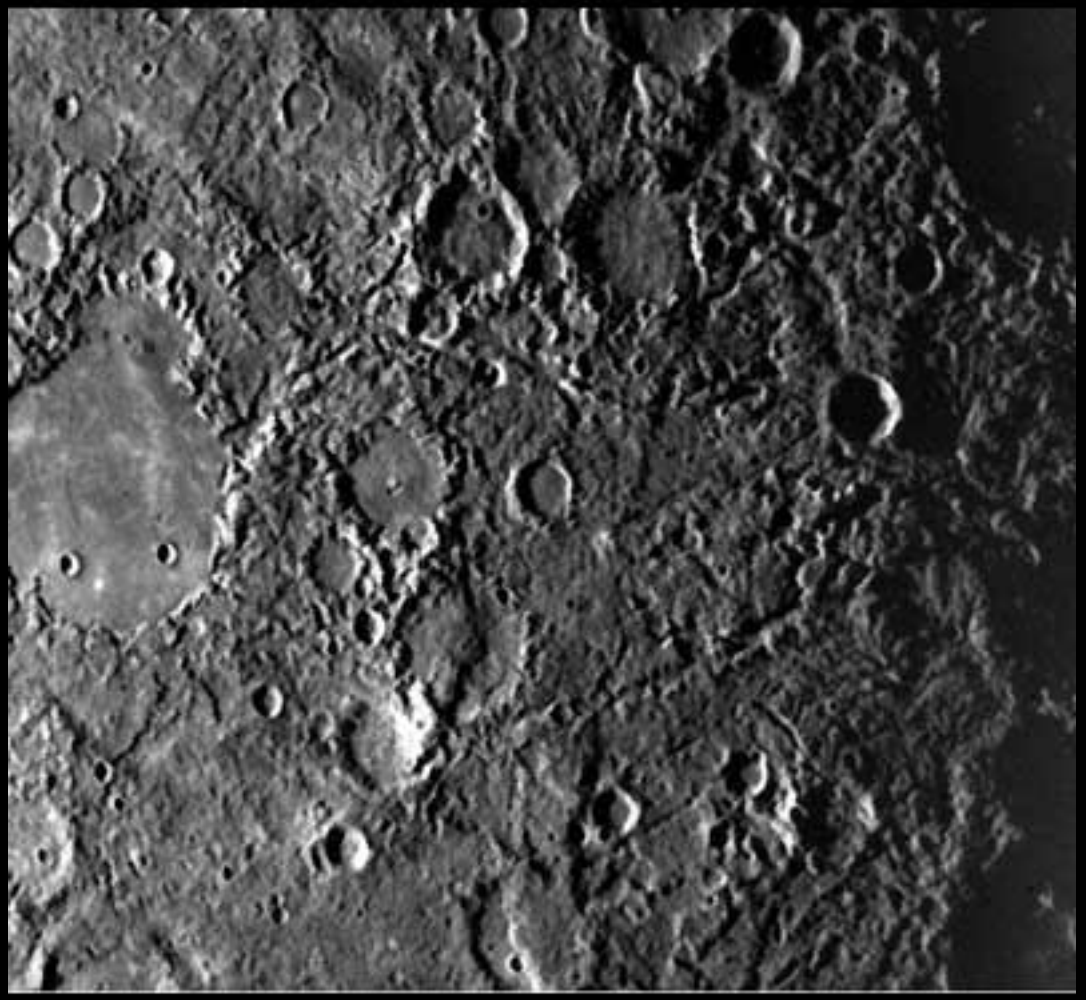




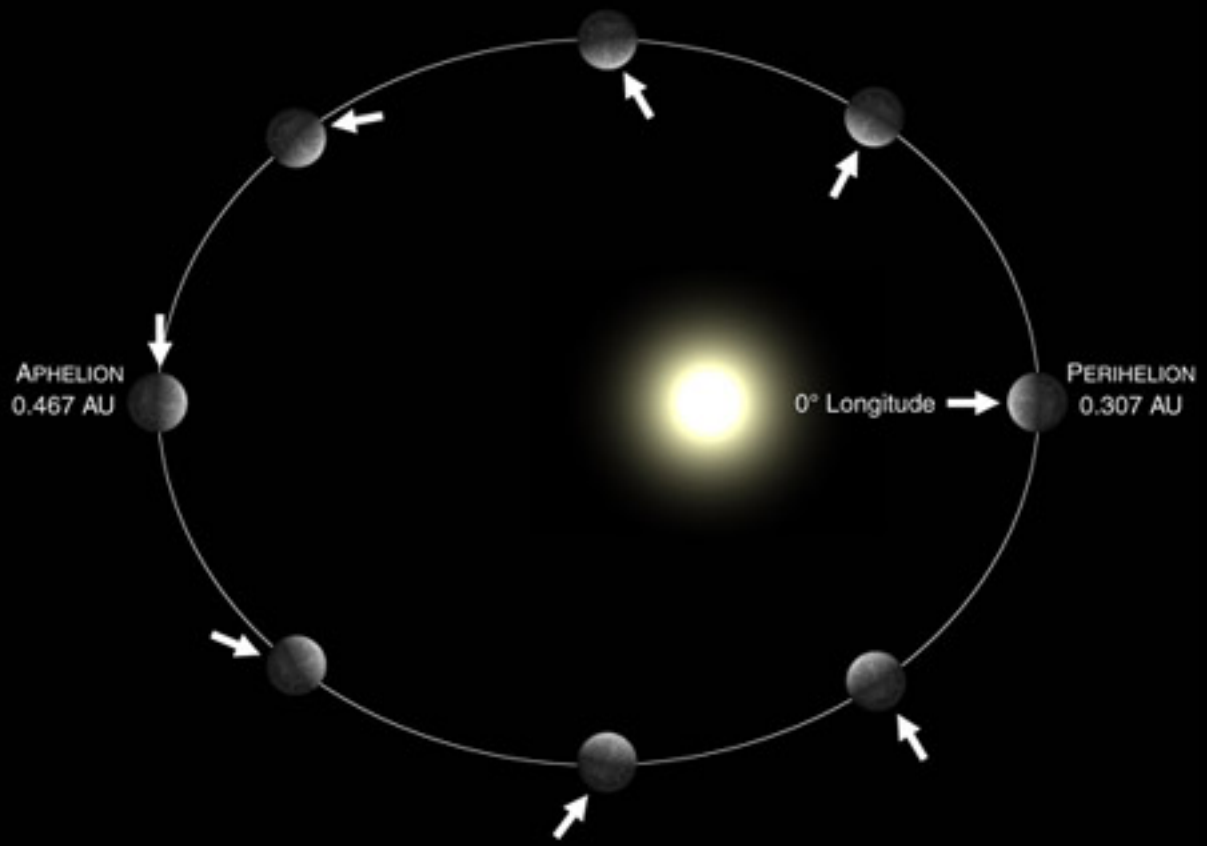
http://en.wikipedia.org/wiki/File:4_Terrestrial_Planets_Size_Comp_True_Color.png

MESSENGER spacecraft 2008

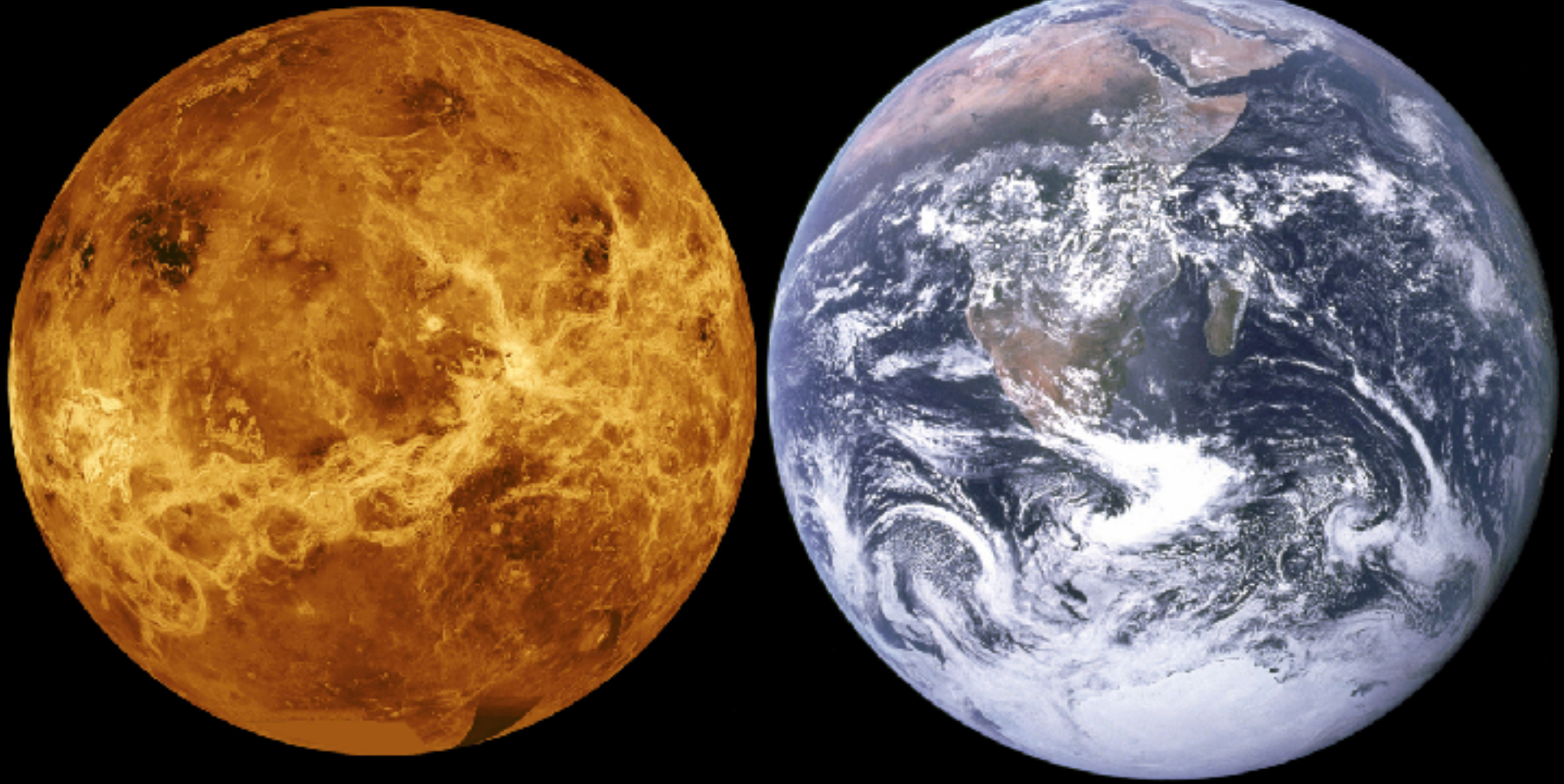
http://photojournal.jpl.nasa.gov/jpegMod/PIA19213_modest.jpg



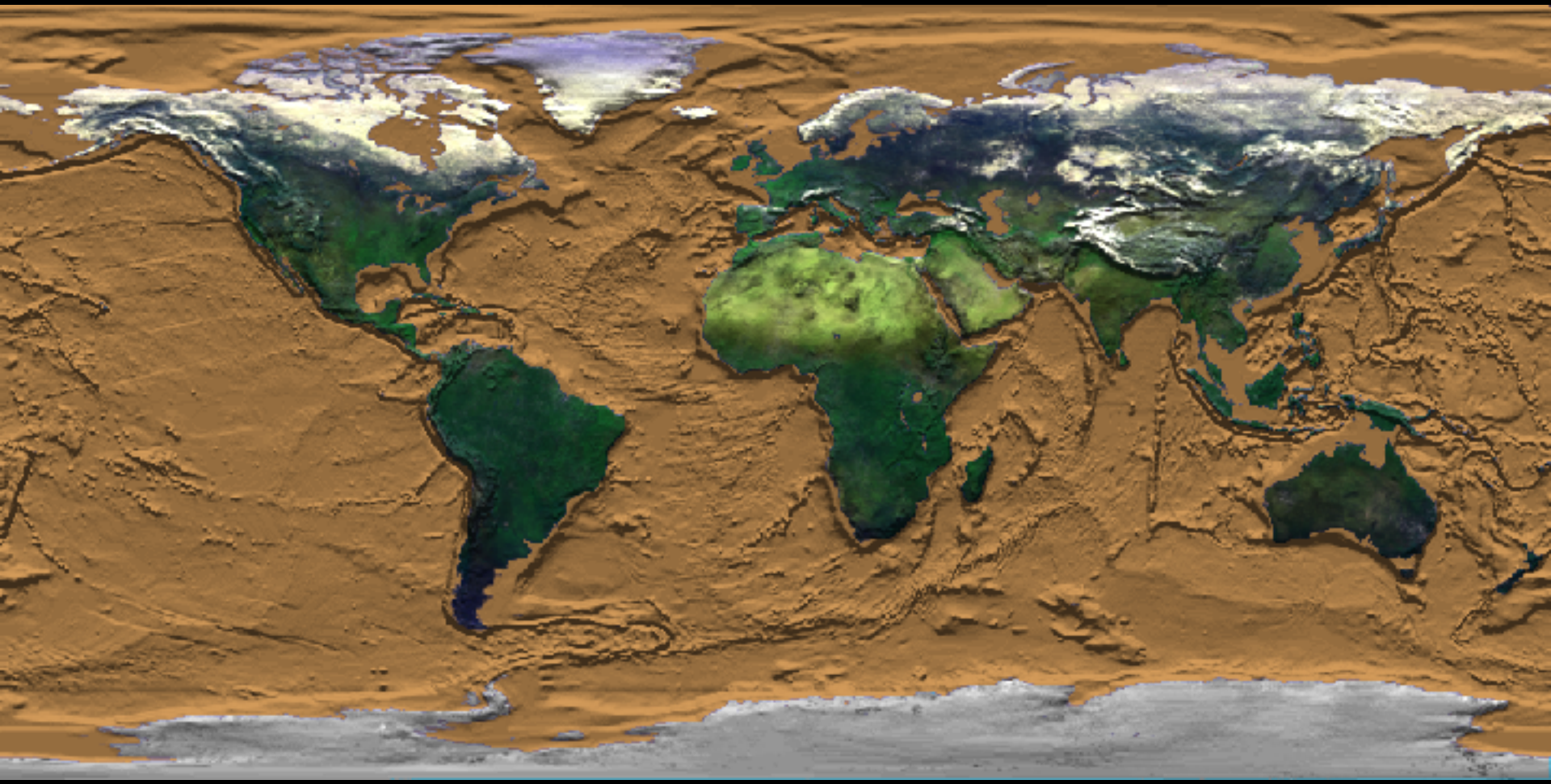
https://pds.jpl.nasa.gov/planets/captions/mercury/mercter.htm



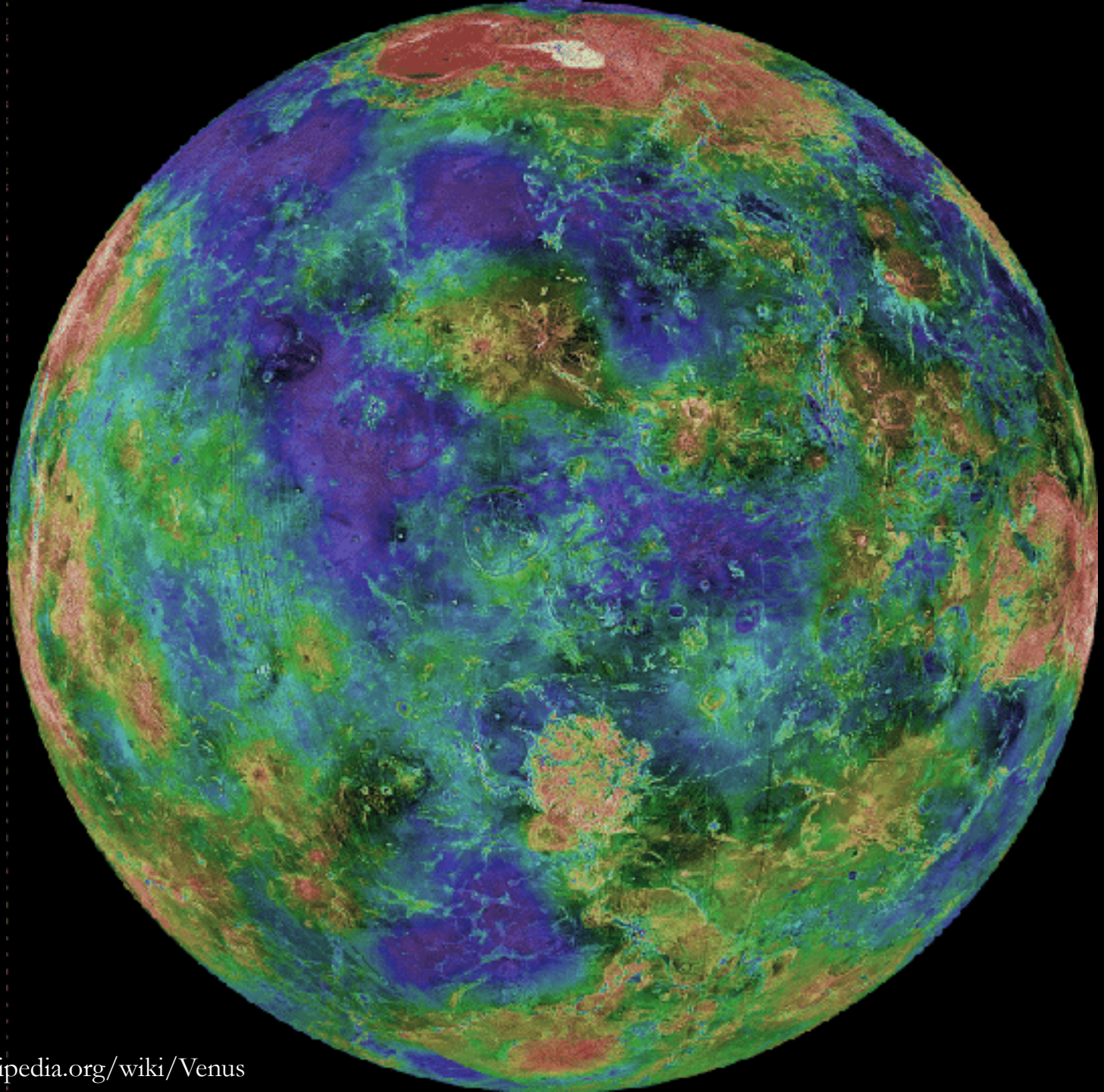
http://diviner.ucla.edu/mercury/posters/Poster-03/poster-03.html



