The Sun and its Planets
ASTR 101 - Fall 2019

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Time: Tu Th 11:30 AM - 12:45 PM
Room: Nord 410

Textbook
The Cosmic Perspective
The Solar System
Eighth edition, paper or electronic
Bennett, Donahue, Schneider, & Voit

Electronic materials: Mastering Astronomy
Instructions for accessing electronic materials

The text is for reference outside of class;
you do not need to bring it to class

Jupiter up close, as seen by Juno

Syllabus

- Course Description
- Lecture Schedule including links to pdf files of lecture slides
- Learning Outcomes
- Grades
- Assignemnts and Exams
- Homework

- PDF syllabus

Course News

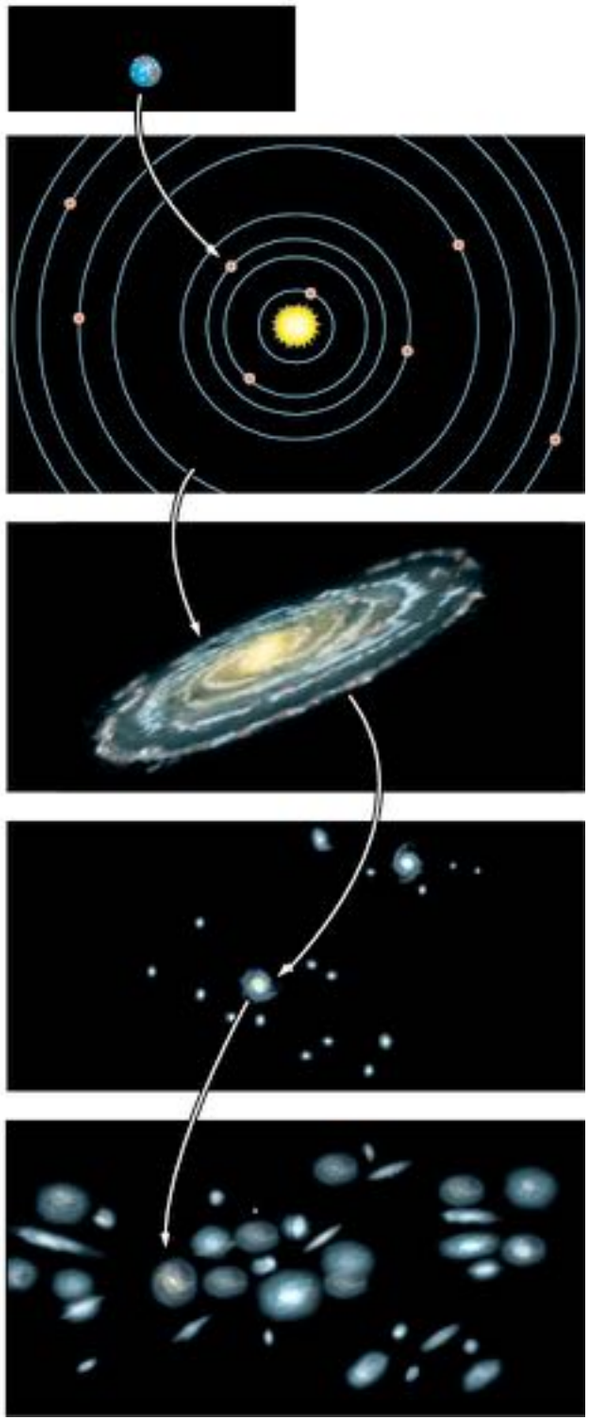
First class: August 27

Miscellany

Glossary of Astronomy terms
Stellarium freeware (as seen in lecture!)
World Wide Telescope
Astronomy Picture of the Day
Further Links for the curious.

All material available from
http://astroweb.case.edu/ssm/astr101/
which is the primary document for the course (not Canvas).

