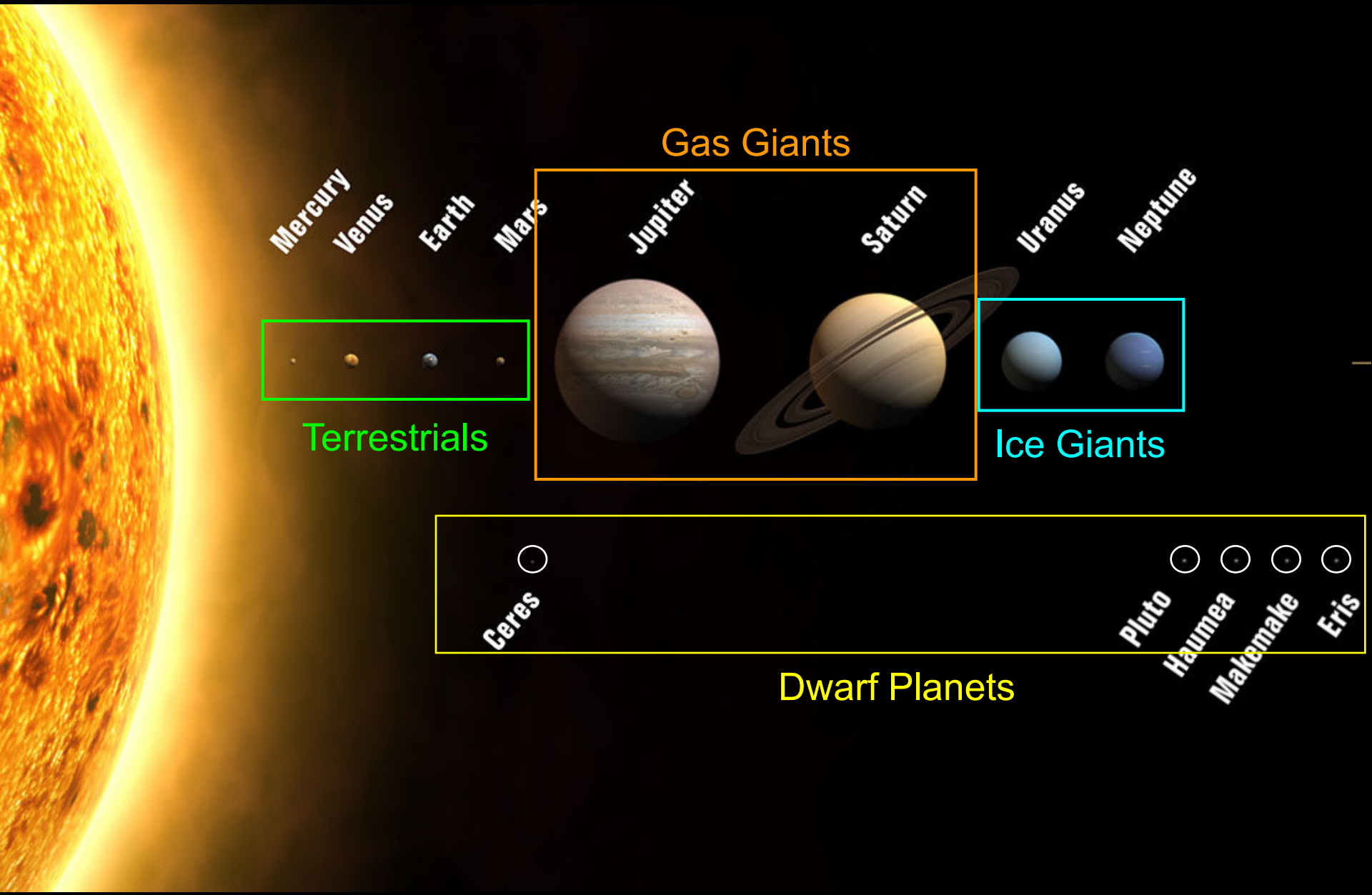
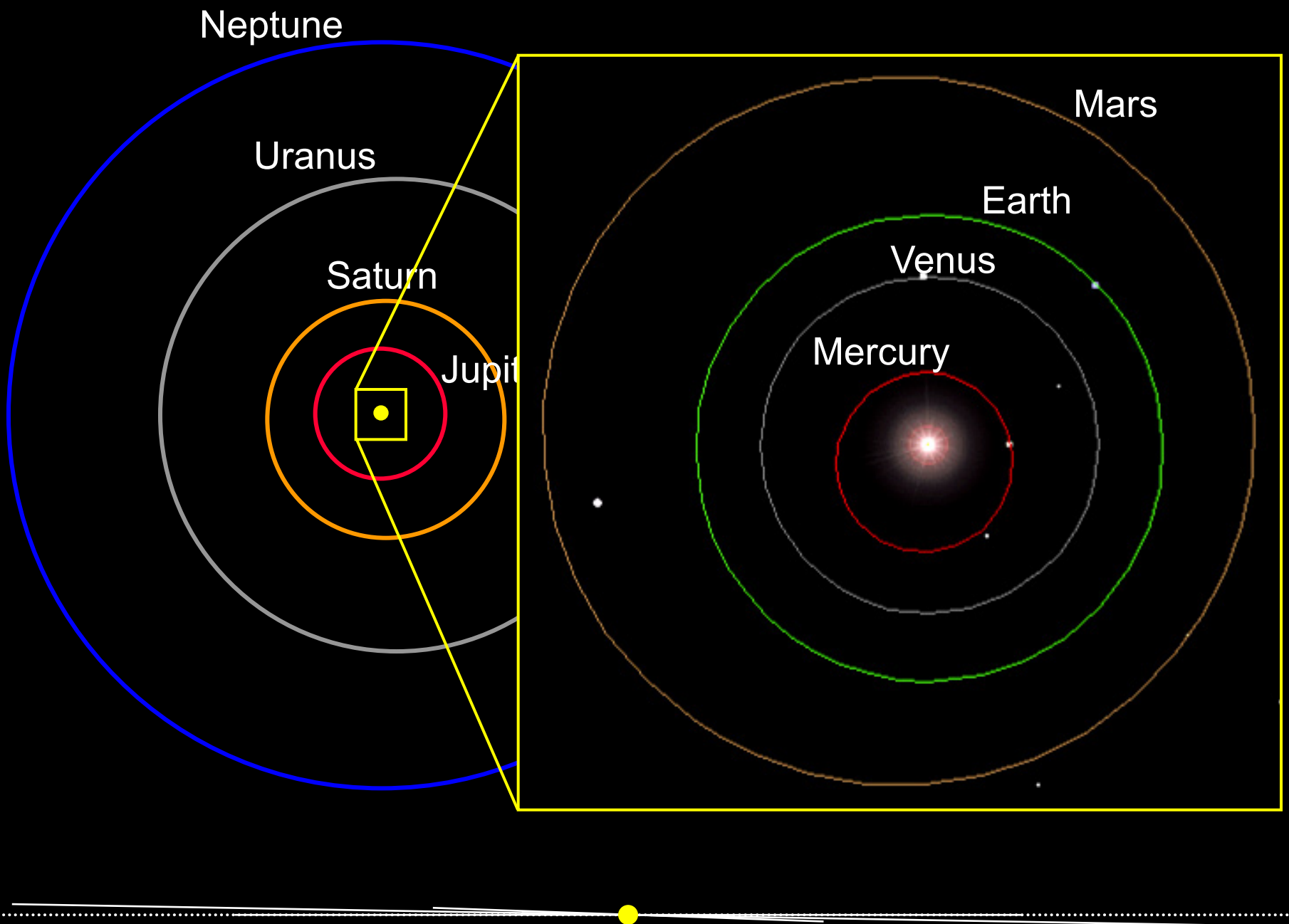
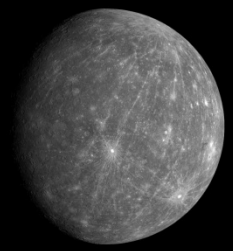
The Solar System