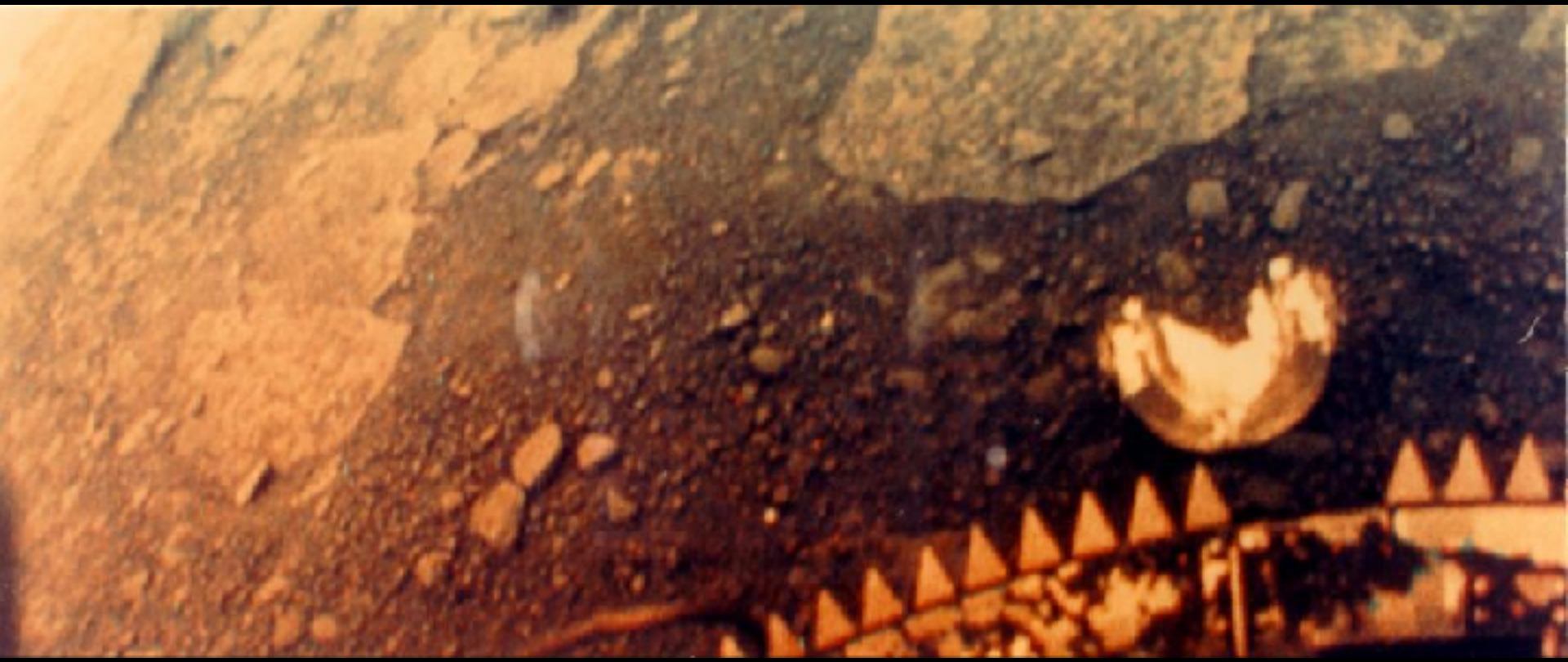
https://en.wikipedia.org/wiki/Venus



http://svs.gsfc.nasa.gov/vis/a000000/a002900/a002953/



https://en.wikipedia.org/wiki/Venus



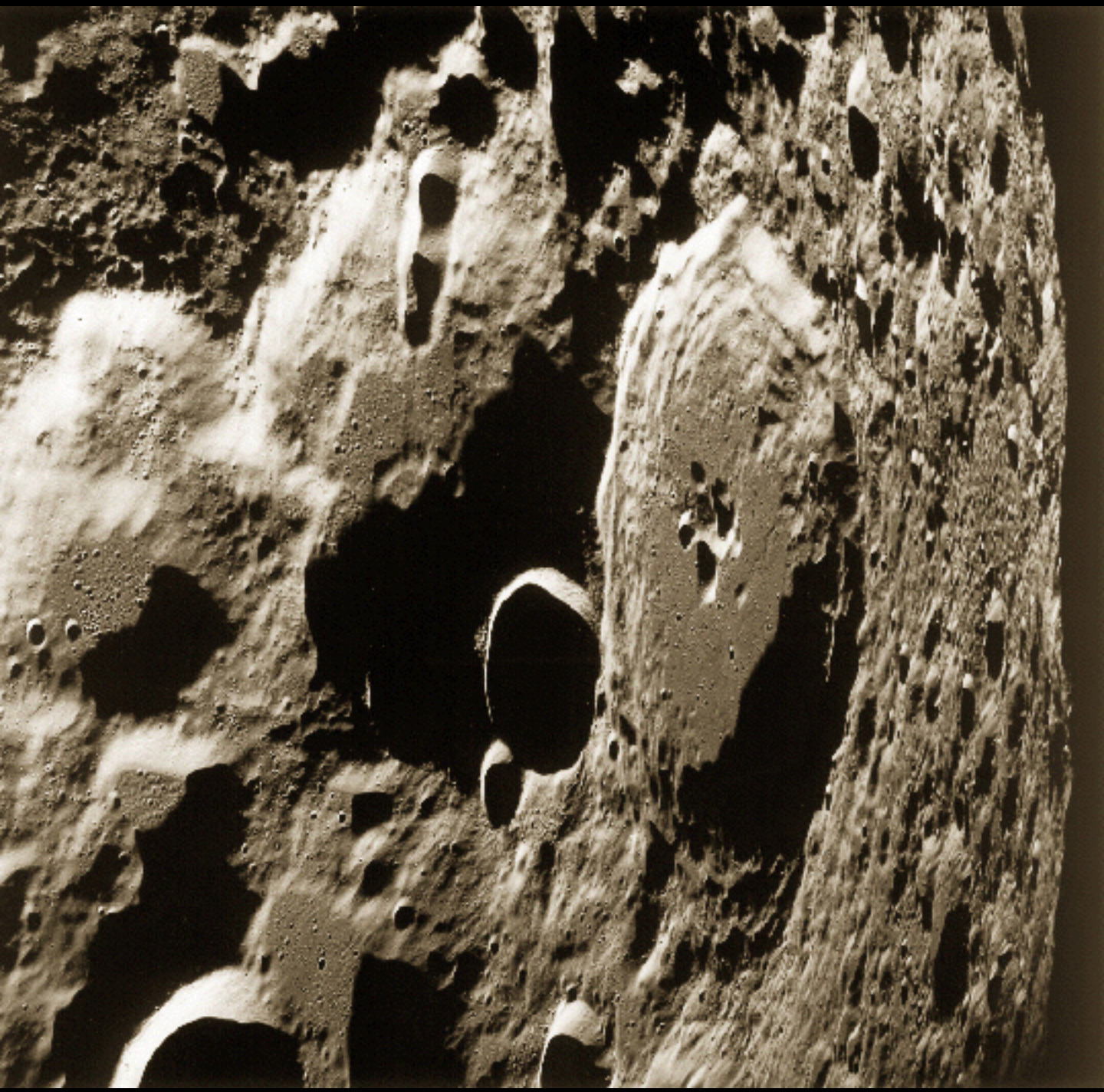
http://en.wikipedia.org/wiki/File:Venera_13_-_venera13-left.jpg

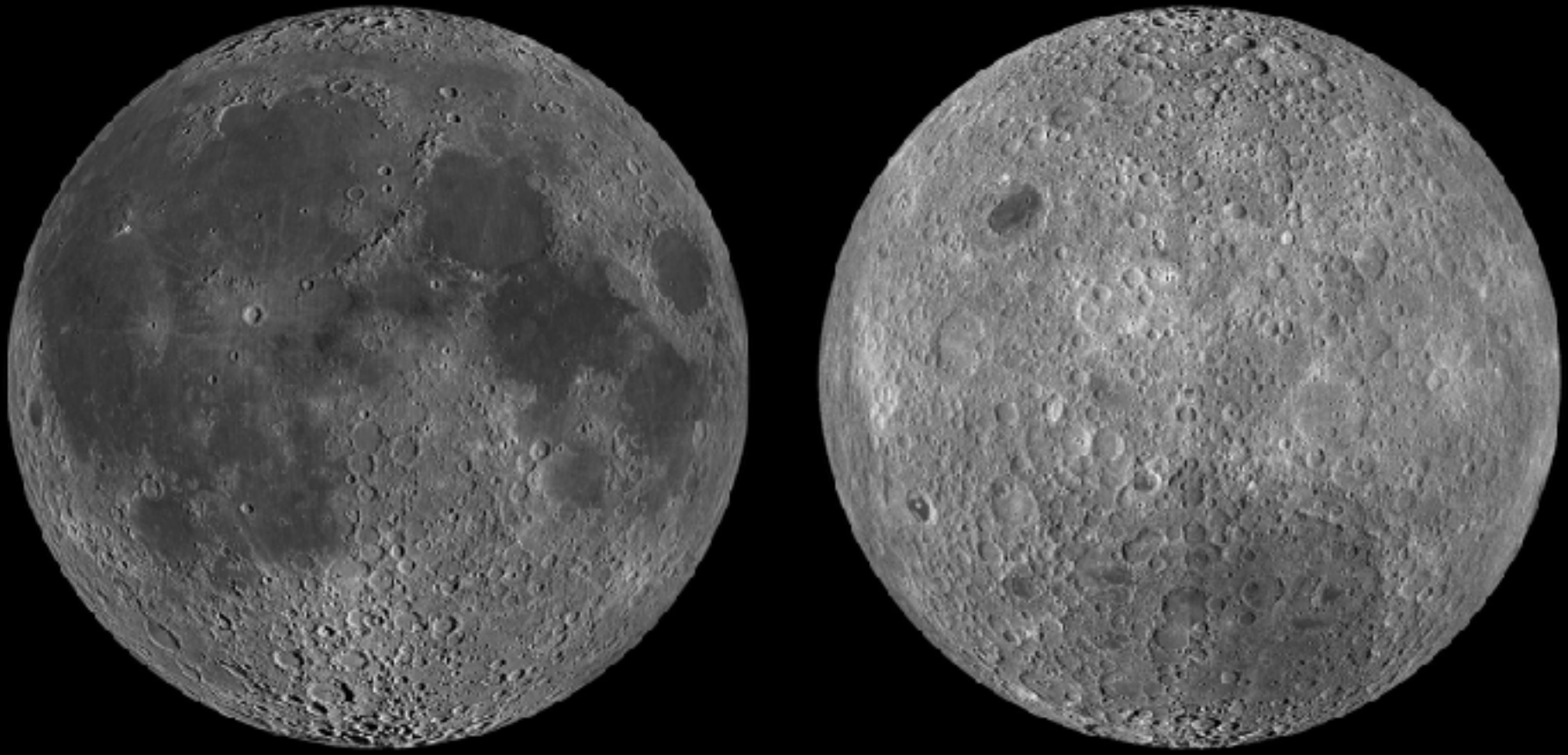
http://science.nasa.gov/media/medialibrary/
2005/10/02/04oct_leonardo_resources/AS11-44-6551.jpg

http://photojournal.jpl.nasa.gov/jpeg/PIA00134.jpg

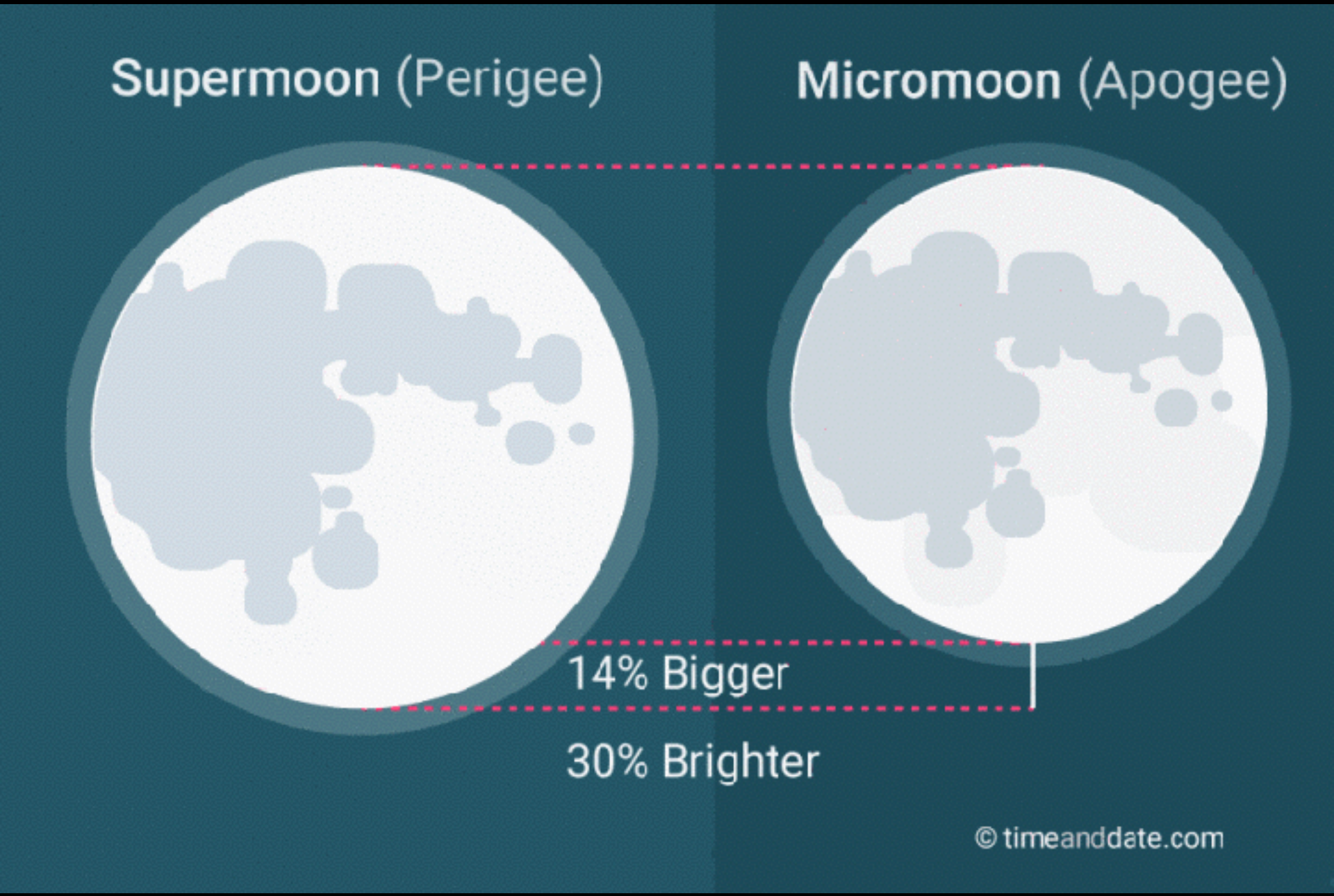
http://apod.nasa.gov/apod/image/1304/LunarEclipsesVinyaminov.jpg

Apollo 11 image of Daedalus, 93 km diameter, lunar far side.
http://en.wikipedia.org/wiki/File:Moon-craters.jpg





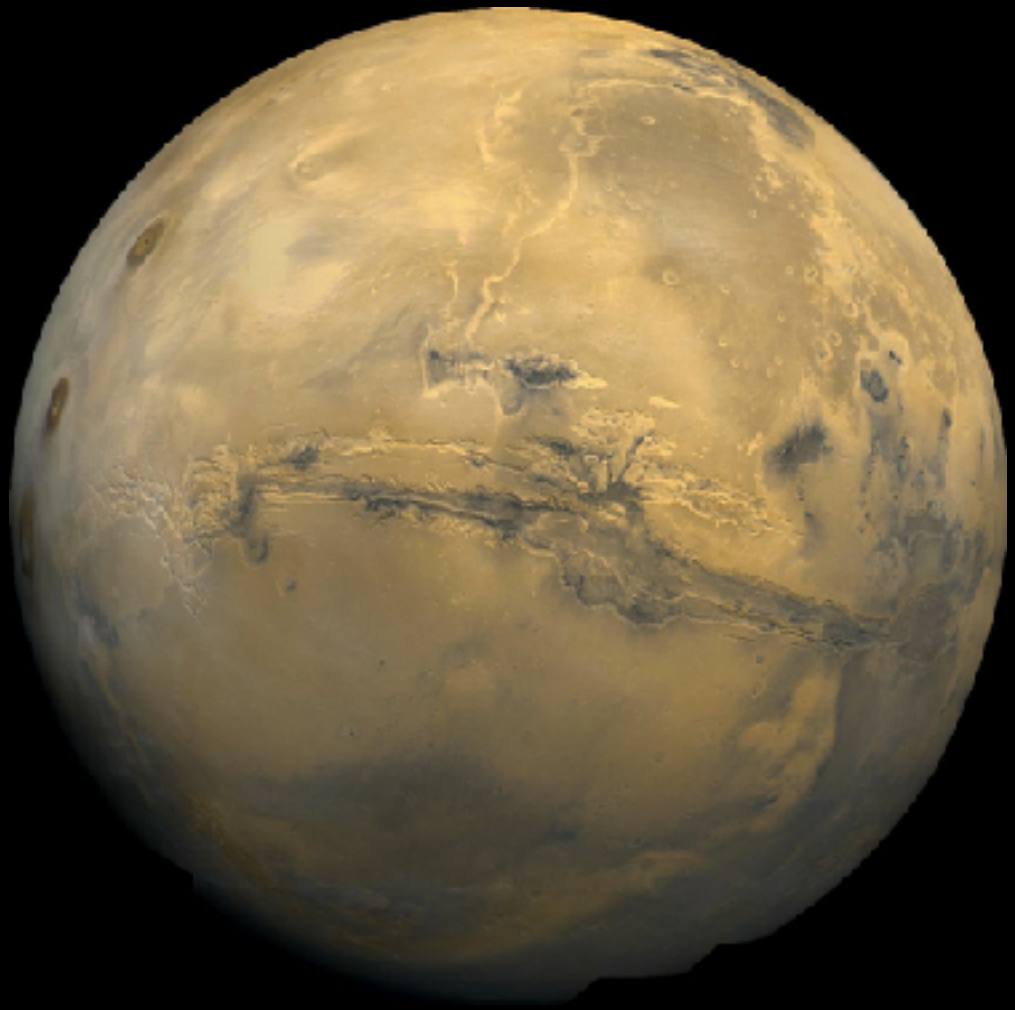
https://astrobiology.nasa.gov/media/medialibrary/2014/06/nearside_NASA.jpg



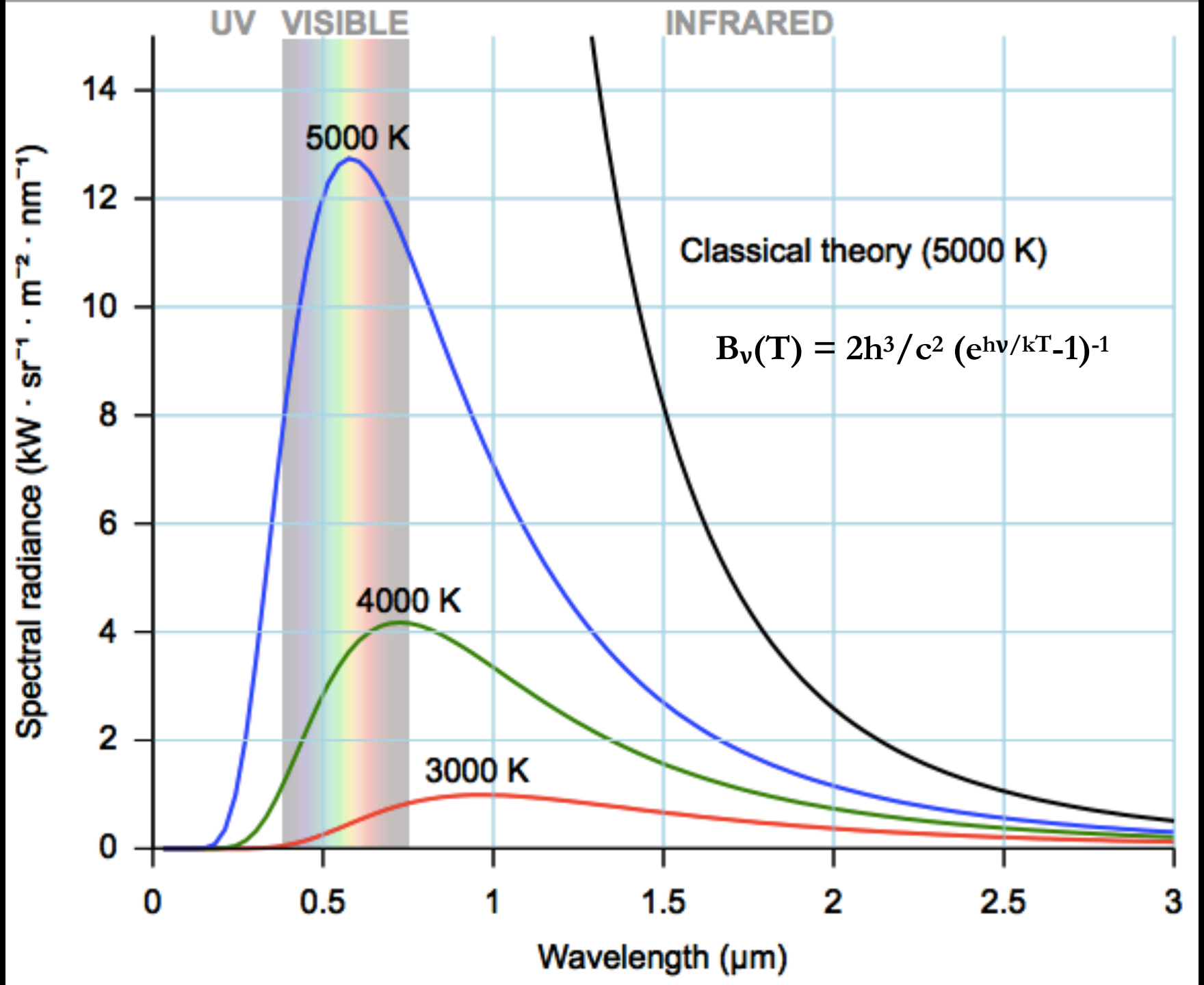
https://www.timeanddate.com/astronomy/moon/lunar-perigee-apogee.html

Fluxes drop as r^{-2} : $F(r)=L/4\pi r^2$ = ? for the solar flux at Earth?

So an average Mars distance of 1.52 AU means that, compared to Earth the flux received at Mars is only $r_{Earth}^2 / r_{Mars}^2 = 0.43$



http://apod.nasa.gov/apod/ap140511.html


UV
VISIBLE
INFRARED
5000 K
4000 K
3000 K
Classical theory (5000 K)
$B_\nu(T) = 2h^3/c^2\ (e^{h\nu/kT}-1)^{-1}$
Spectral radiance (kW · sr⁻¹ · m⁻² · nm⁻¹)
Wavelength (μm)
0
2
4
6
8
10
12
14
0
0.5
1
1.5
2
2.5
3

Wien's Law shows how the peak of the blackbody spectrum depends on wavelength and temperature:

$$\lambda_{max}(\text{cm})\ T(\text{K}) = 0.29$$

Challenge #1

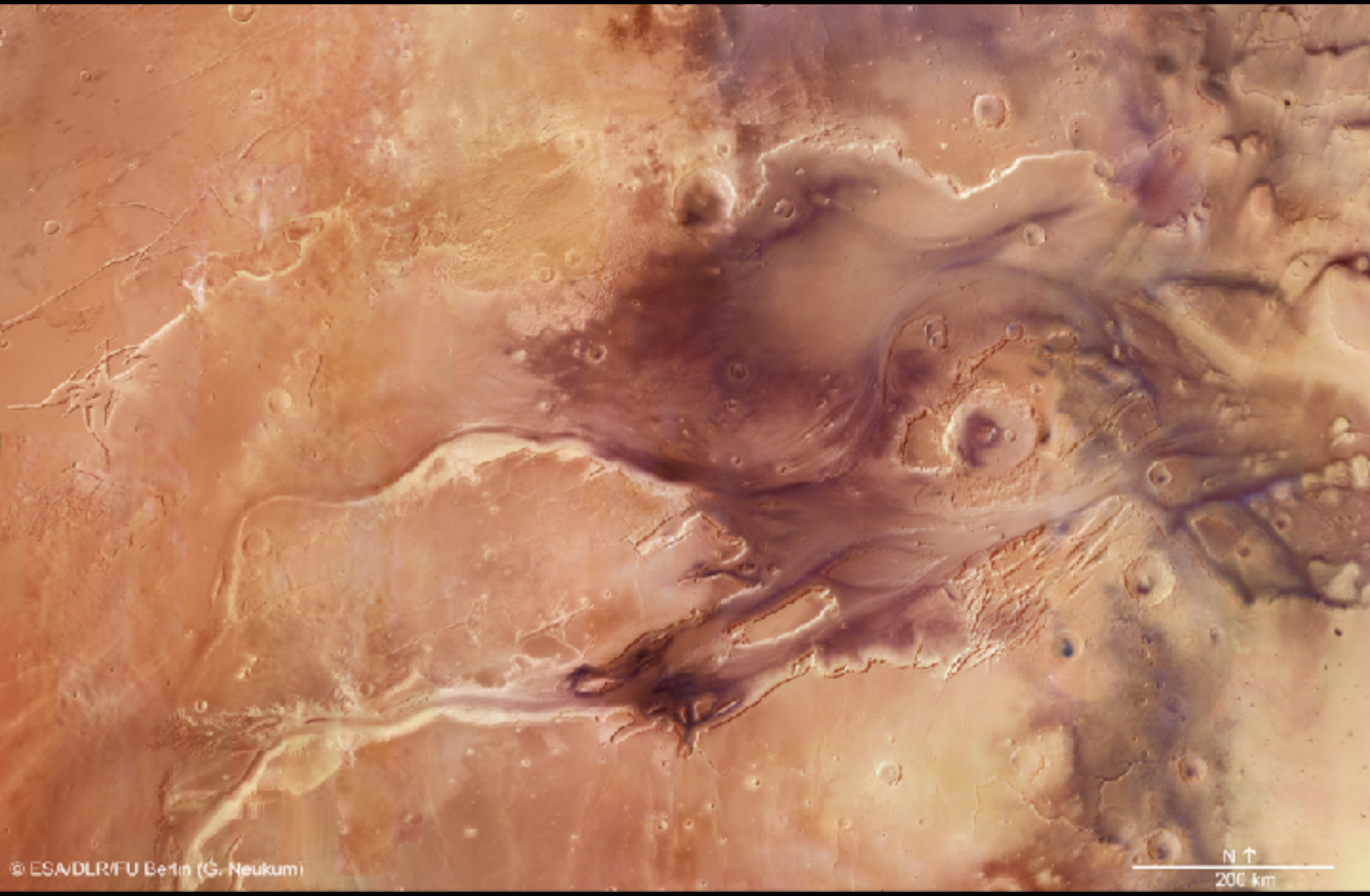
At what wavelength does our favorite star, the M dwarf, have its spectrum peak? Look up the photospheric temperature of an M dwarf, and use the PhET simulator Blackbody Spectrum to determine the answer. Compare with the prediction based on Wien's Law.