Our Place in the Universe



Earth is a small planet,

orbiting a medium-sized star,

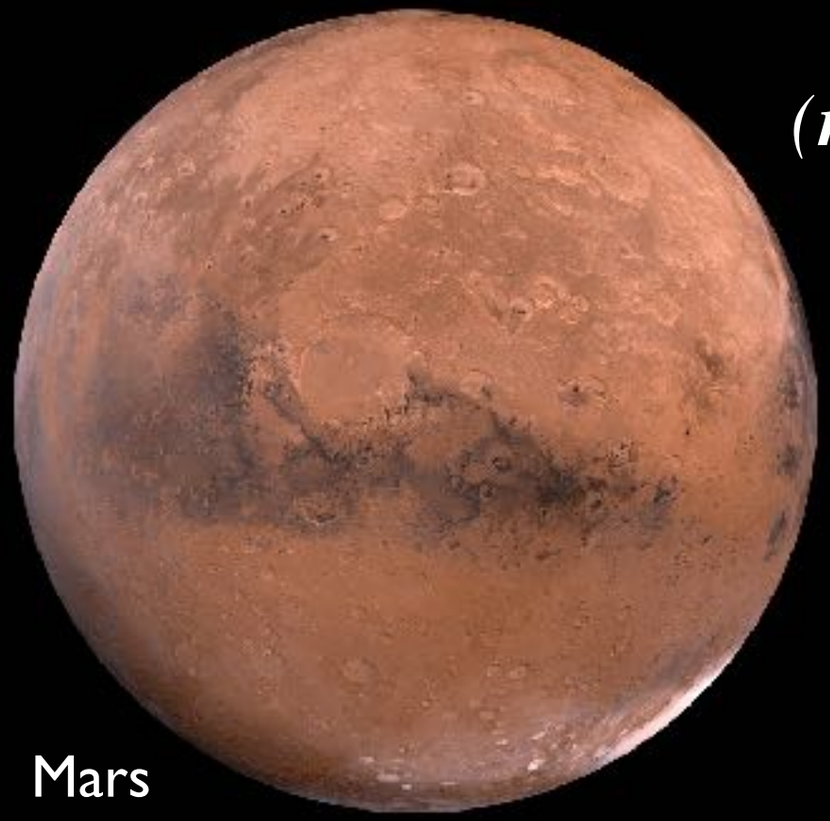
in a galaxy of 100 billion stars,

which is just one of billions of galaxies,

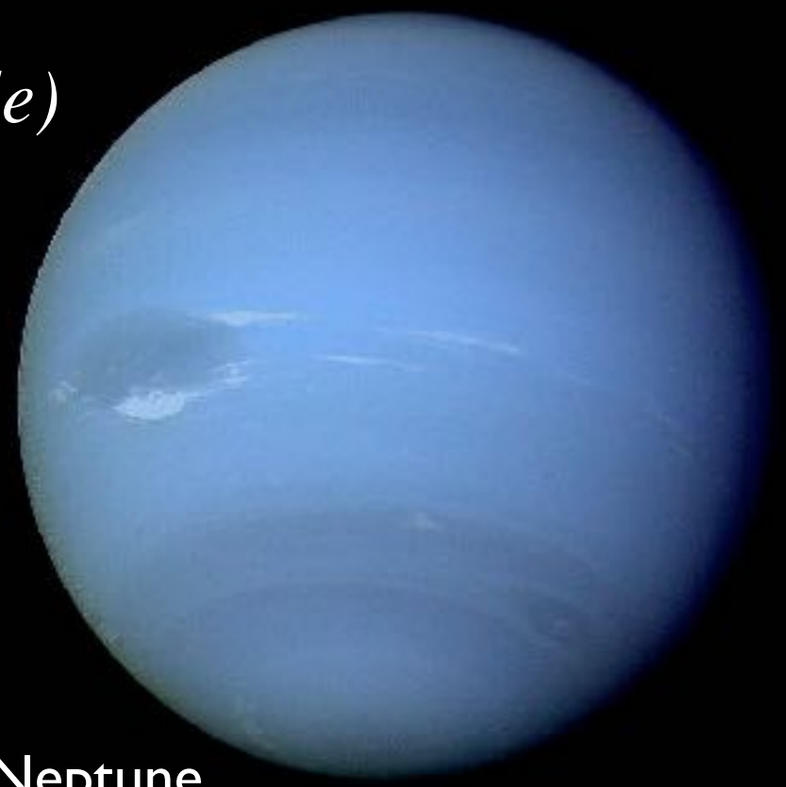
in a universe that is ~14 billion years old.