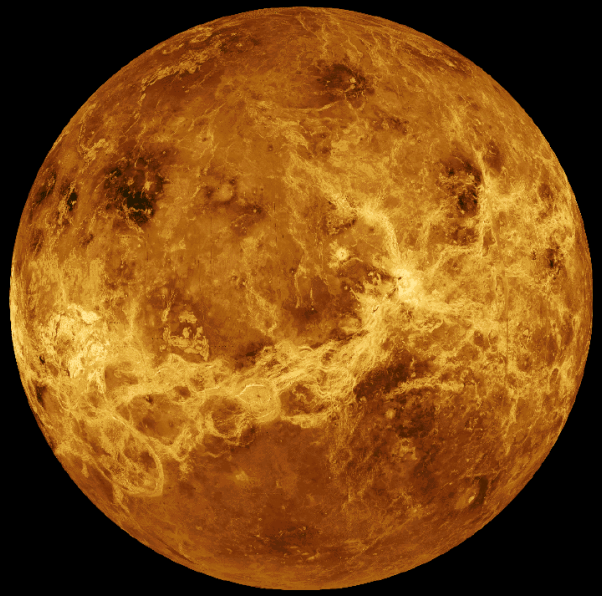



Neptune
Uranus
Saturn
Jupit
Mars
Earth
Venus
Mercury

The Terrestrial Planets

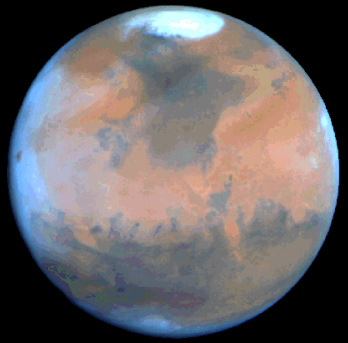


Mercury
0.055 M_E
0.4 AU



Venus
0.82 M_E
0.7 AU

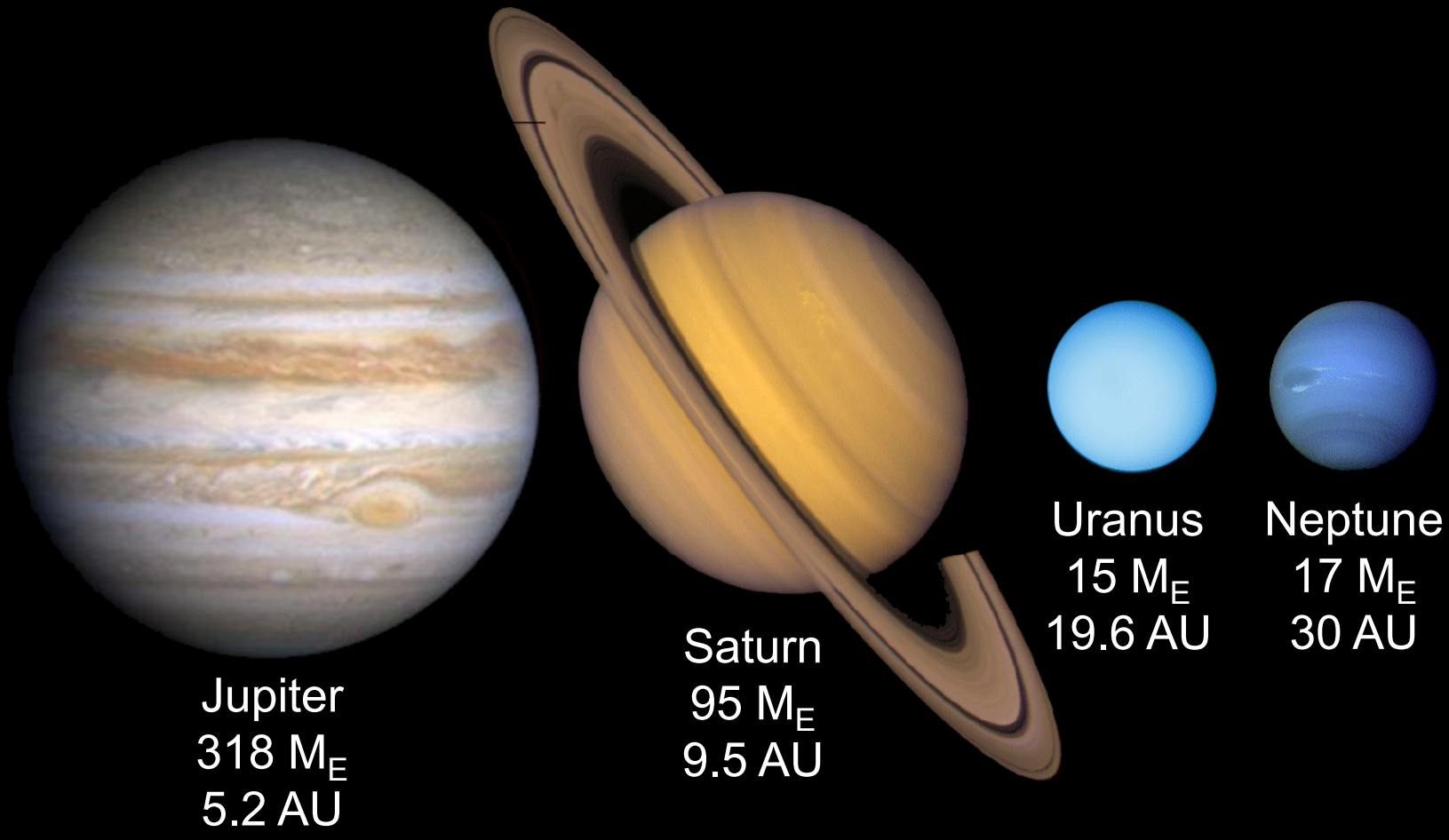
Earth
1 M_E
1 AU



Mars
0.11 M_E
1.5 AU

Composed of mostly O, Si, Mg, S, Fe & Ni with solid surfaces
All are High Density: 3900 – 5500 kg m^{-3}