Challenge #2

How does the peak wavelength of the M dwarf compare to the peak wavelength of an incandescent light bulb? Grab a laptop and a spectrometer!

http://nssdc.gsfc.nasa.gov/image/hi-res/planetary/mars/olympus_mons.tiff

Olympus Mons

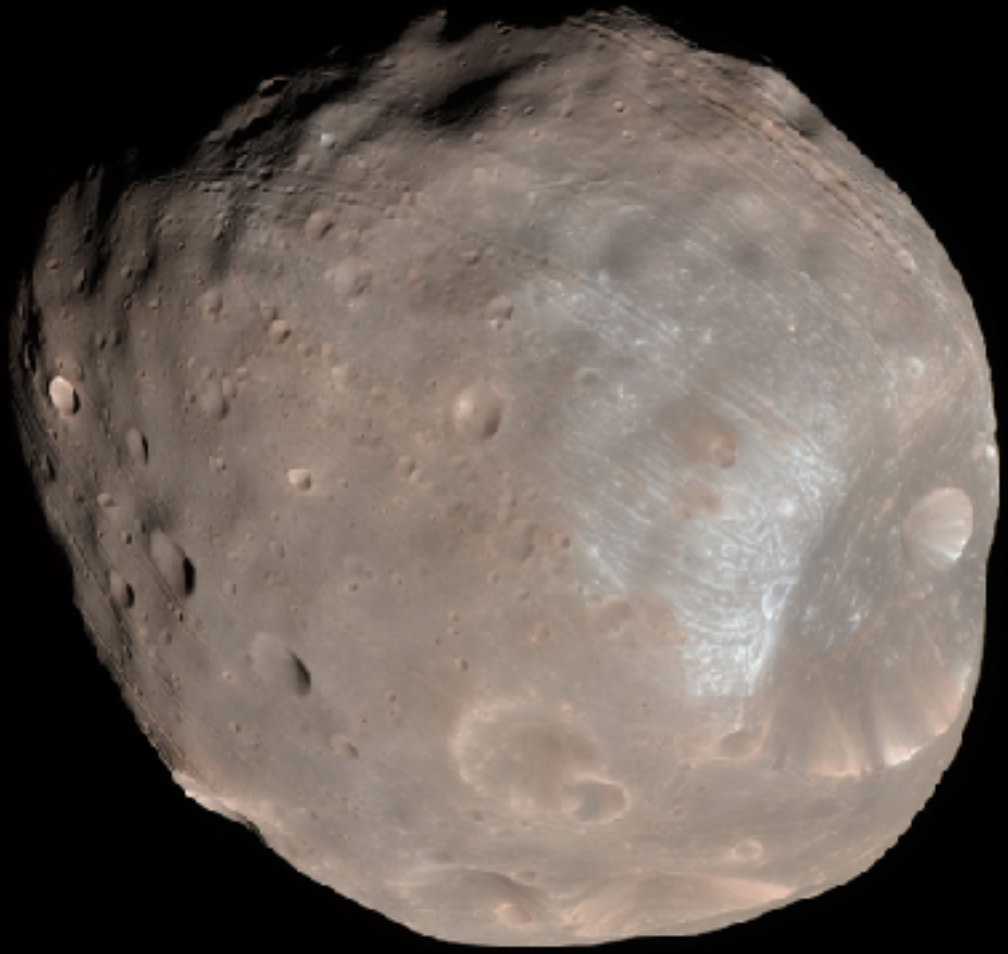


Kasei Valles

Newton crater

http://apod.nasa.gov/apod/ap110808.html

Phobos & Deimos

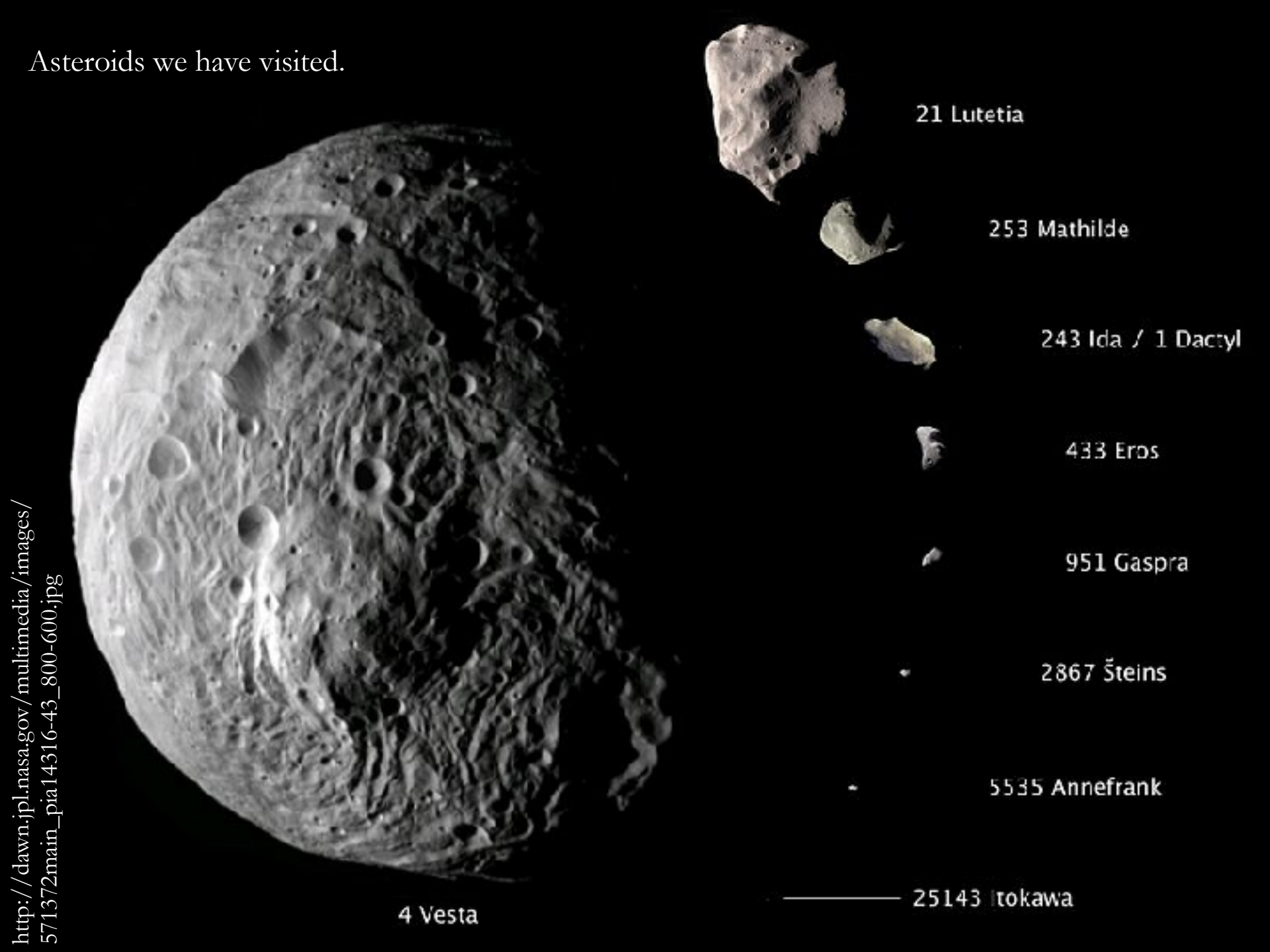


Q: Suppose the Moon's orbital period was more like Phobos' (~8 hours). What would be some implications?

https://en.wikipedia.org/wiki/Phobos_(moon)

https://en.wikipedia.org/wiki/Deimos_(moon)

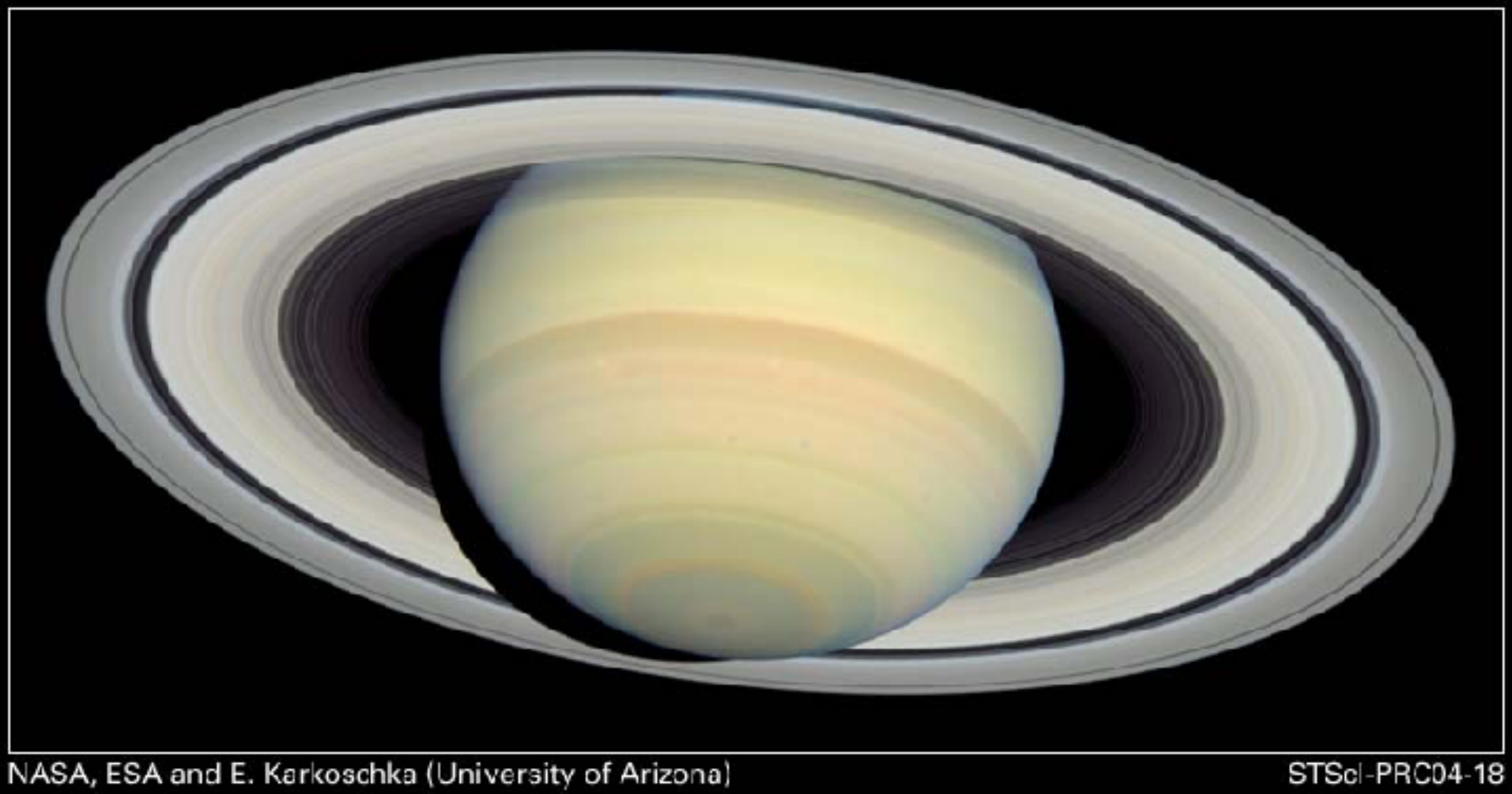
Asteroids we have visited.



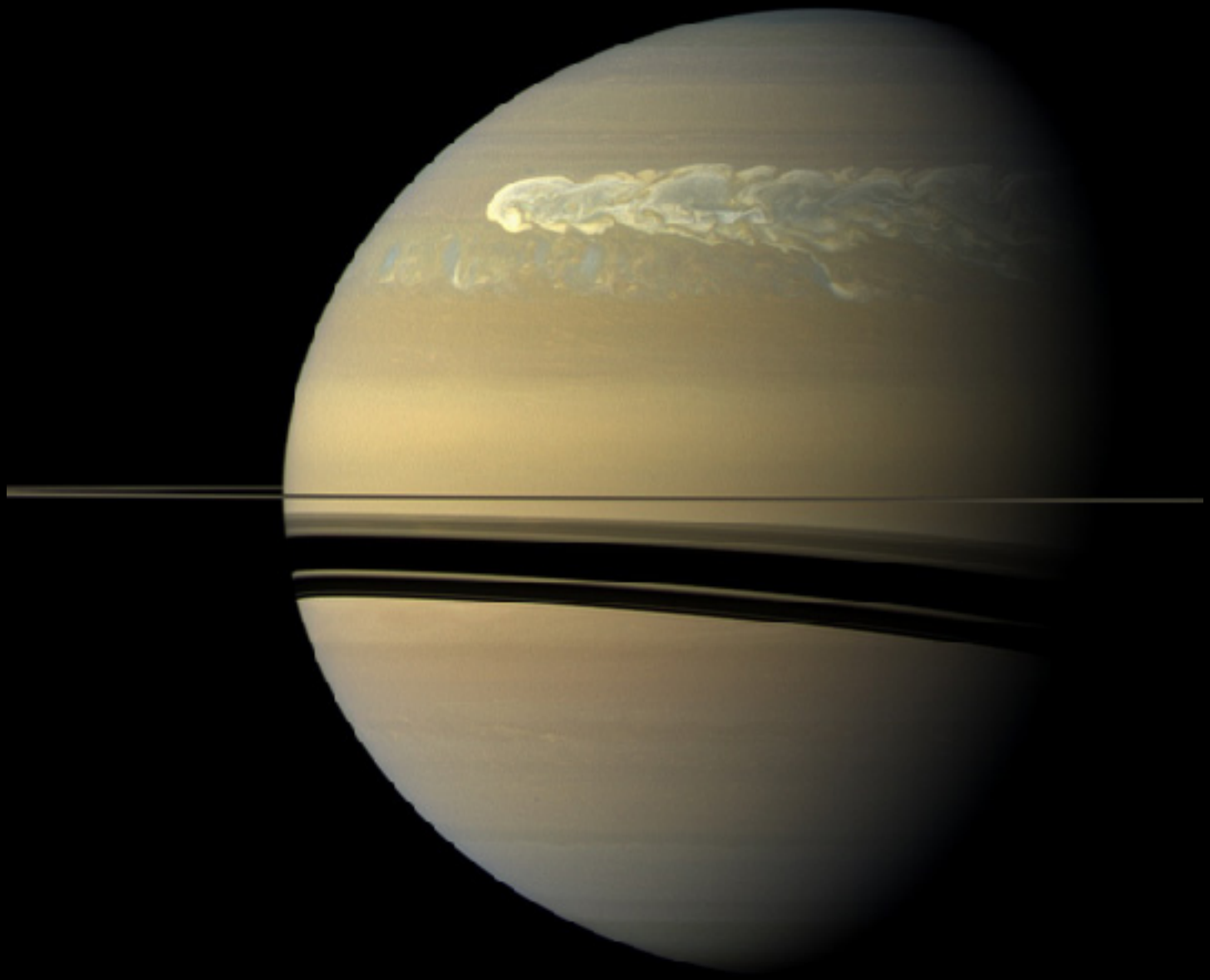
http://dawn.jpl.nasa.gov/multimedia/images/571372main_pia14316-43_800-600.jpg

http://photojournal.jpl.nasa.gov/catalog/PIA04866

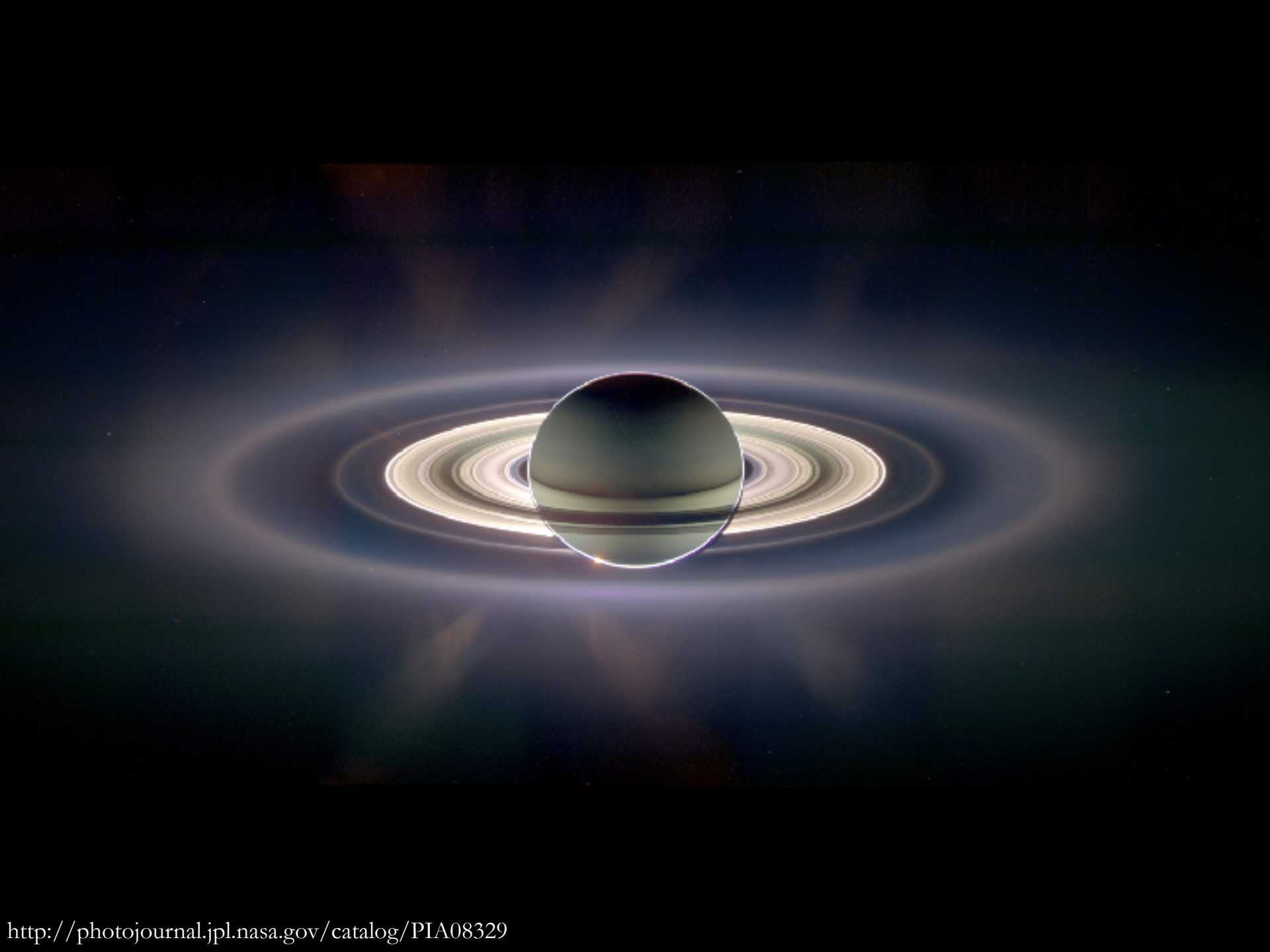
Voyager 1 “Blue Movie”