Planet

*(**not** to scale)*



Mars

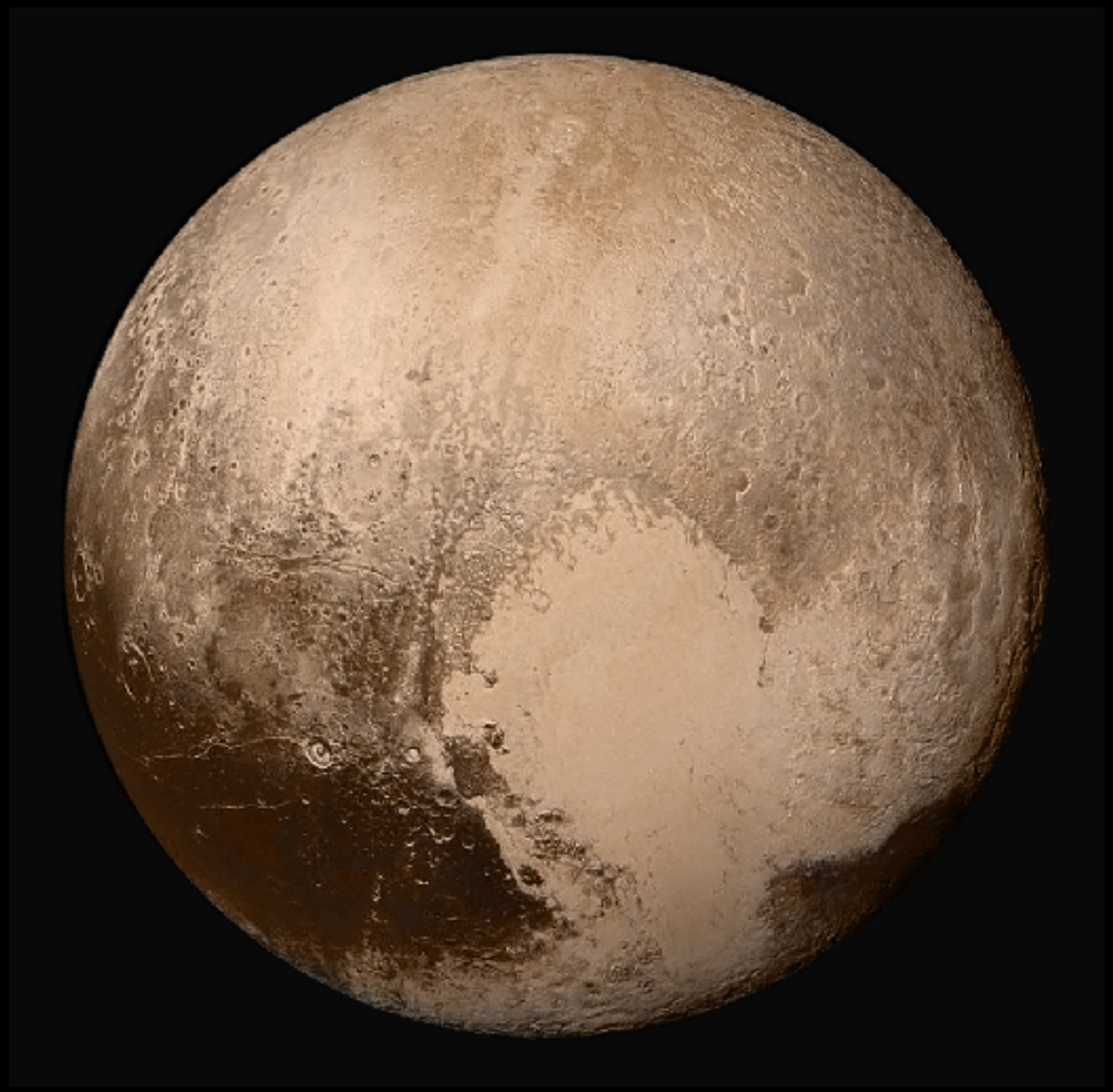


Neptune

A moderately large object that orbits a star that has cleared its orbit of similar objects.

It shines by reflected light. Planets may be rocky, icy, or gaseous in composition.