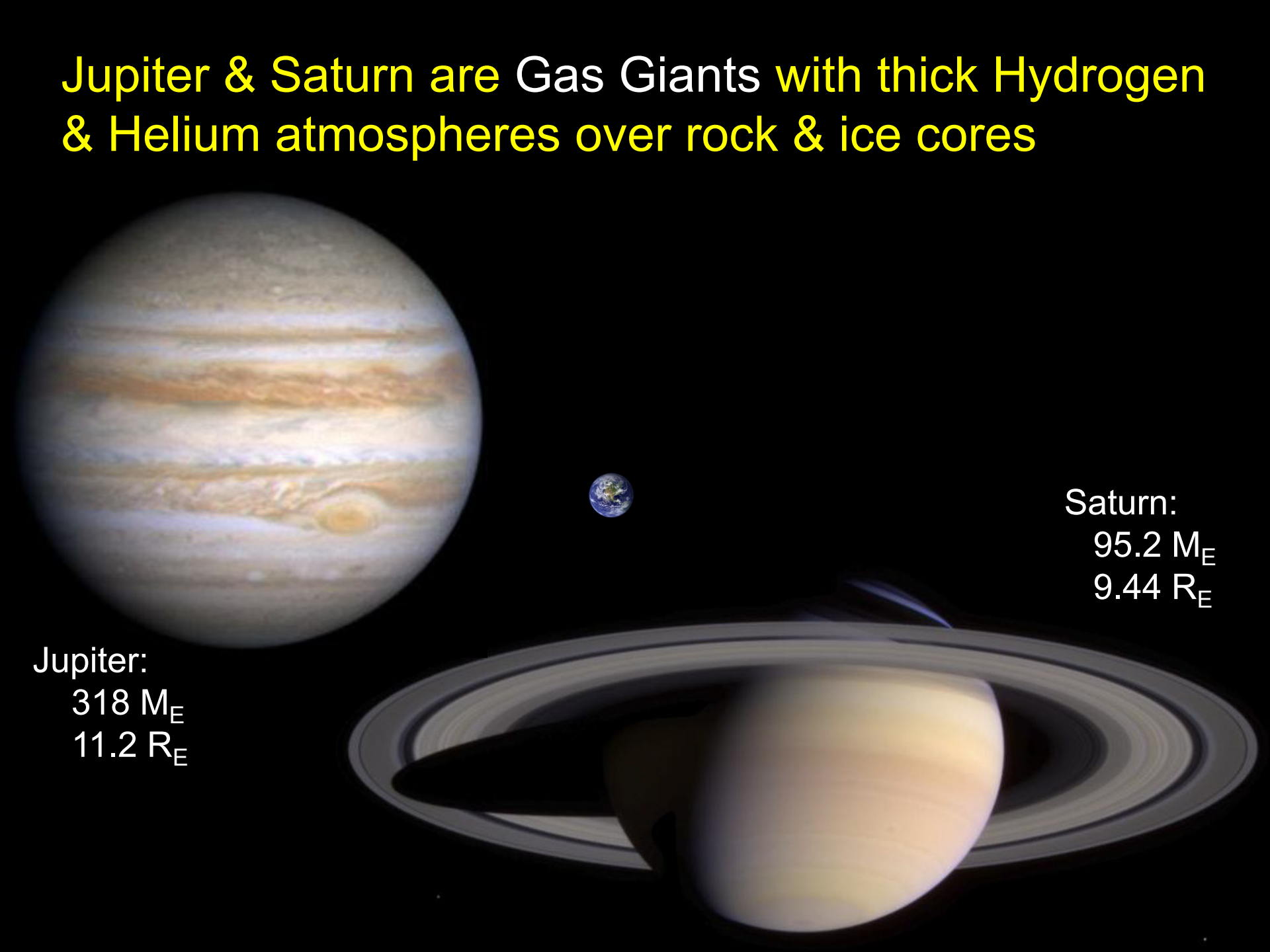
The Jovian Planets



Composed of mostly H & He and ices, with no solid surfaces

All are Low-Density: 687 – 1648 kg m^{-3}

Jupiter & Saturn are Gas Giants with thick Hydrogen & Helium atmospheres over rock & ice cores



Jupiter:
318 M_E
11.2 R_E

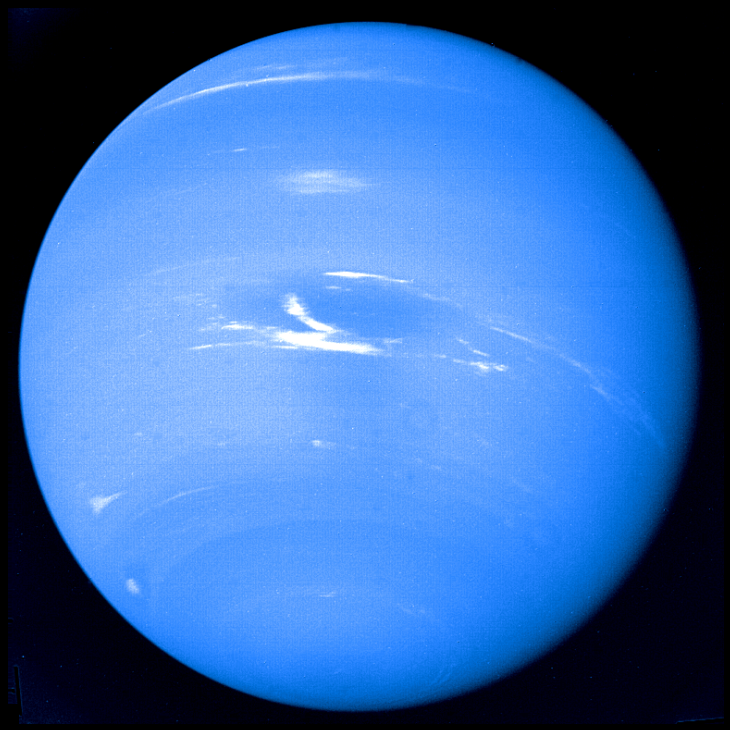
Saturn:
95.2 M_E
9.44 R_E

Uranus and Neptune are Ice Giants made mostly of ices with thin Hydrogen & Helium atmospheres.

Uranus

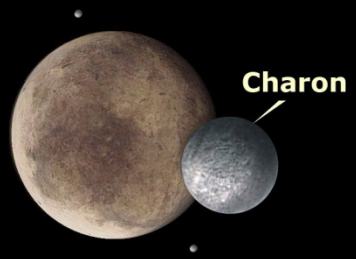
14.5 M_E
4.01 R_E

Neptune



17.1 M_E
3.88 R_E

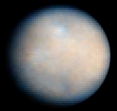
The Dwarf Planets are a new class of Solar System objects defined by the IAU in 2006.