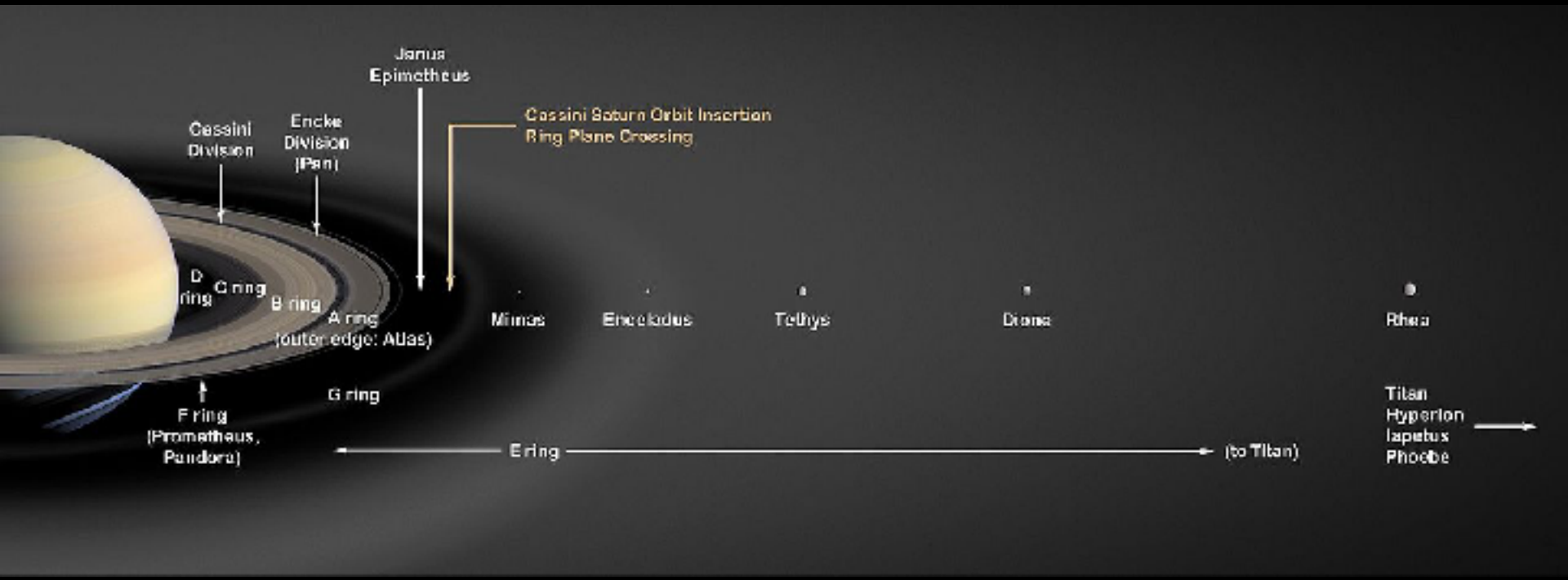
http://hubblesite.org/newscenter/archive/releases/2004/18/image/a/format/web_print/



http://www.jpl.nasa.gov/spaceimages/details.php?id=pia12826

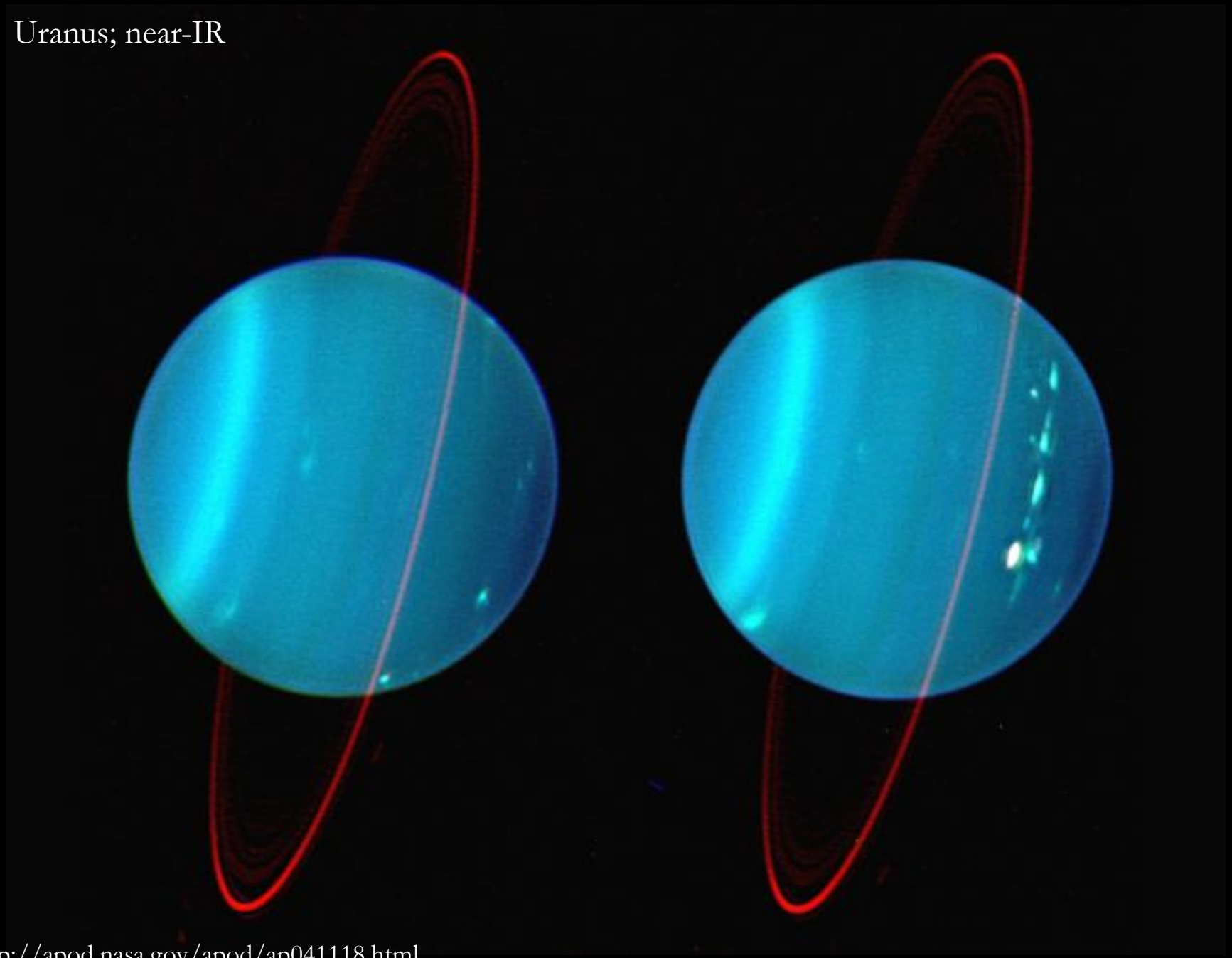


http://photojournal.jpl.nasa.gov/catalog/PIA08329

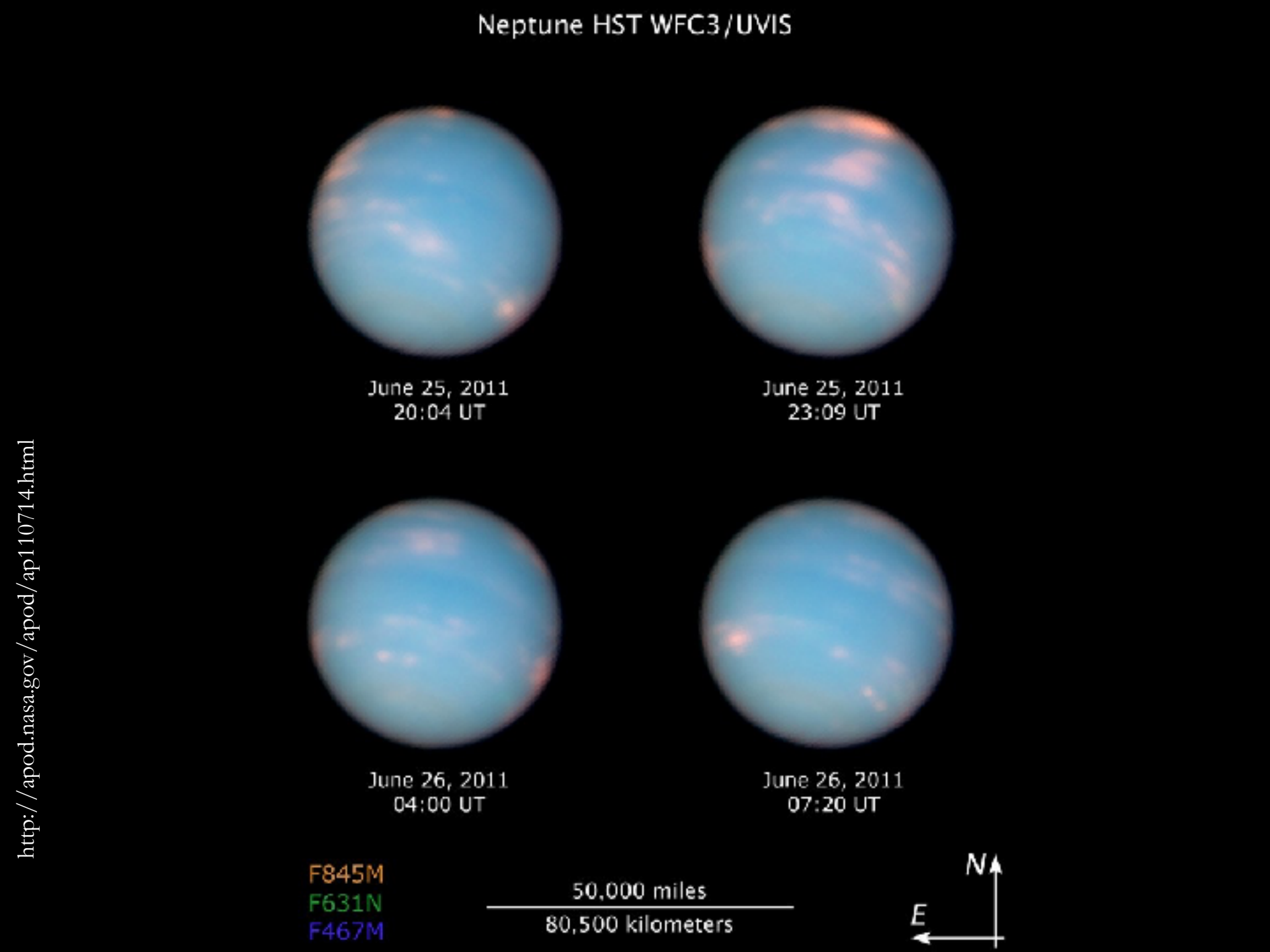


http://photojournal.jpl.nasa.gov/catalog/PIA03550

Uranus; near-IR



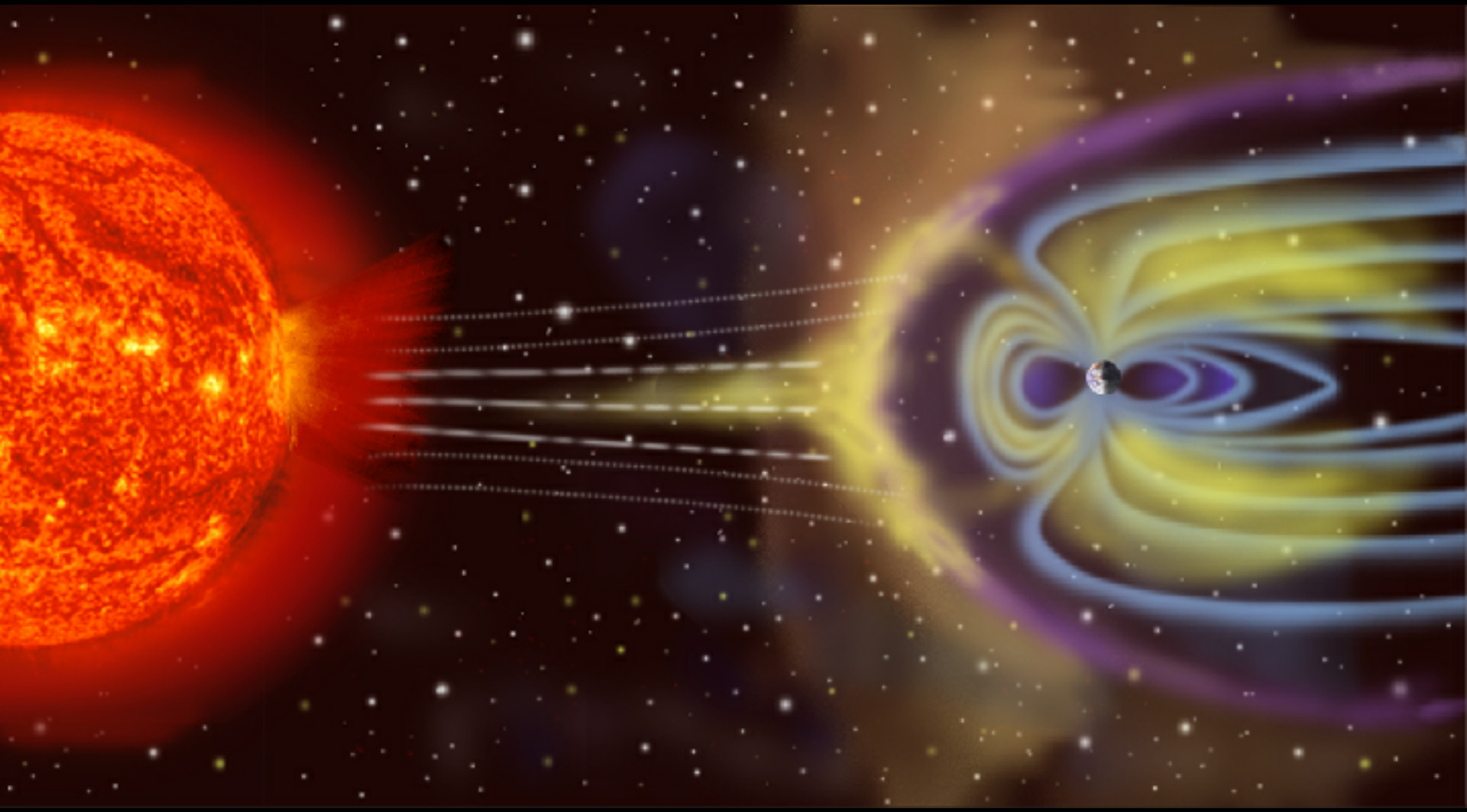
http://apod.nasa.gov/apod/ap041118.html



http://apod.nasa.gov/apod/ap110714.html

Neptune rings

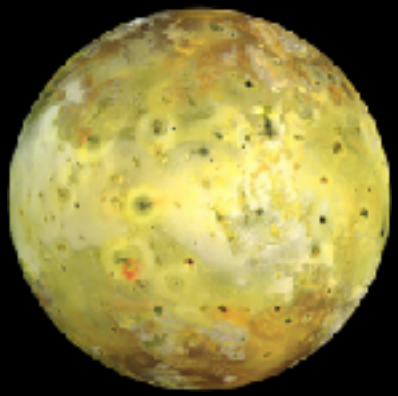
http://photojournal.jpl.nasa.gov/catalog/PIA02202

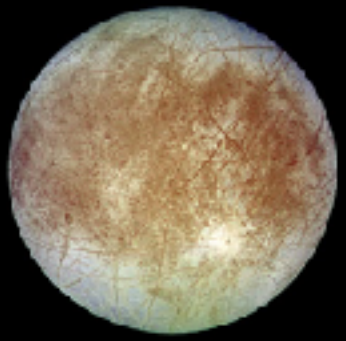


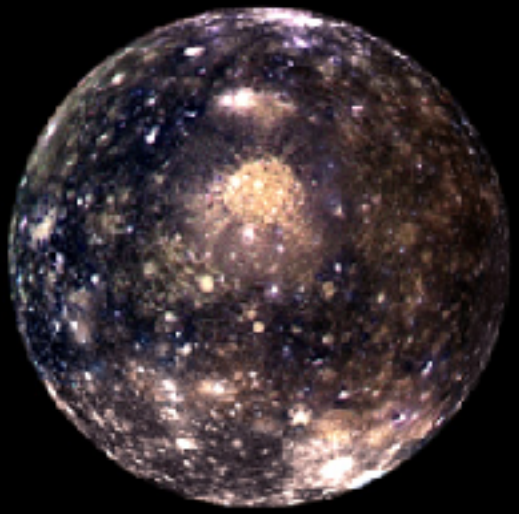
Wikipedia magnetosphere

http://photojournal.jpl.nasa.gov/catalog/PIA01299

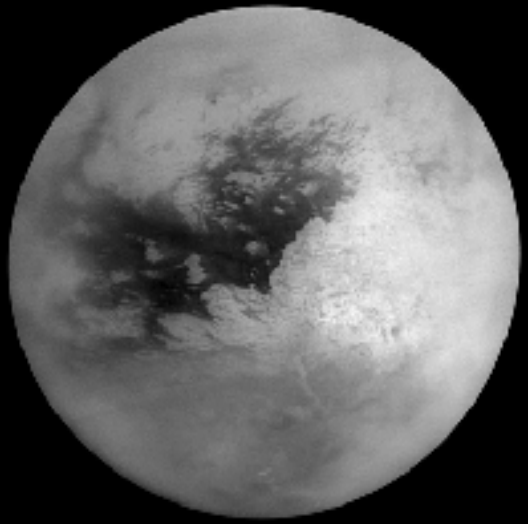
http://photojournal.jpl.nasa.gov/catalog/PIA02308







Moons are unlikely to have atmospheres due to their low escape speeds; Mercury is large enough but so close to the Sun that particles have very large thermal velocities

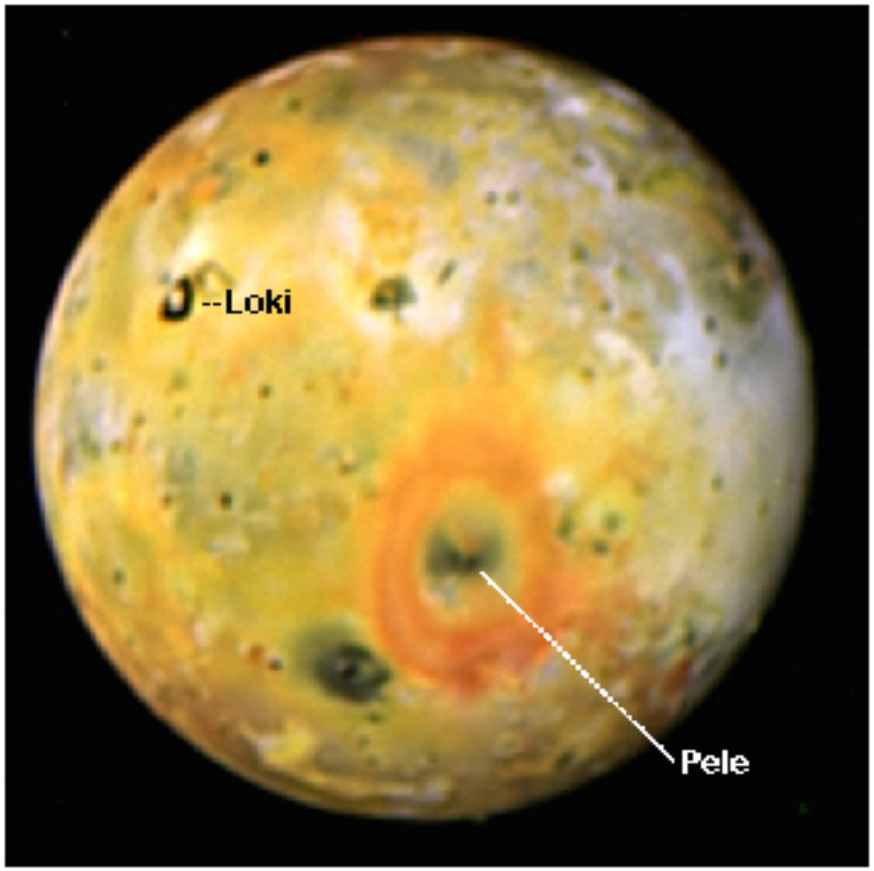


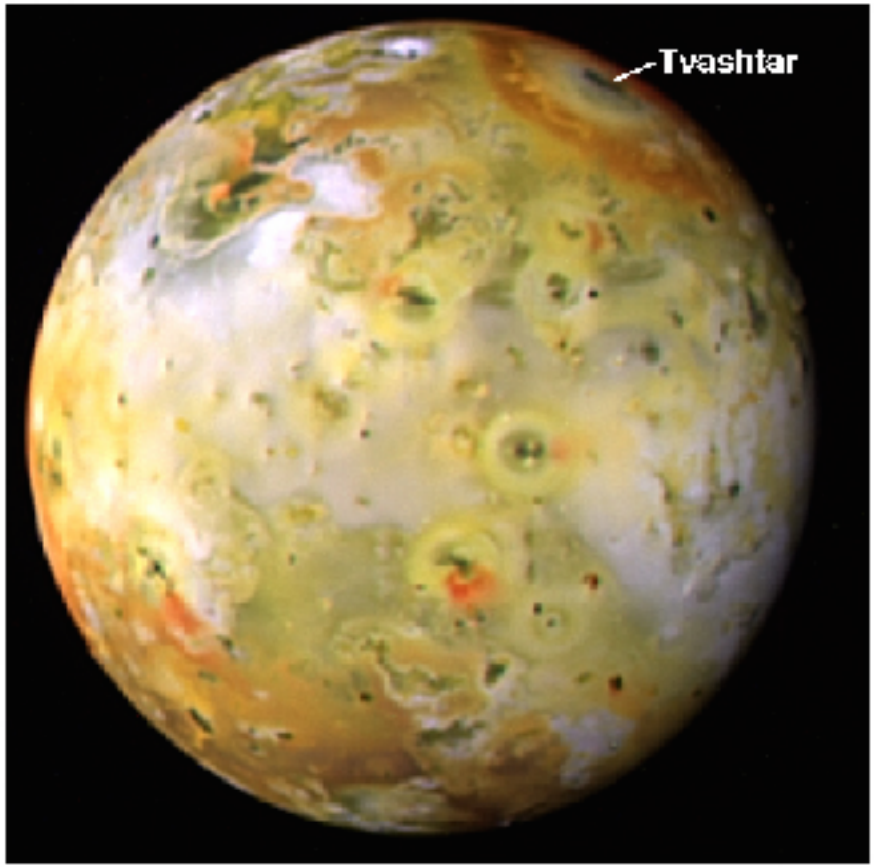
http://photojournal.jpl.nasa.gov/catalog/PIA06185

http://photojournal.jpl.nasa.gov/catalog/PIA00317

Volcanoes on Io

Galileo Images:

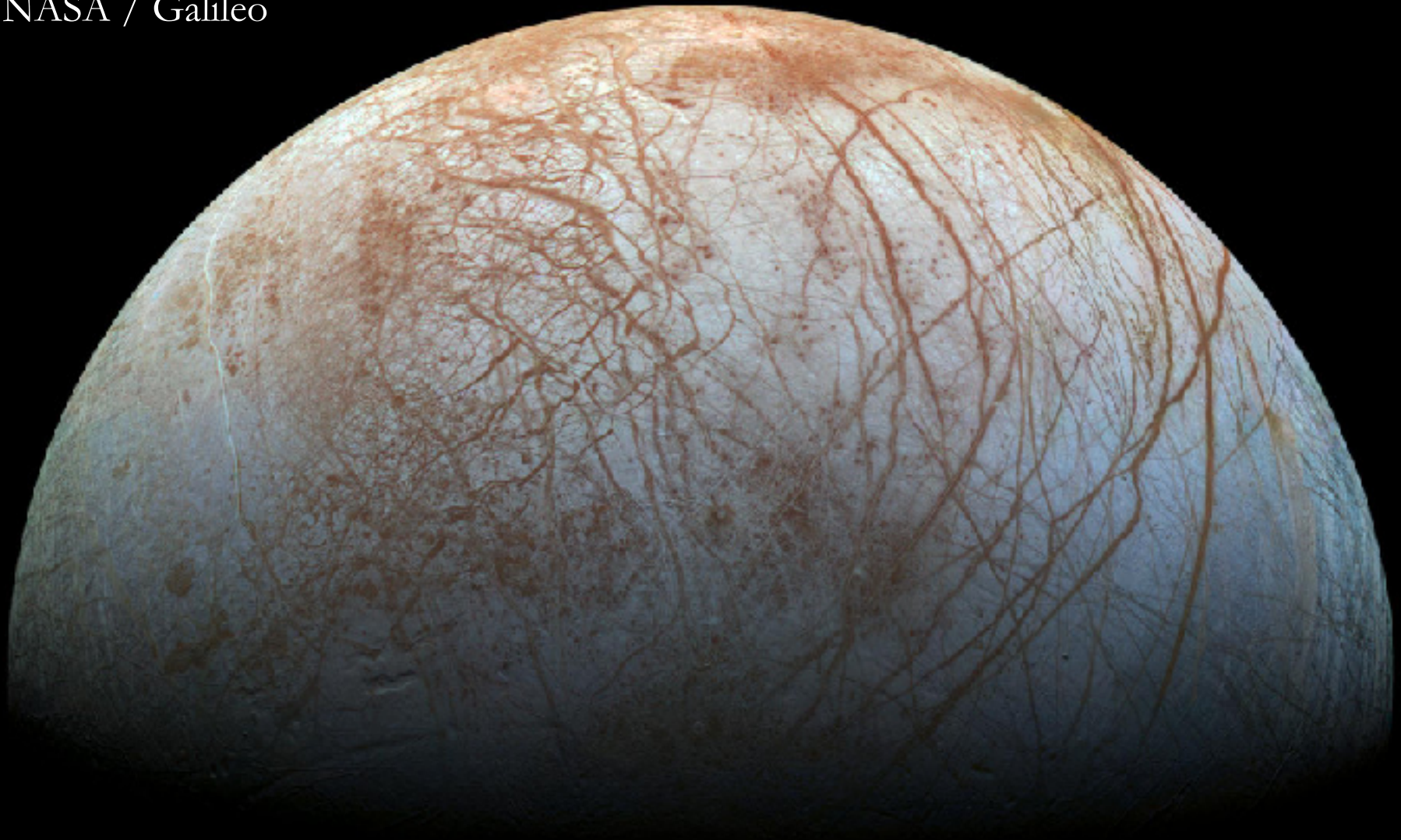




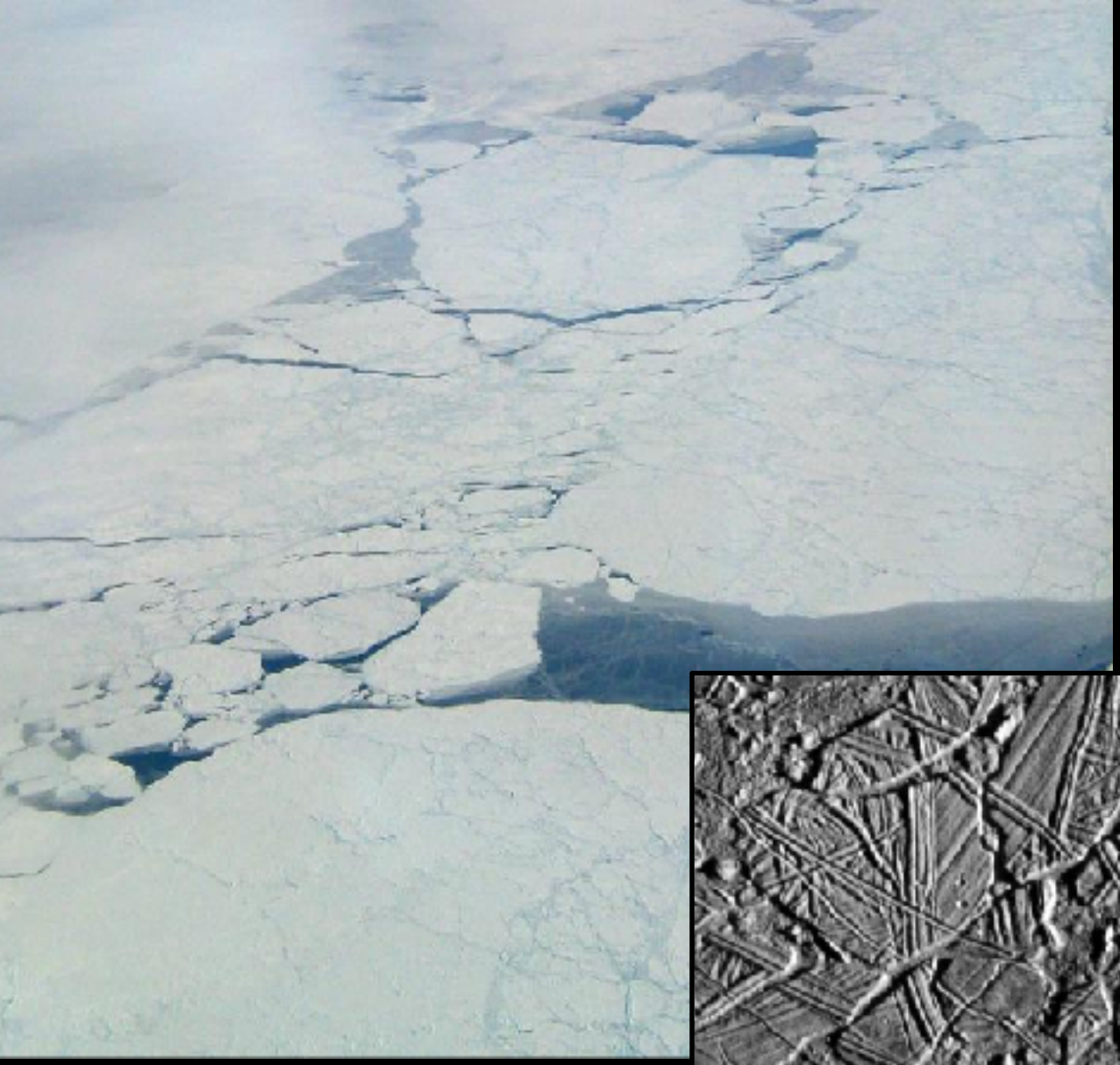
https://solarsystem.nasa.gov/images/galleries/Io_Views.jpg

Europa

NASA / Galileo

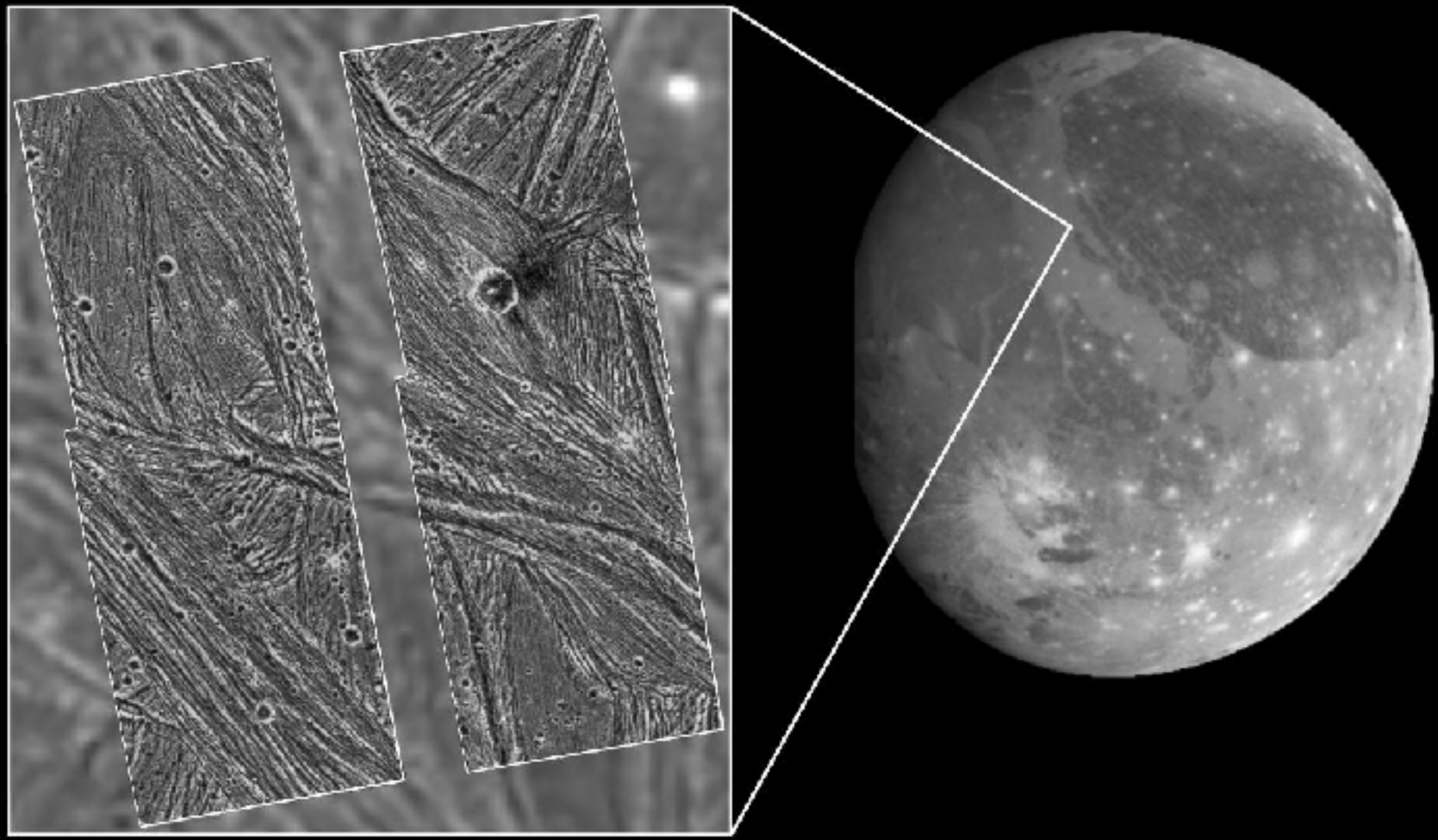


http://apod.nasa.gov/apod/ap141127.html

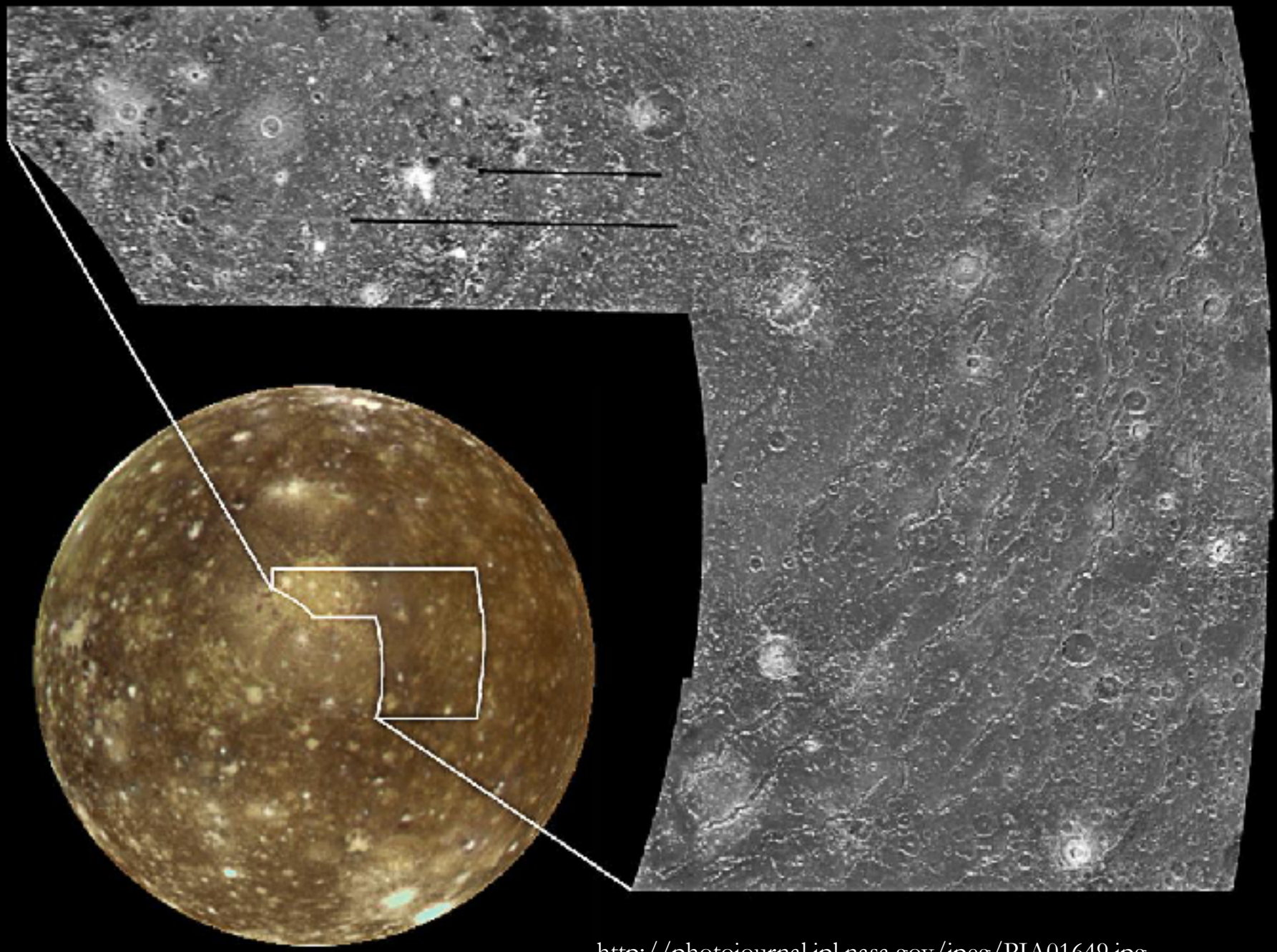


http://www.nasa.gov/topics/earth/features/earth20120422-image.html

http://photojournal.jpl.nasa.gov/catalog/PIA01403



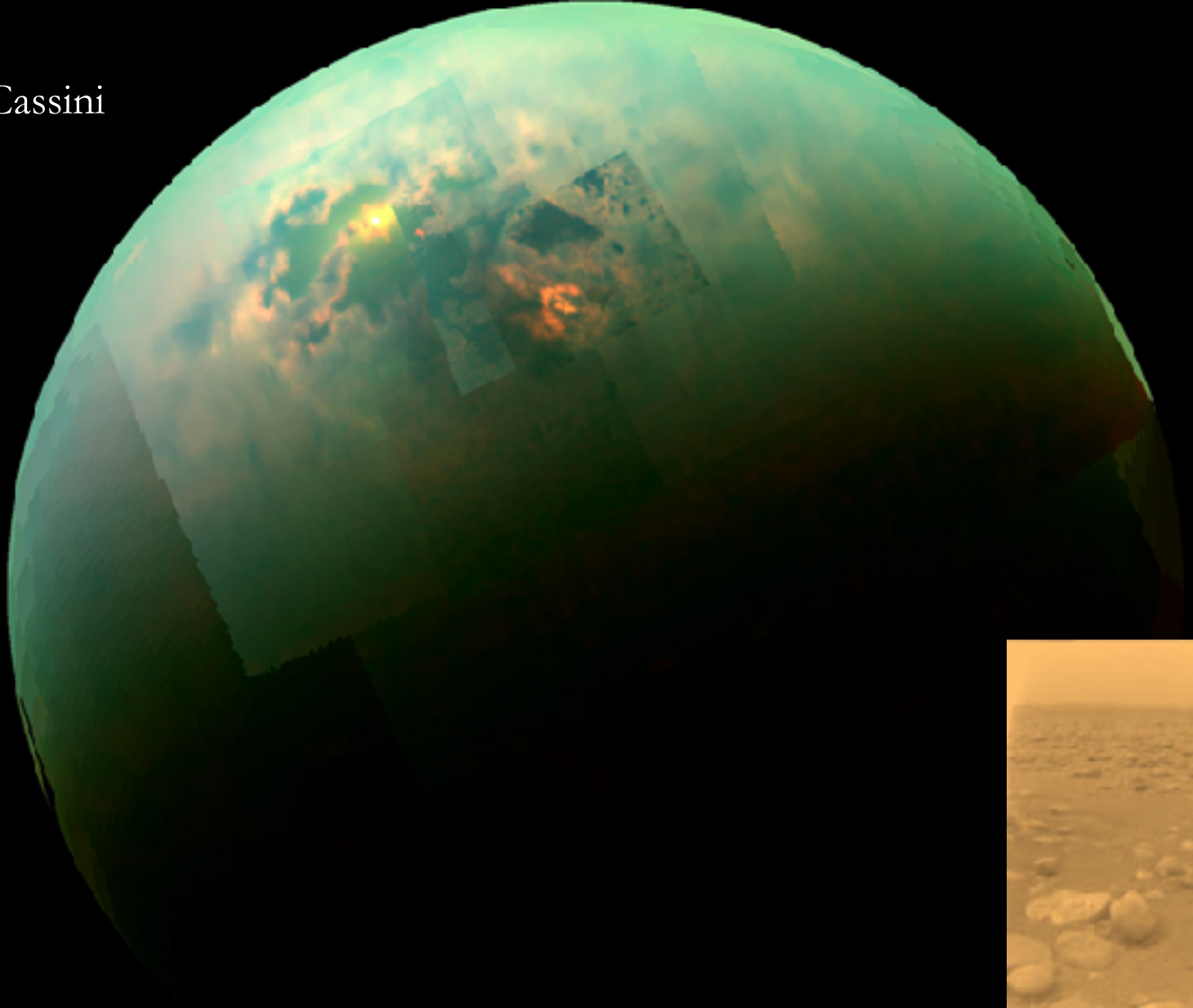
http://photojournal.jpl.nasa.gov/catalog/PIA00579



http://photojournal.jpl.nasa.gov/jpeg/PIA01649.jpg

Titan

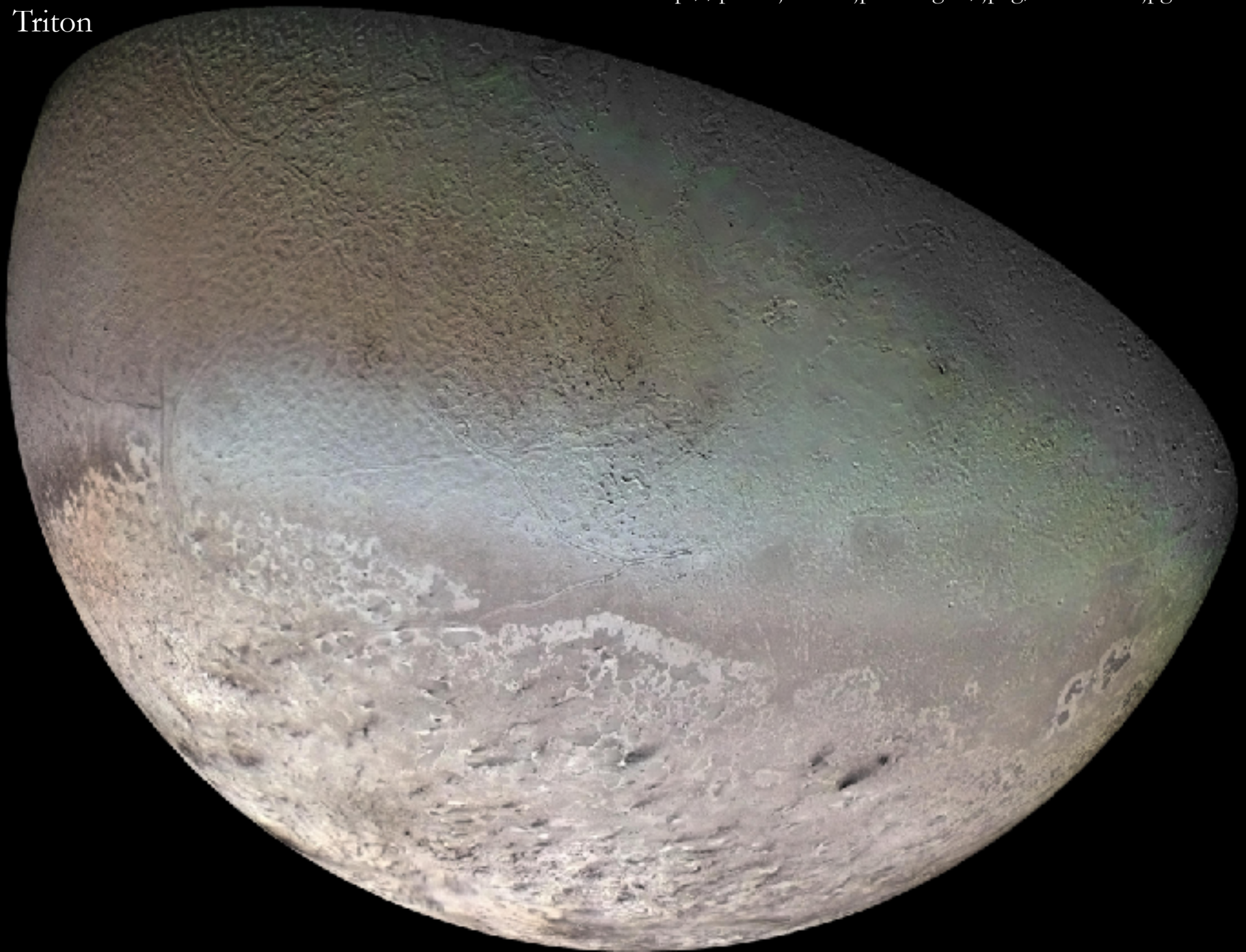
NASA / Cassini



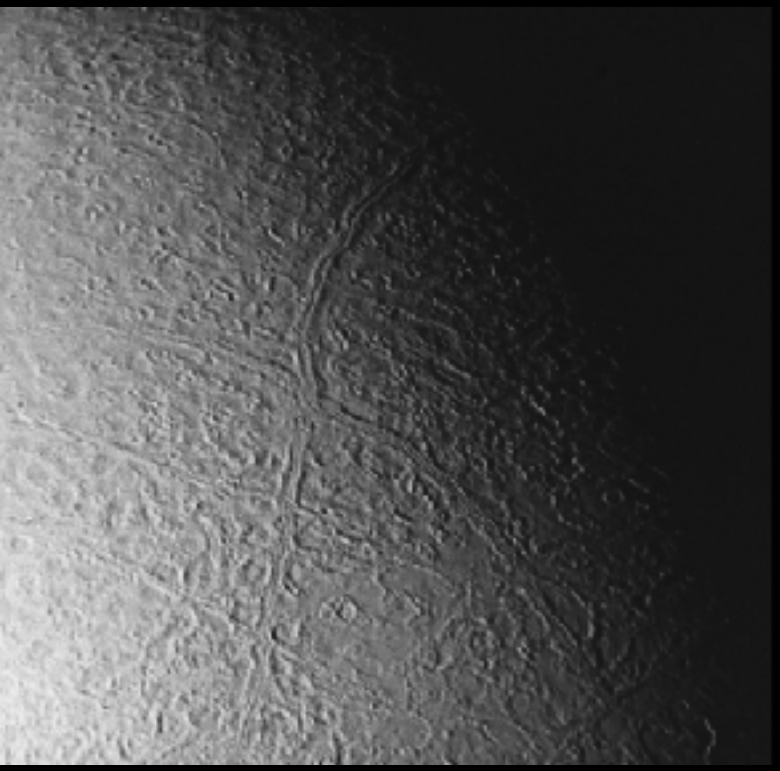
http://photojournal.jpl.nasa.gov/catalog/PIA07232