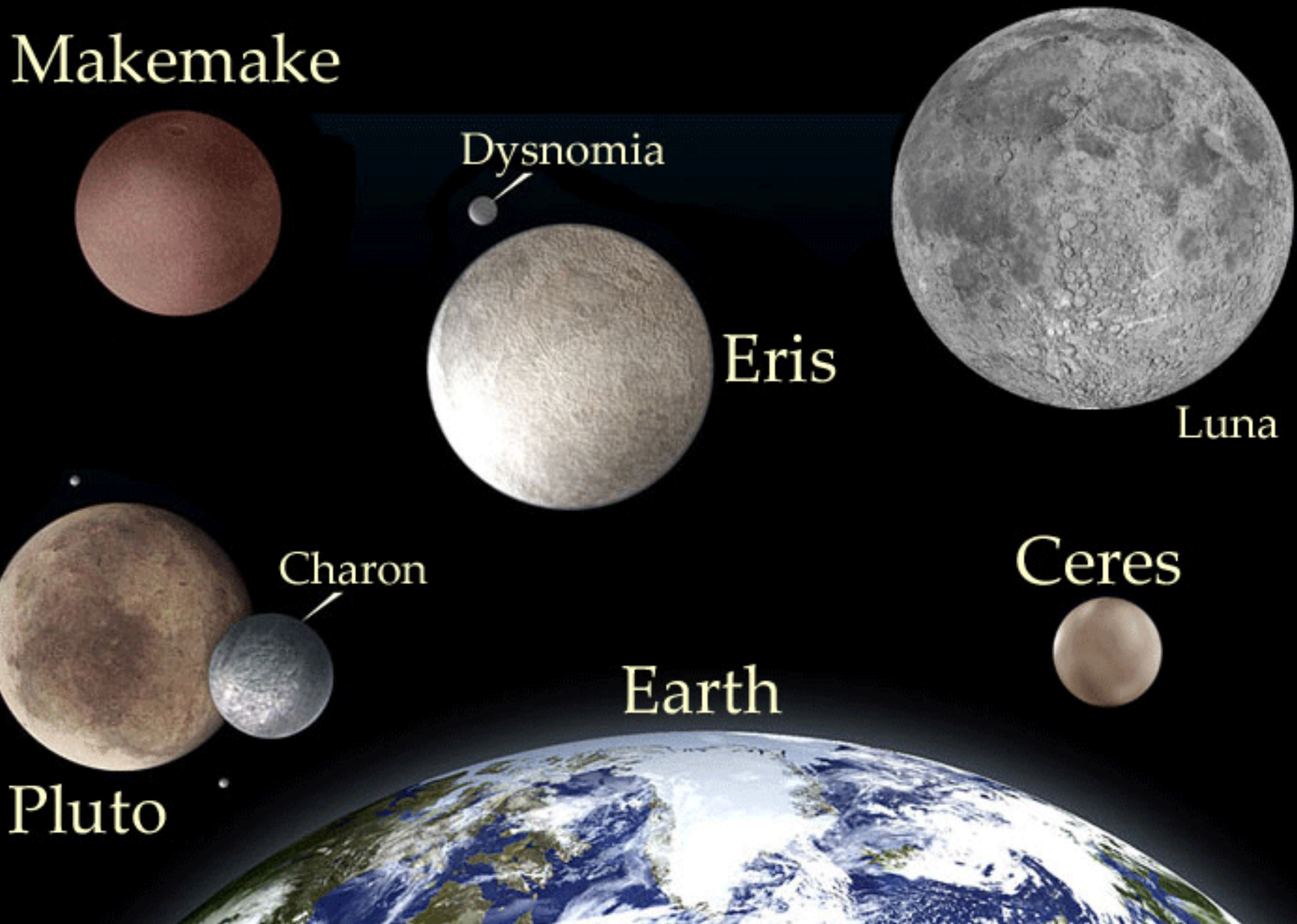
Dwarf Planet



A moderately small object that orbits a star.

It has not cleared similar objects out its orbit.

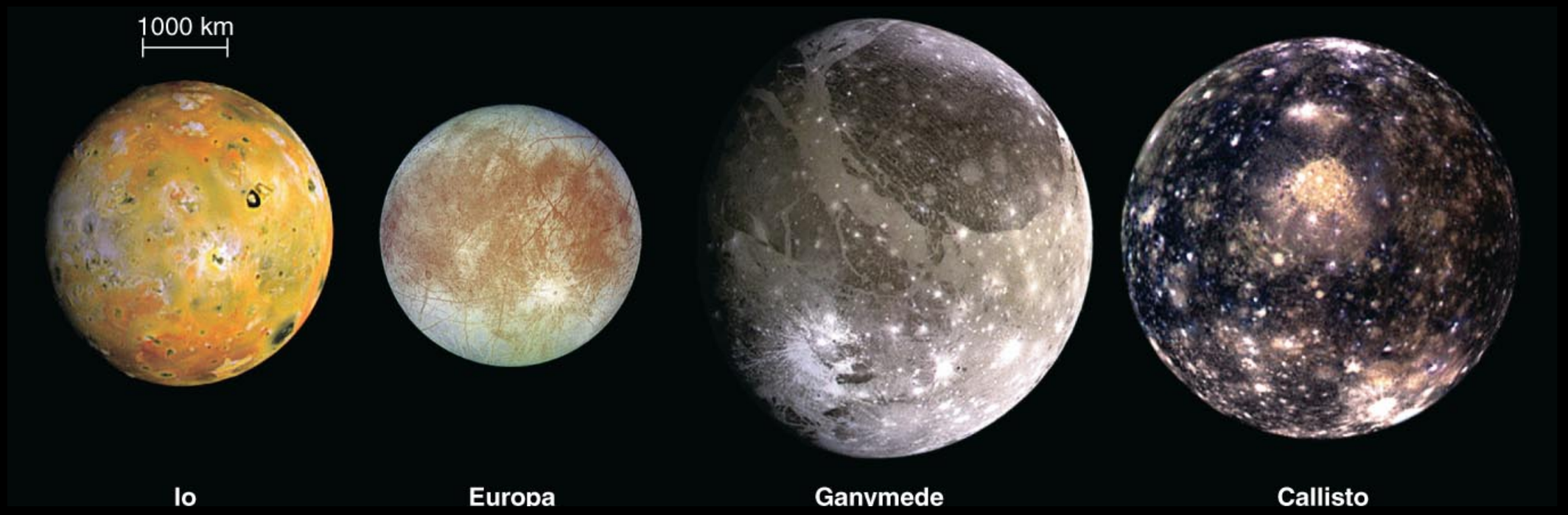
A few dwarf planets to scale



Moon (or satellite)

An object that orbits a planet.