Triton

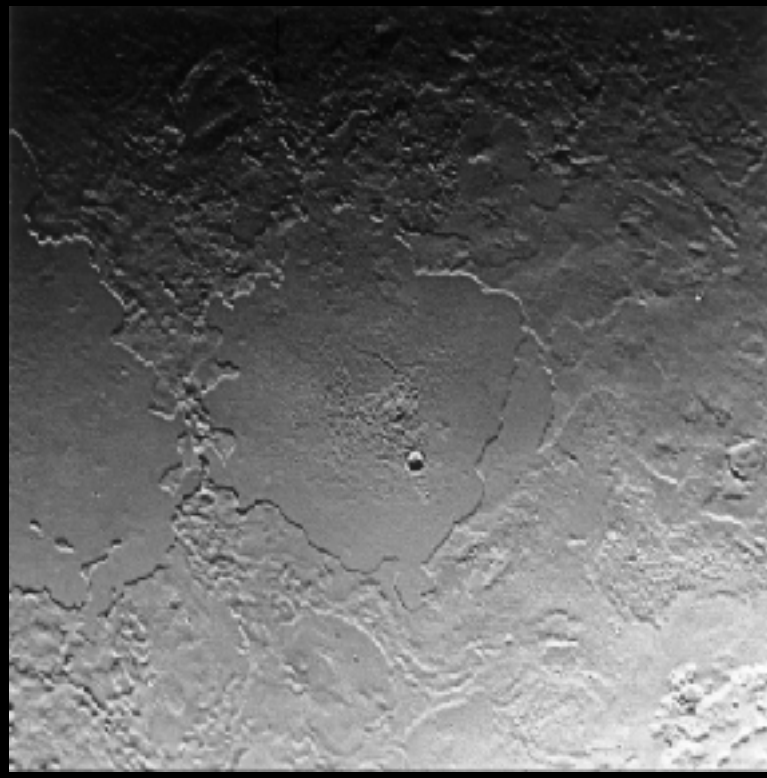
http://photojournal.jpl.nasa.gov/jpeg/PIA00317.jpg



Triton



http://photojournal.jpl.nasa.gov/jpeg/PIA01537.jpg

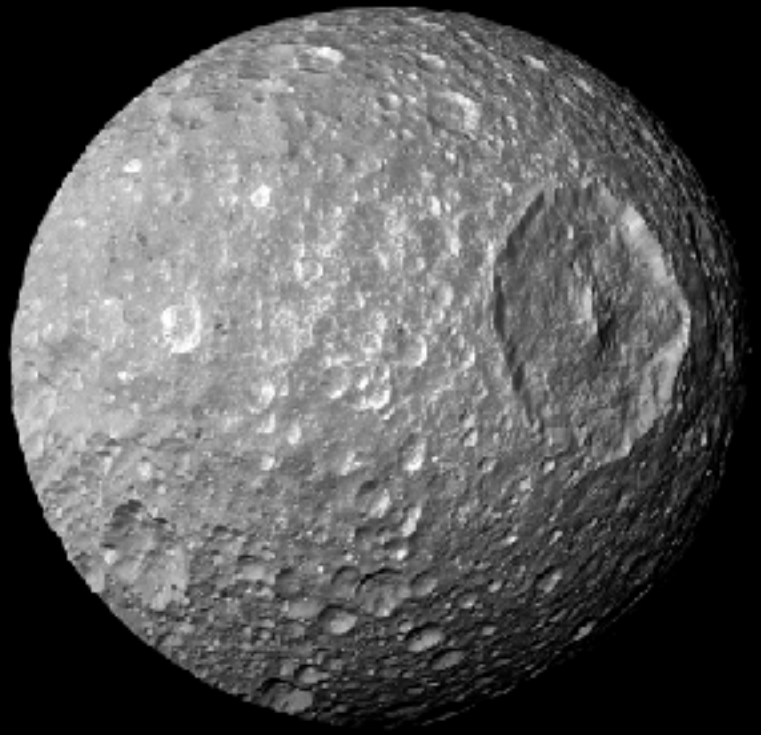


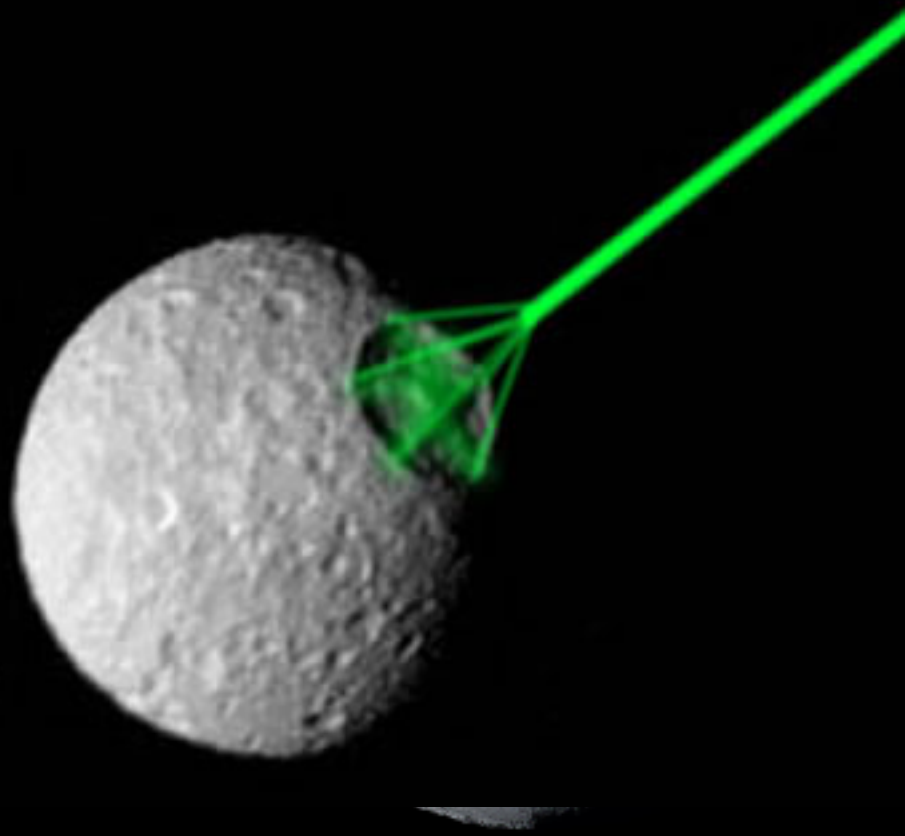
http://photojournal.jpl.nasa.gov/jpeg/PIA021538.jpg

Medium-sized moons

+ Titan, Triton, and our Moon

Mimas (Saturn)

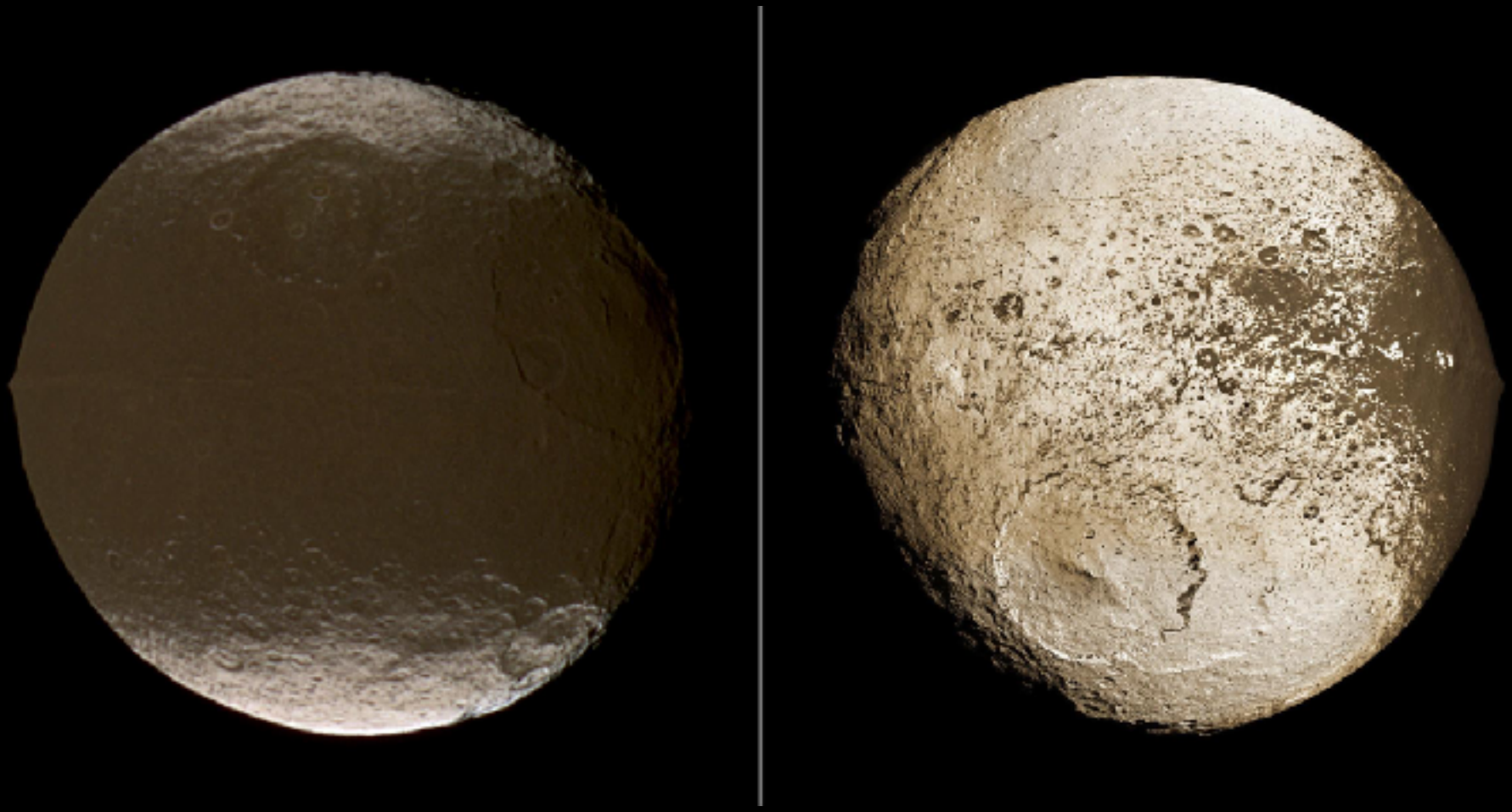




http://photojournal.jpl.nasa.gov/catalog/PIA12570

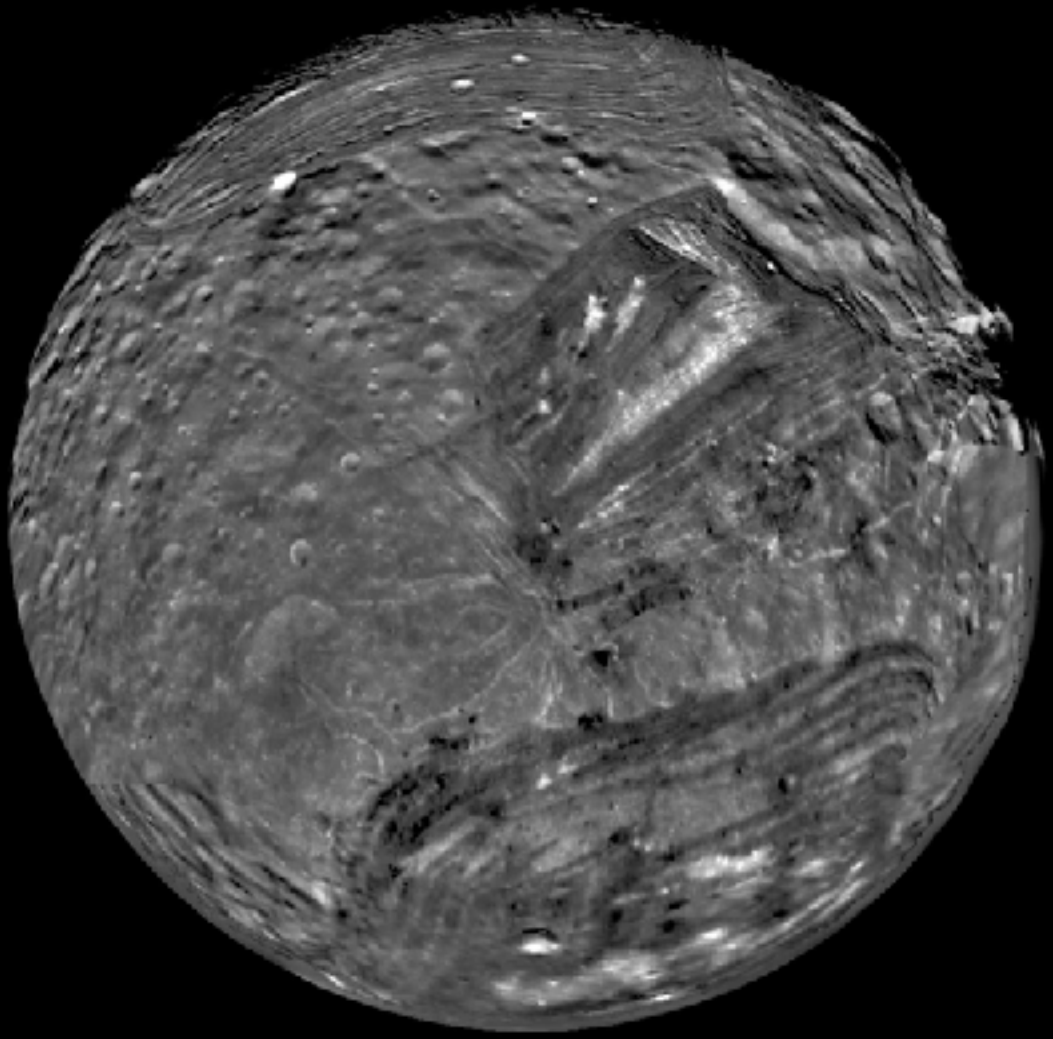
http://photojournal.jpl.nasa.gov/catalog/PIA06254

Iapetus (Saturn)



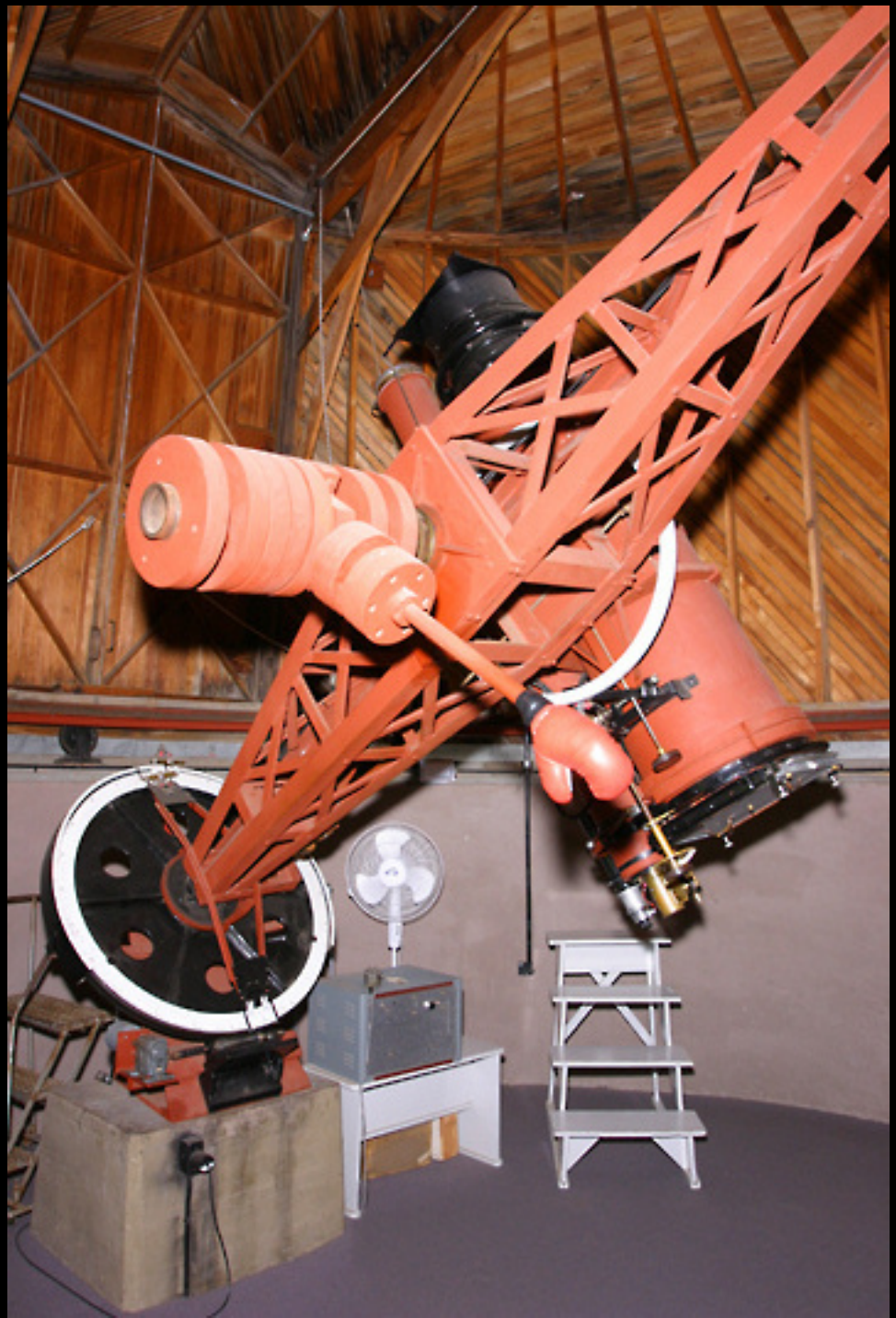
http://photojournal.jpl.nasa.gov/jpeg/PIA11690.jpg

Miranda (Uranus)