Moons of Jupiter



Selected Moons of the Solar System, with Earth for Scale

Earth
Moon

Mars
Phobos
Deimos

Asteroid Ida
Dactyl

Jupiter
Io
Europa
Ganymede
Callisto

Saturn
Mimas
Enceladus
Tethys
Dione
Rhea
Titan
Hyperion
Iapetus
Phoebe

Uranus
Puck
Miranda
Ariel
Umbriel
Titania
Oberon

Neptune
Proteus
Triton
Nereid

Pluto
Charon

Eris
Dysnomia

Scale: 1 pixel = 25 km

Earth

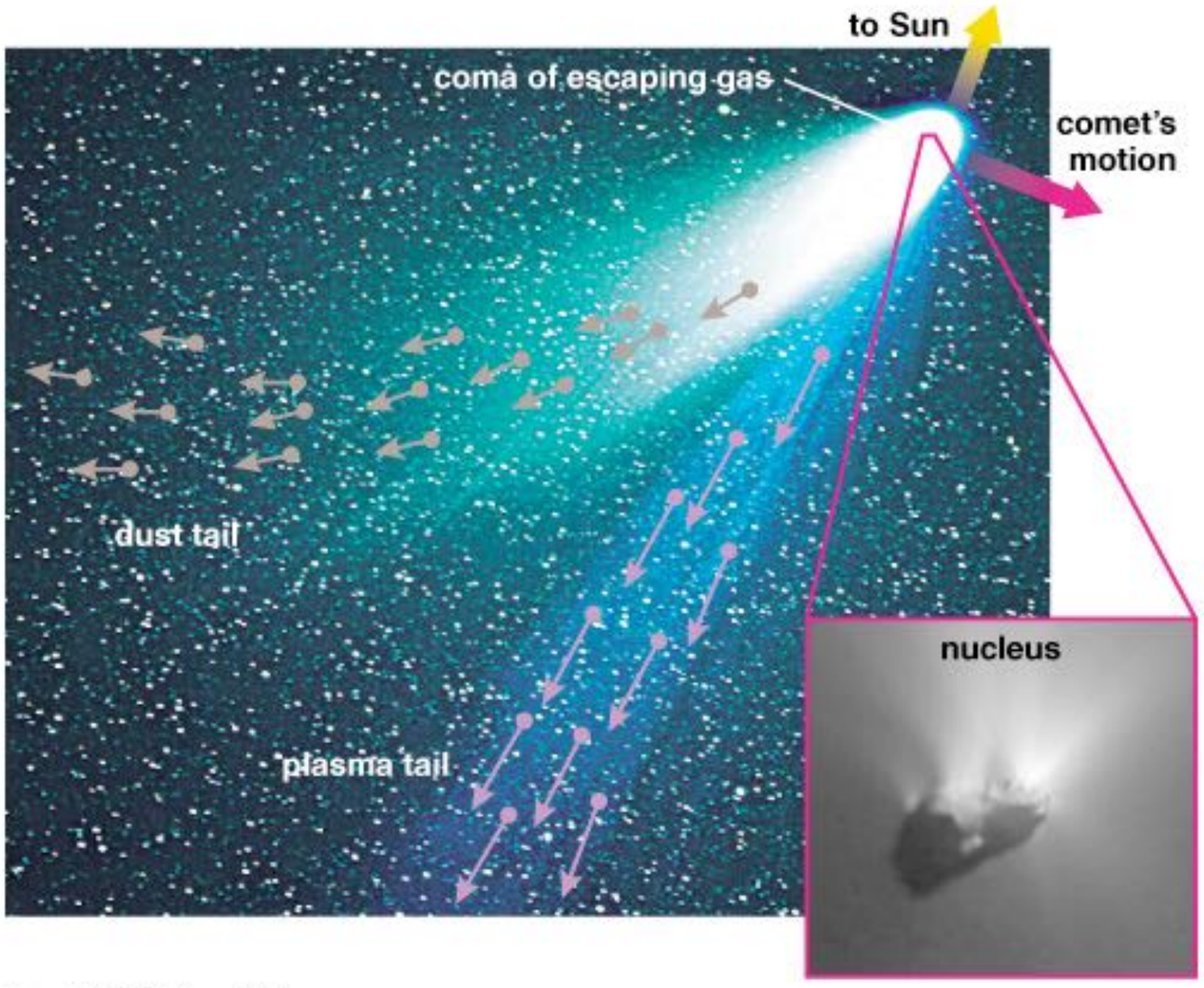
Asteroid

A relatively small and rocky object that orbits a star.