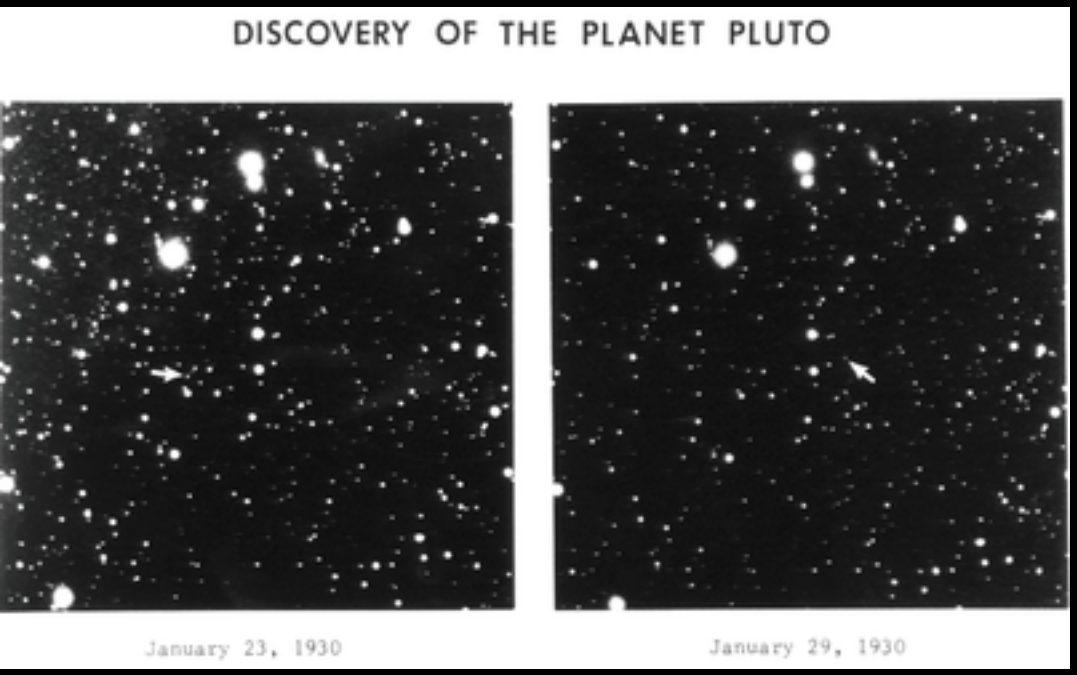
http://photojournal.jpl.nasa.gov/jpeg/PIA01490.jpg

http://cagle.msnbc.com/news/Pluto/main.asp



https://lowell.edu/history/the-pluto-telescope/

https://lowell.edu/in-depth/pluto/the-discovery-of-pluto/



https://en.wikipedia.org/wiki/Pluto

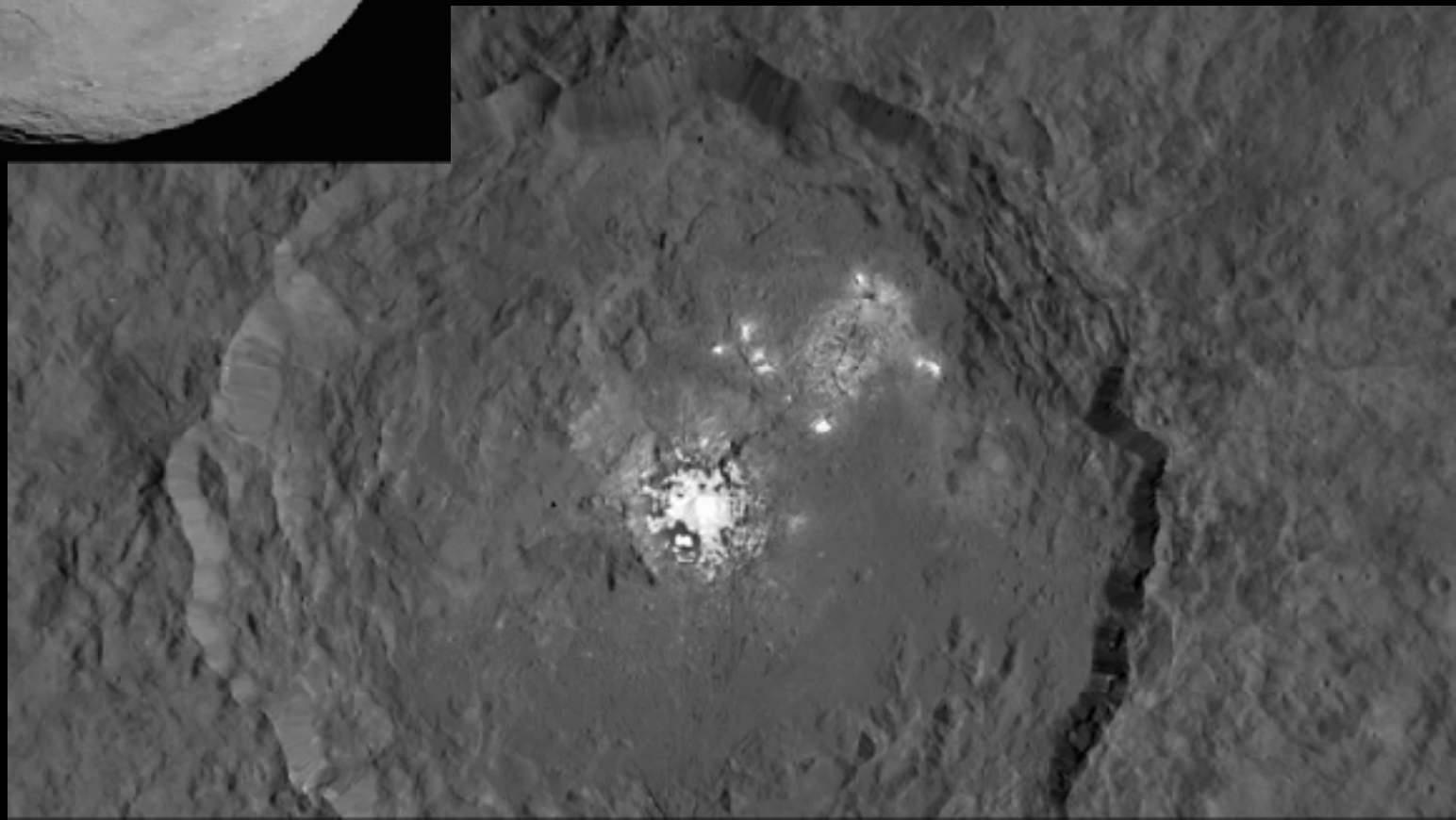
Pluto. . .Lowell Observatory 1930

New Horizons flyby 2015

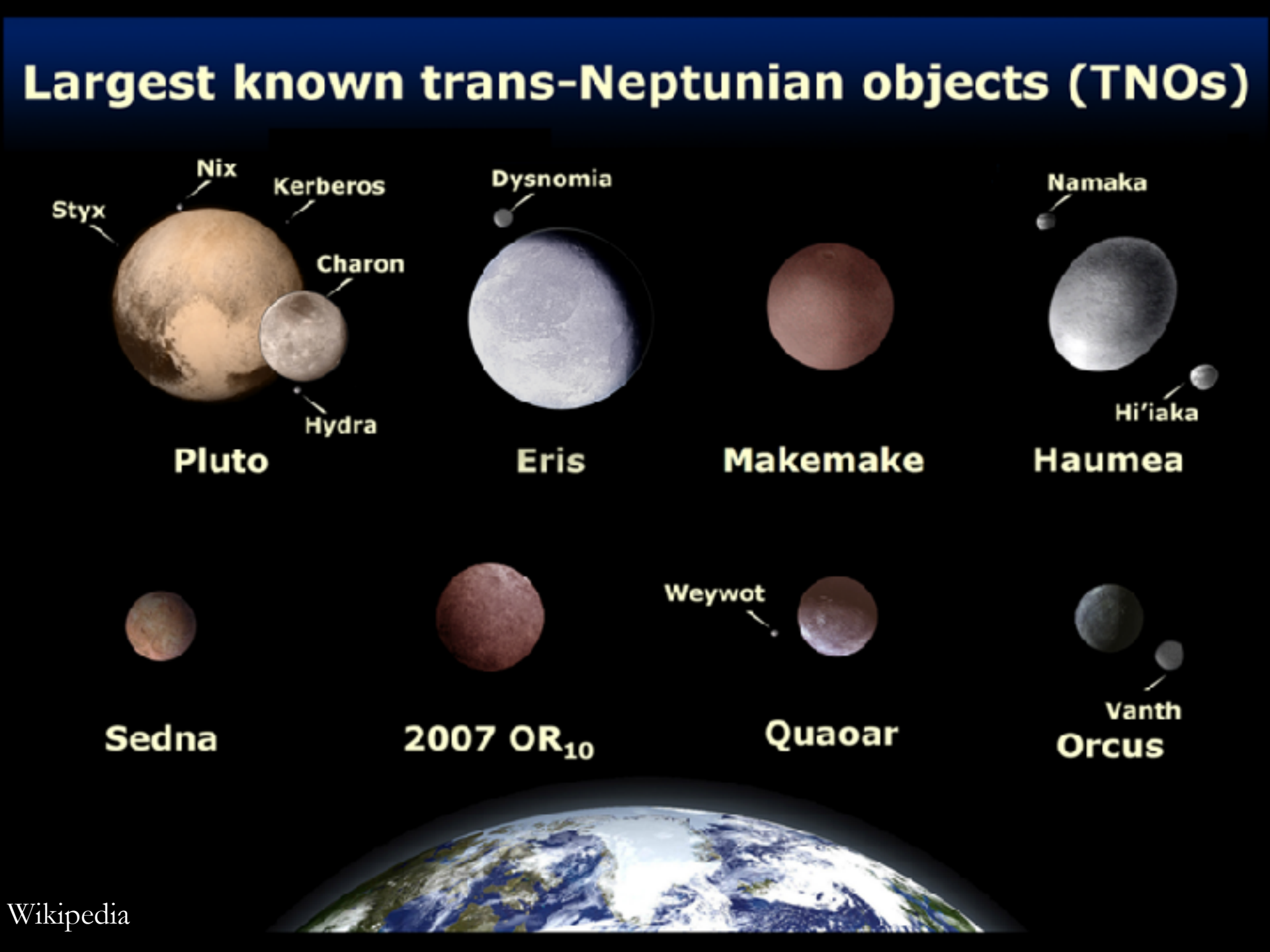
Ceres

http://photojournal.jpl.nasa.gov/jpeg/PIA19562.jpg

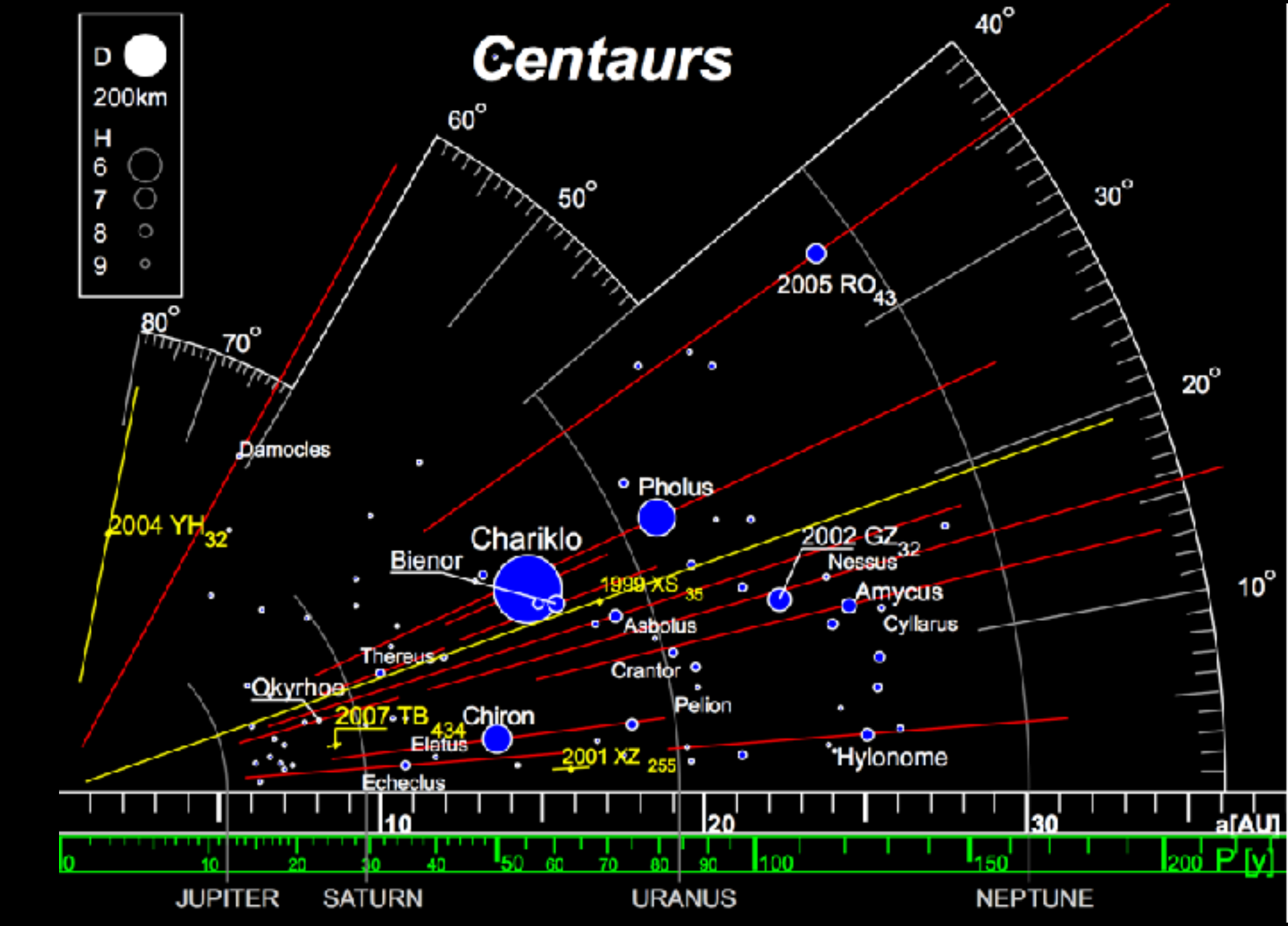
http://www.jpl.nasa.gov/news/news.php?release=2015-294



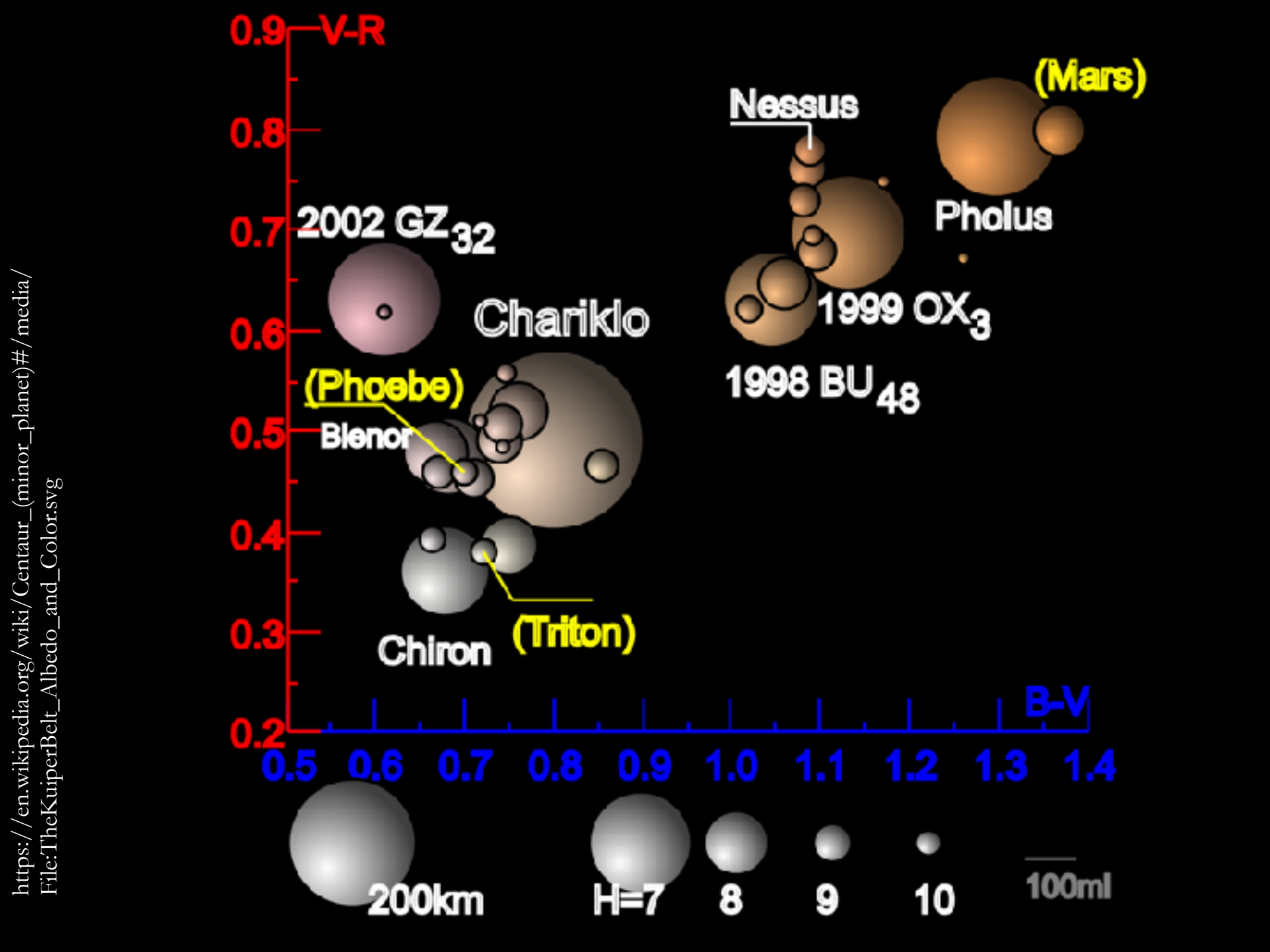
Largest known trans-Neptunian objects (TNOs)



Wikipedia



https://en.wikipedia.org/wiki/Centaur_(minor_planet)#/media/File:TheKuiperBelt_42AU_Centaurs.svg



https://en.wikipedia.org/wiki/Centaur_(minor_planet)#/media/File:TheKuiperBelt_Albedo_and_Color.svg

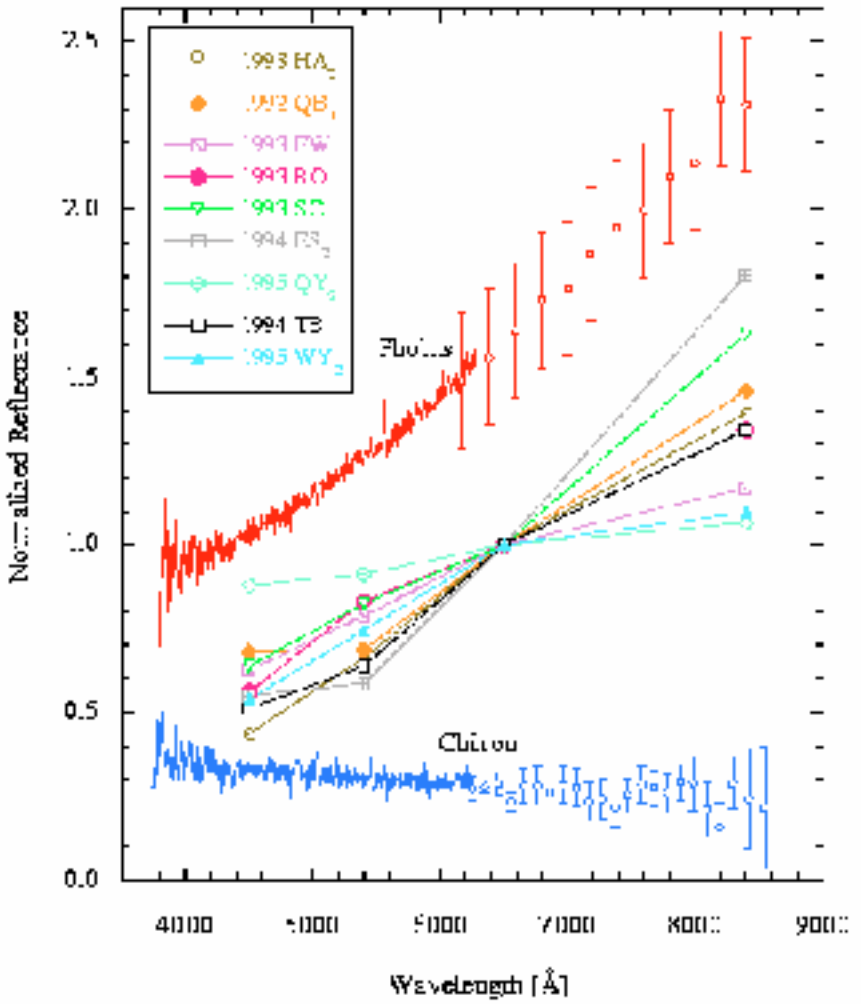
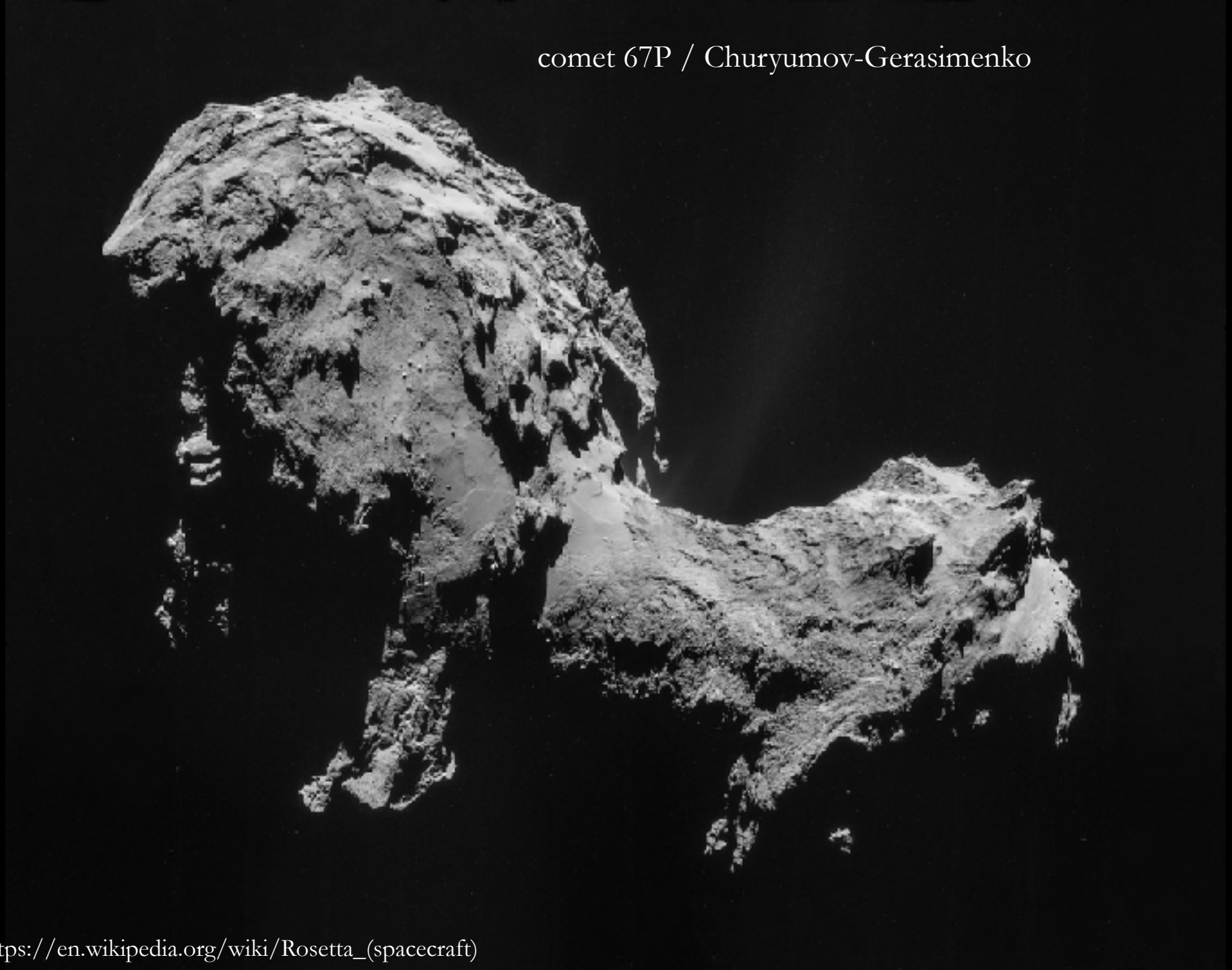