Most asteroids are too small for their self-gravity to make them round

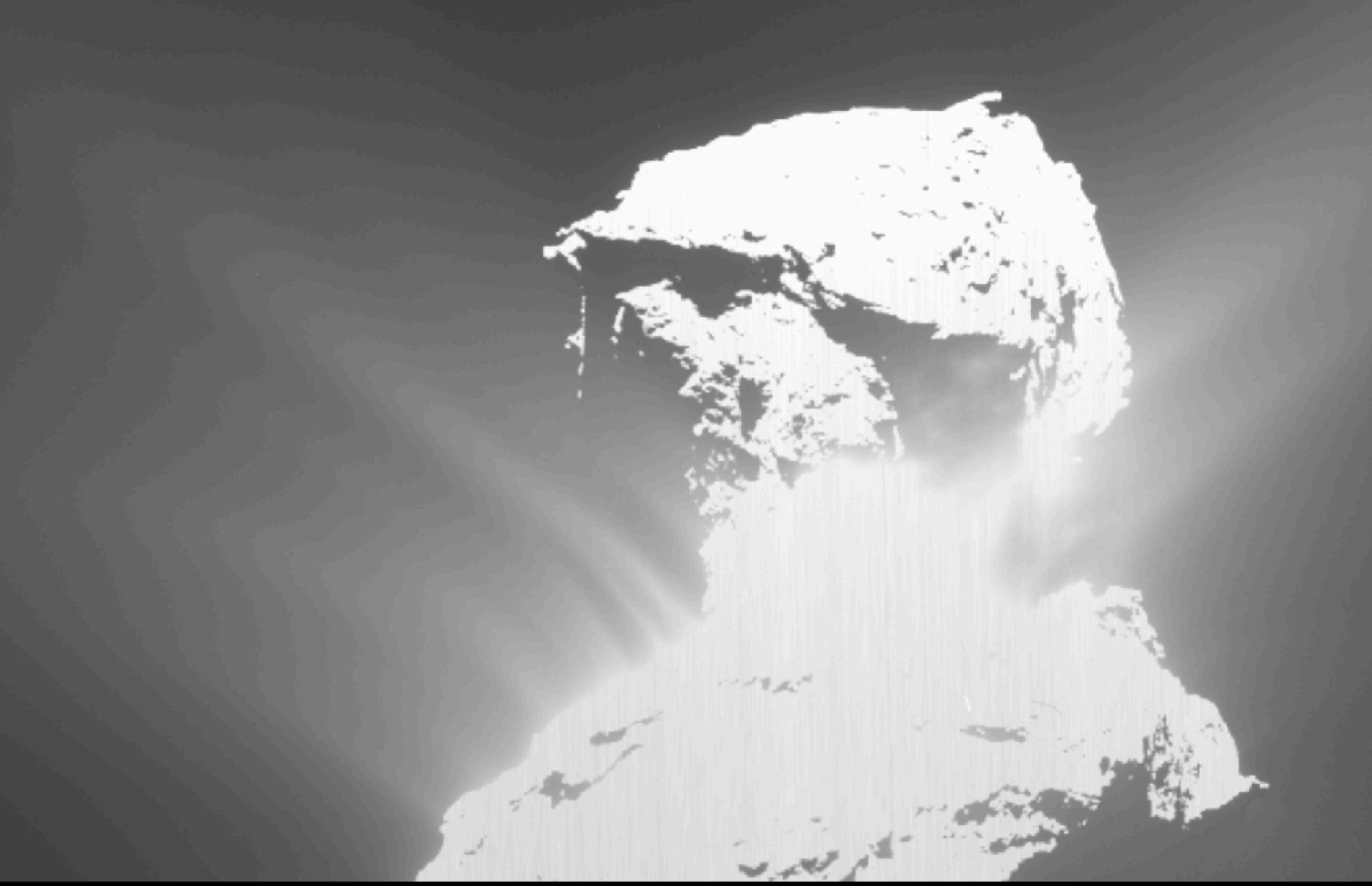
Ida

Comet



A relatively small and icy object that orbits a star.

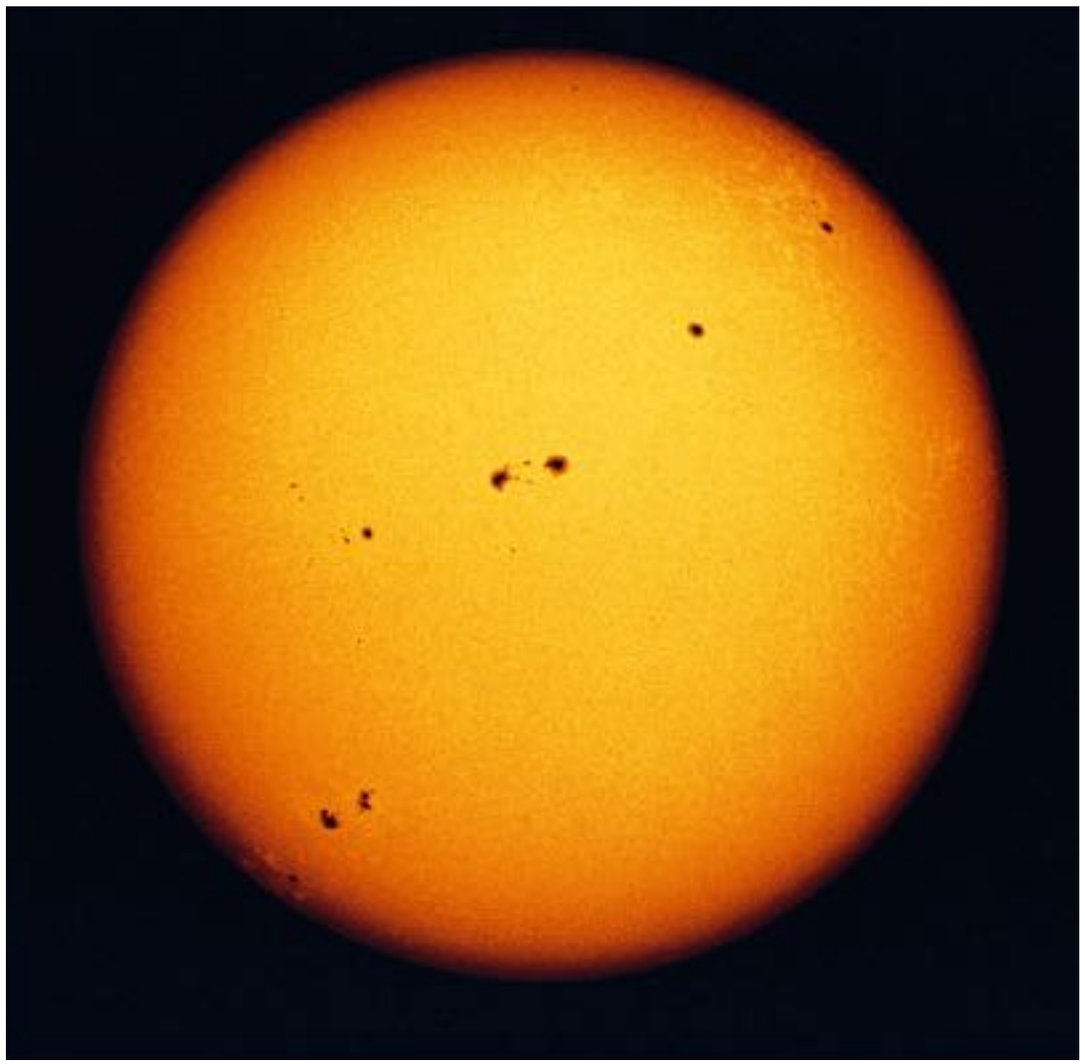
Comet 46P



Comet 67P
Outburst imaged by Rosetta last year.

Star

A large, glowing ball of gas that generates heat and light through nuclear fusion



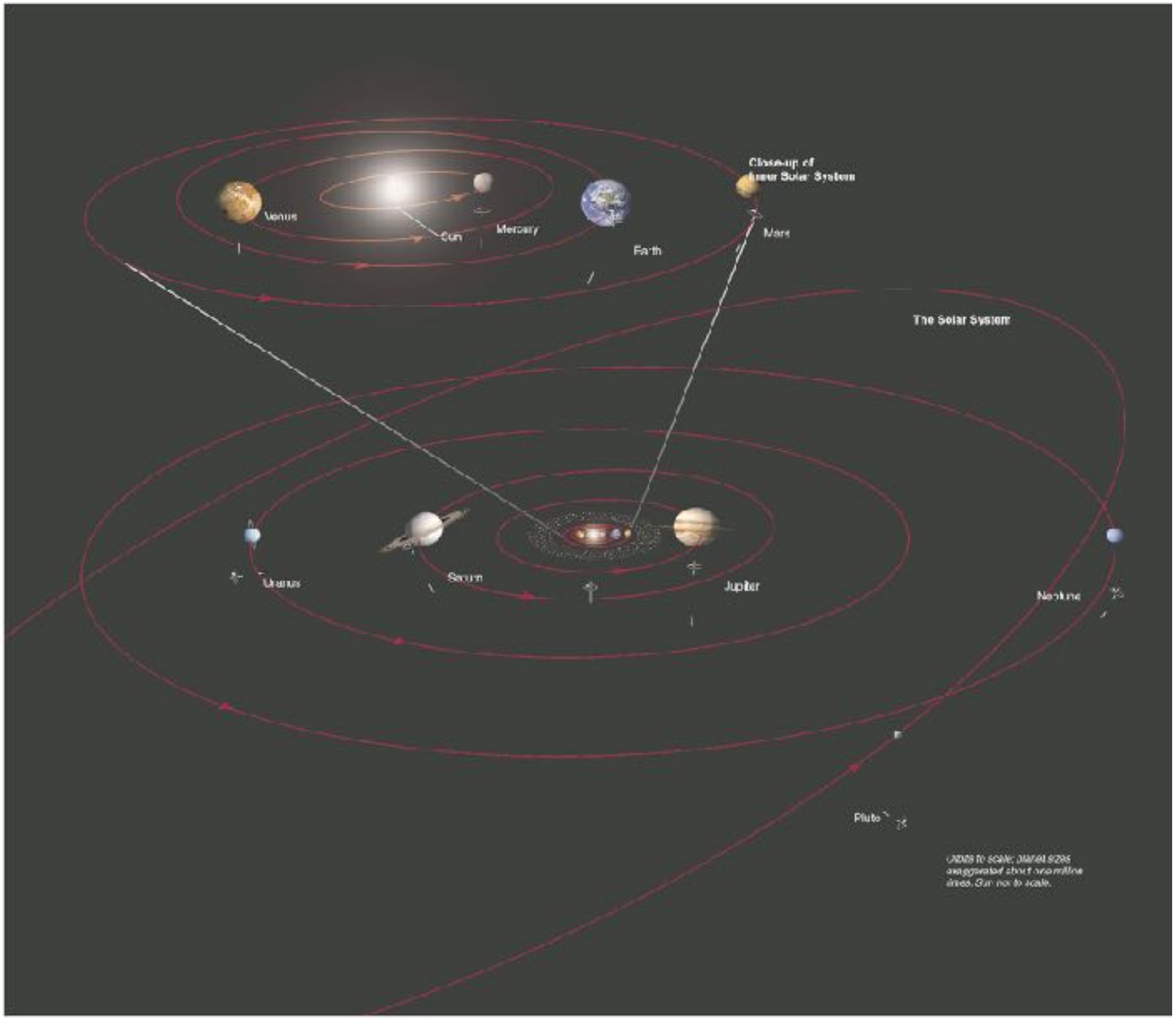
The sun releases more energy every second than a billion H-bombs

The sun as seen through the 9.5” telescope atop A.W. Smith during the partial eclipse Monday August 21, 2017

Sunspots are magnetic storms on the surface of the sun that appear dark because they’re not quite as hot as the surrounding gas.