Fig 3: Lucas & Lowell, AJ Nov 2006

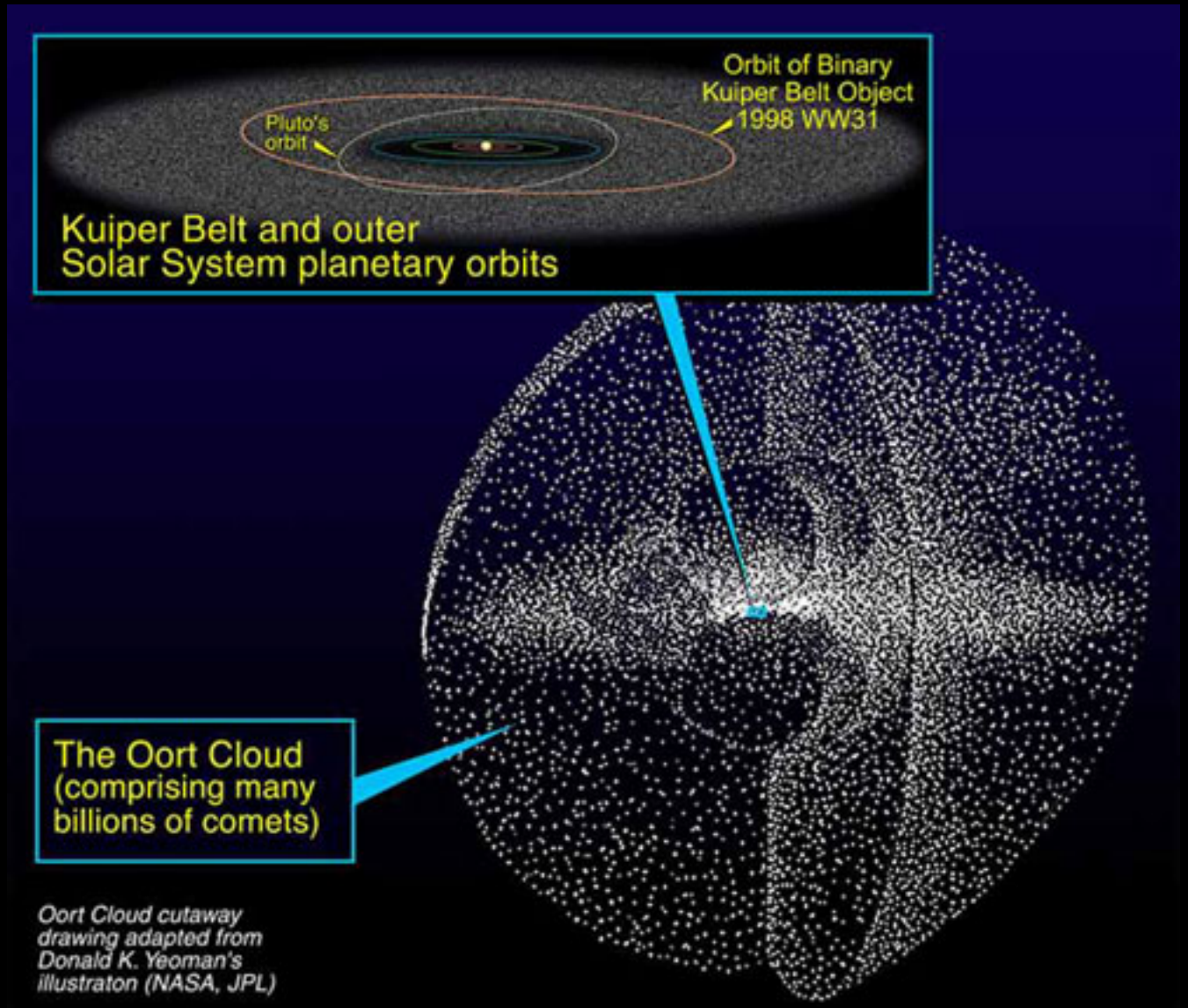
"Comet Hale-Bopp 1995O1" by E. Kolmhofer, H. Raab; Johannes-Kepler-Observatory, Linz, Austria (http://www.sternwarte.at)

Halley's comet

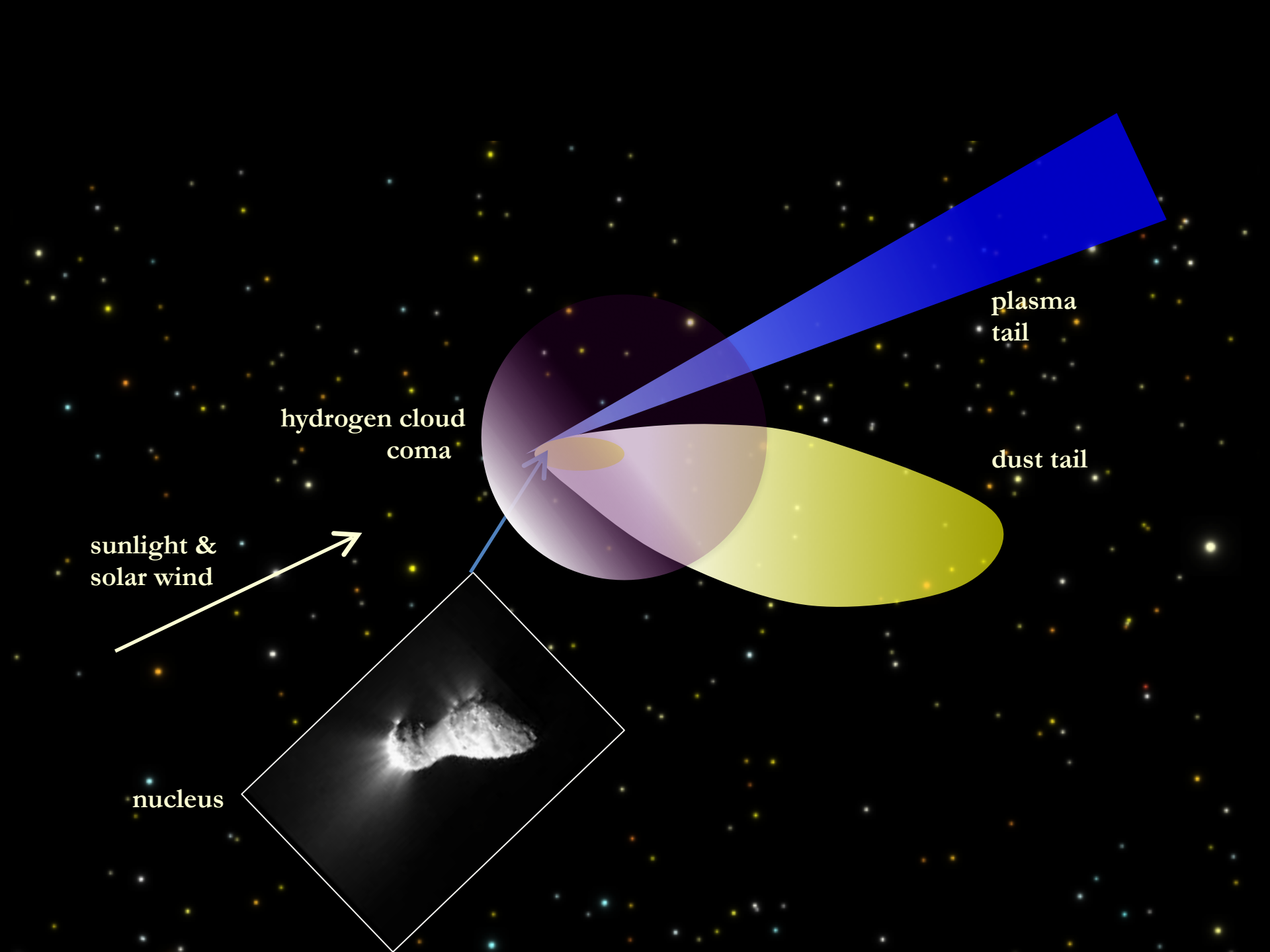
http://apod.nasa.gov/apod/ap100104.html

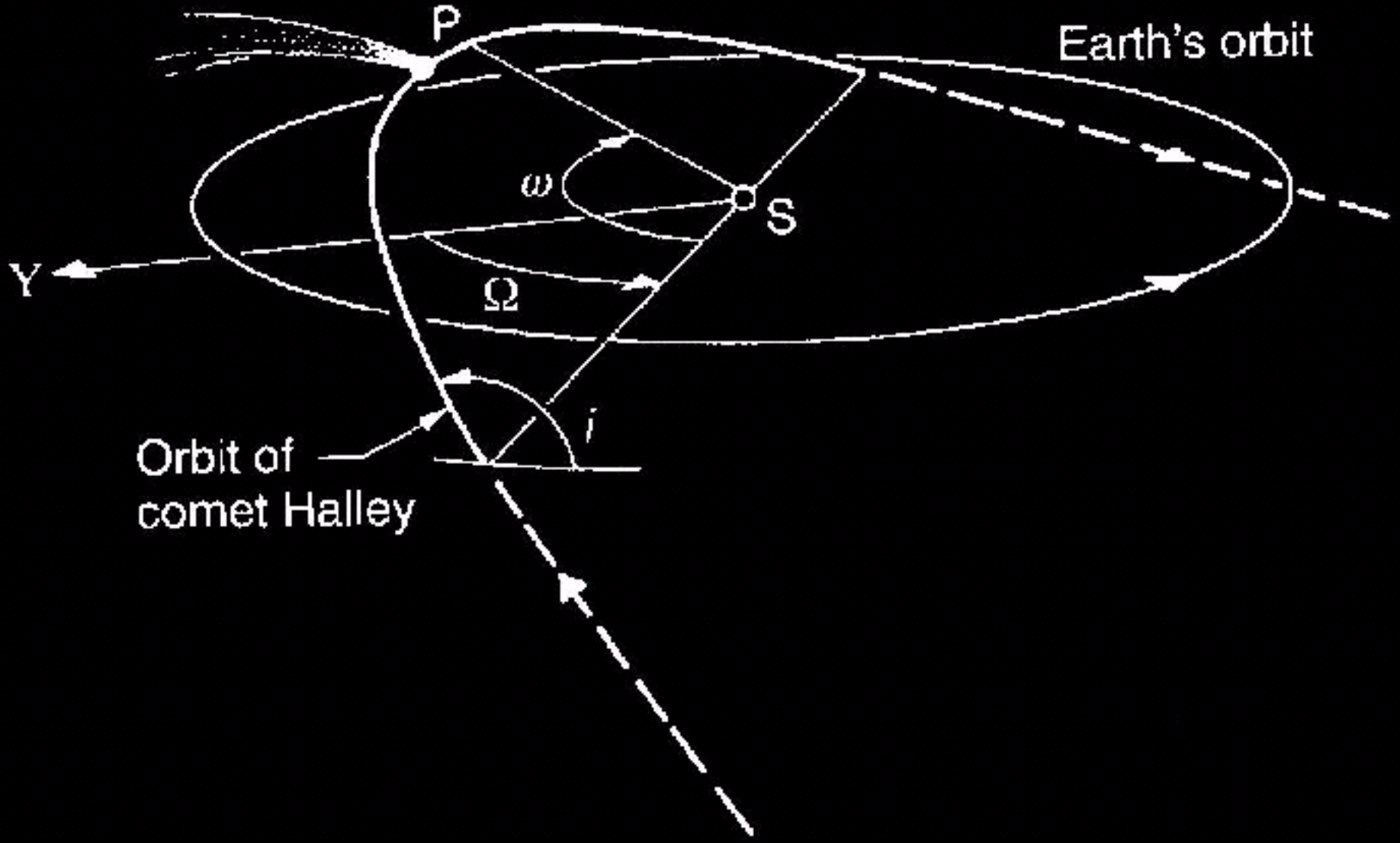


https://en.wikipedia.org/wiki/Rosetta_(spacecraft)

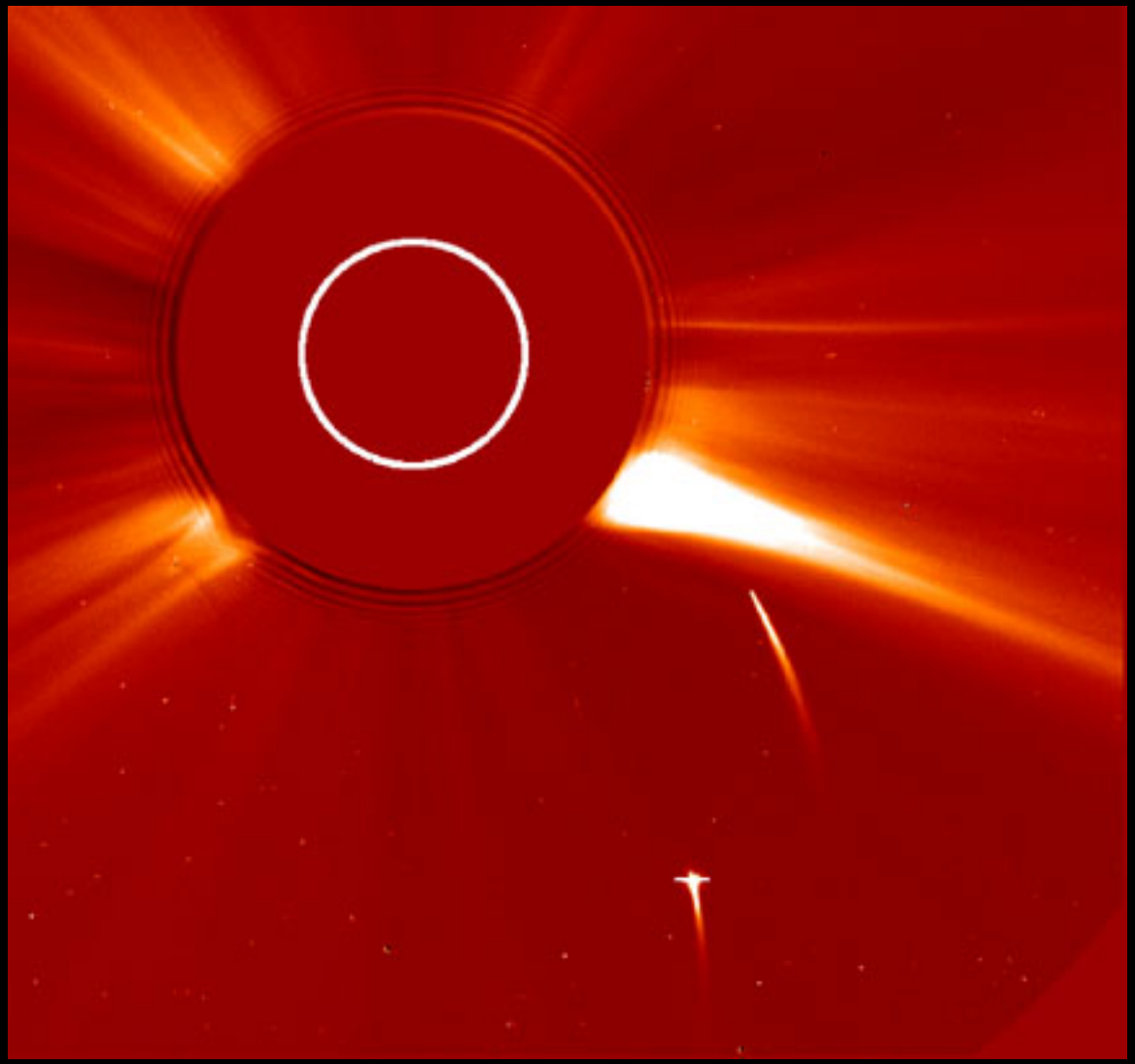


http://herschel.jpl.nasa.gov/solarSystem.shtml


plasma
tail
hydrogen cloud
coma
dust tail
sunlight &
solar wind
nucleus

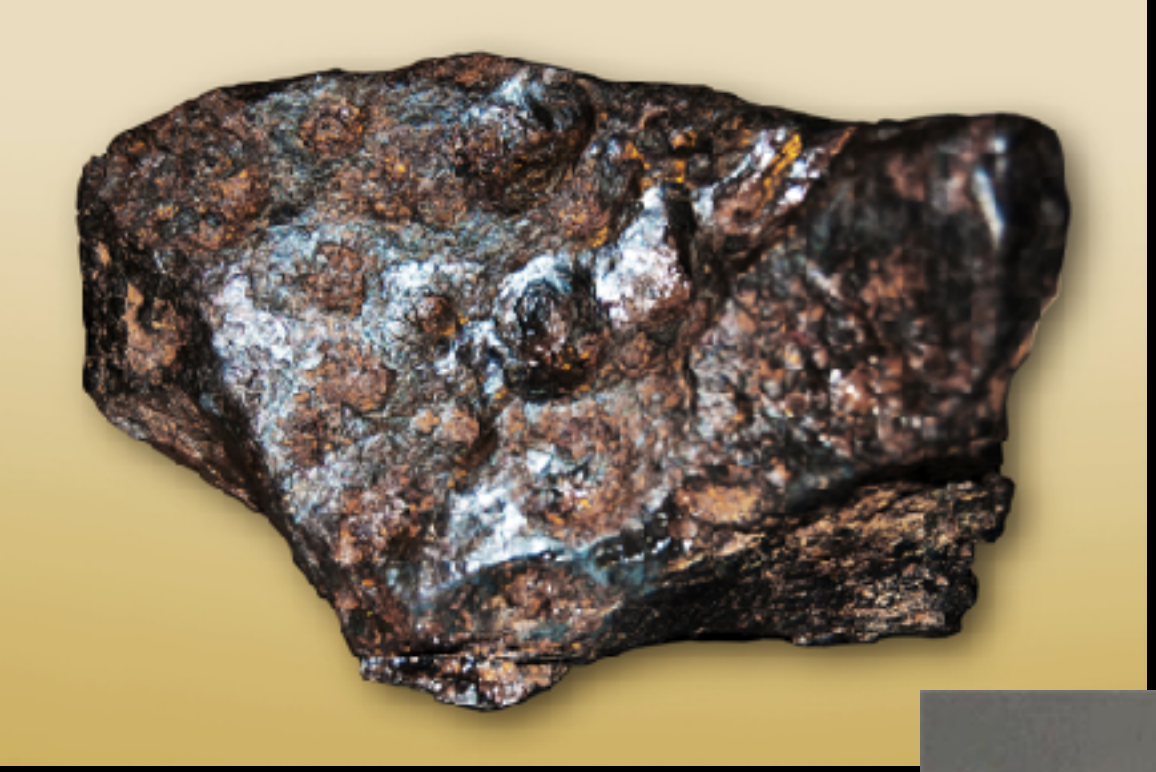

P
Earth's orbit
ω
S
Y
Ω
i
Orbit of
comet Halley

Sungrazing comets



http://www.nasa.gov/centers/goddard/news/topstory/2008/soho_1500comets_prt.htm

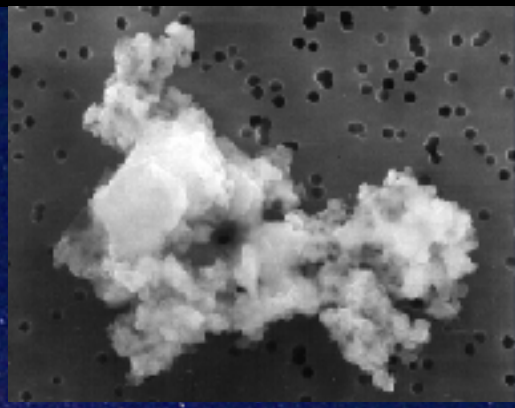
http://apod.nasa.gov/apod/ap090328.html



https://en.wikipedia.org/wiki/Iron_meteorite

https://www.gl.ciw.edu/static/users/gcody/meteorite.html

Hale-Bopp and zodiacal light



J. C. Casado

http://apod.nasa.gov/apod/ap970825.html

http://apod.nasa.gov/apod/ap010813.html