Solar (Star) System

A star and all the material that orbits it, including its planets and moons



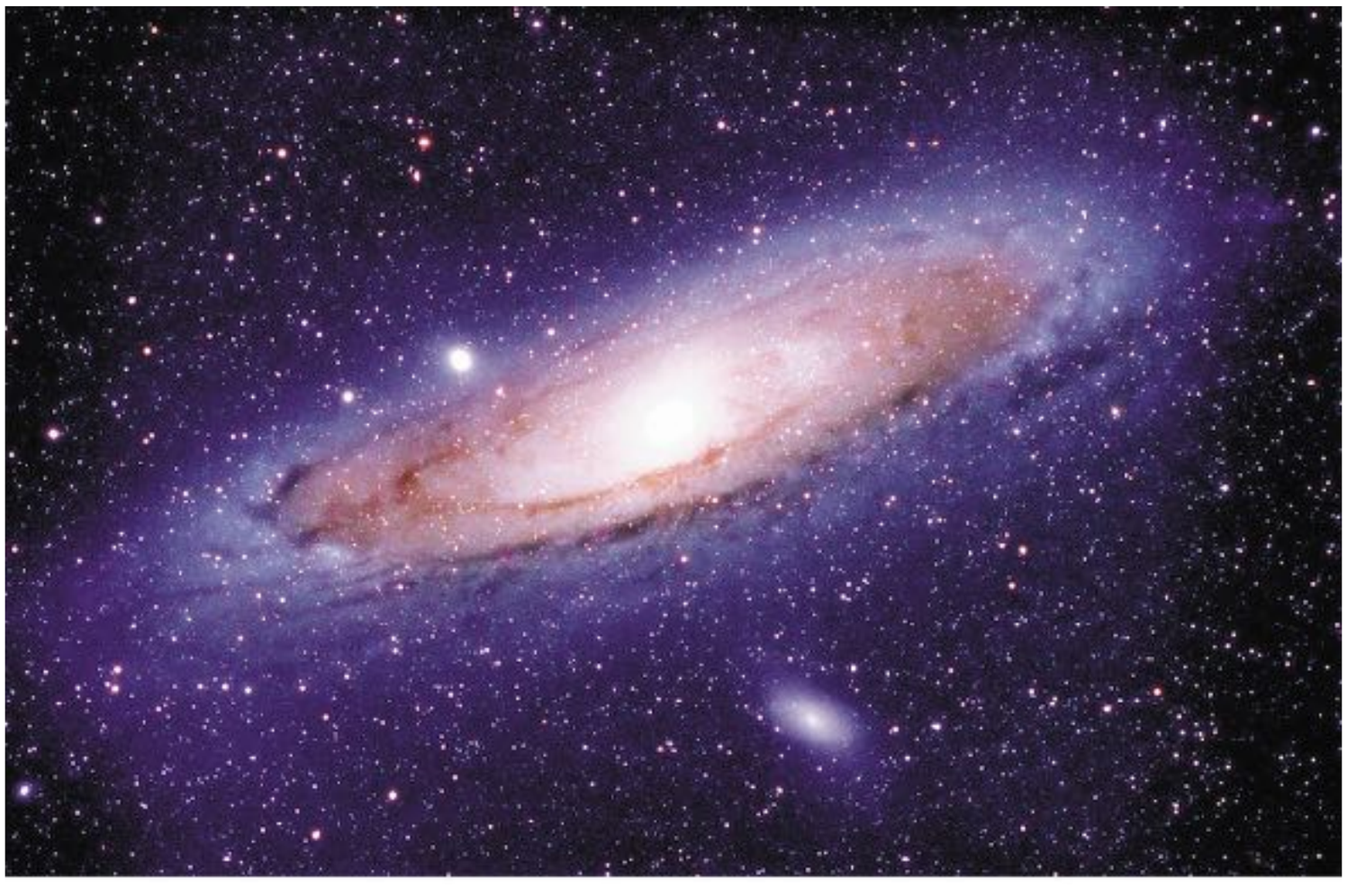
Nebula

An interstellar cloud
of gas and/or dust

Typically larger than the solar system - may contain many stars

Galaxy

A great island of stars in space, all held together by gravity and orbiting a common center



100s of billions of stars

Universe

The sum total of all matter and energy;
that is, everything within and between
all galaxies

100s of billions of galaxies...
in the observable portion of the universe

Powers of Ten video
https://www.youtube.com/watch?v=0fKBhvDjuy0

Scientific Notation

- 10^0 1
- $10^1 = 10$
- $10^2 = 100$
- ...
- $10^6 = 1{,}000{,}000$
- similarly...
- $10^{-1} = 0.1$
- $10^{-6} = 0.000001$

Units important!

1 g cm^{-3} = 1,000 kg m^{-3}
density of water

5.5 g cm^{-3}
average density of the Earth

10^{-29} g cm^{-3}
approximate average density of the universe