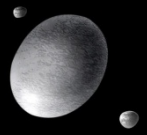
Pluto

Eris

Makemake



Ceres



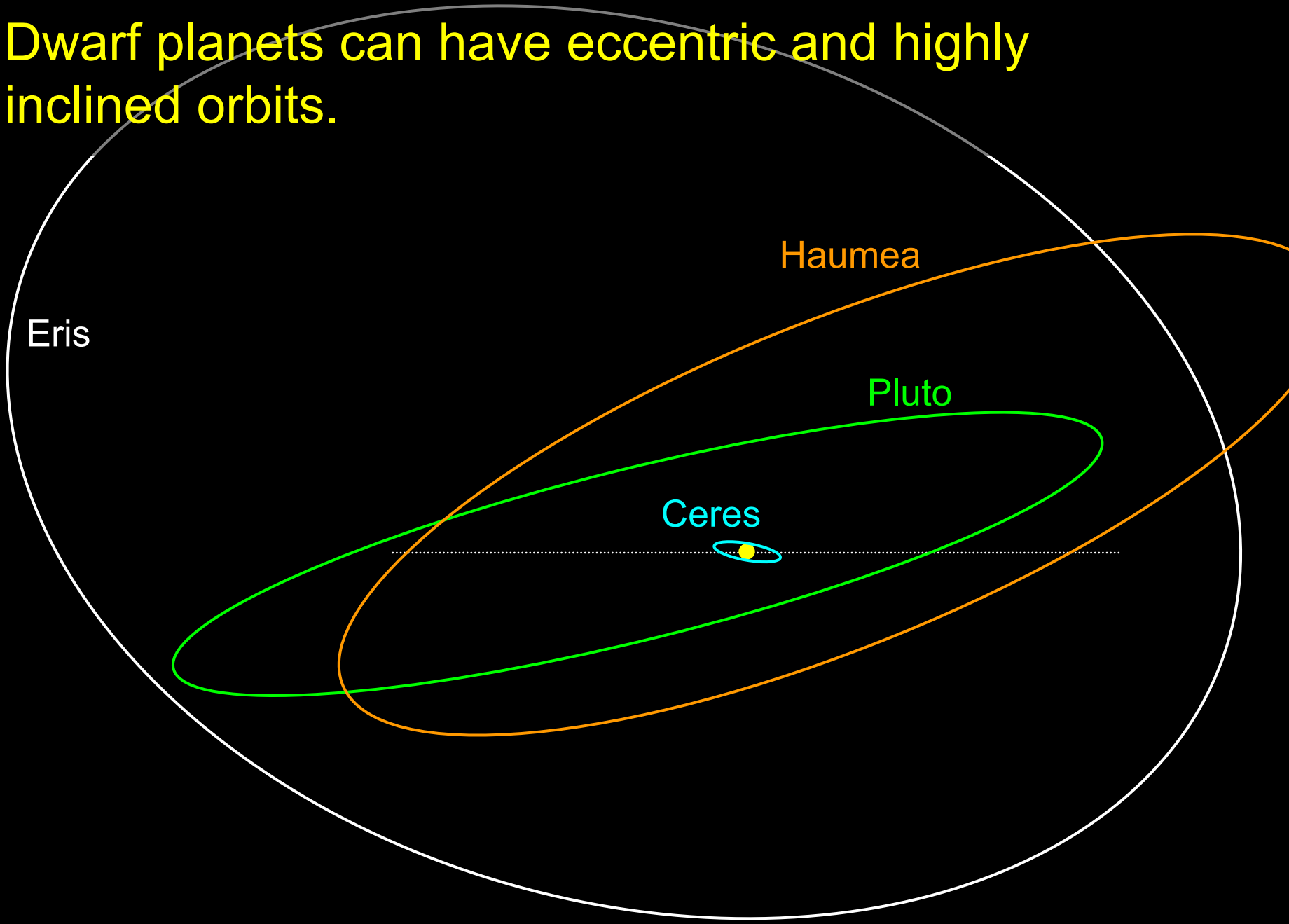
Haumea

Moon

Earth

40+ other candidates…

Dwarf planets can have eccentric and highly inclined orbits.



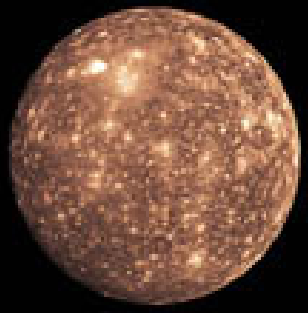
The Solar System has 7 Giant Moons, mostly found orbiting the giant planets of the outer solar system.

Ganymede

5262 km

Titan

5150 km



Callisto

4806 km

Io

3642 km

Moon

3476 km

Europa

3138 km

Triton

2706 km

The Trans-Neptunian Objects are a numerous class of small, icy bodies that orbit beyond Neptune.

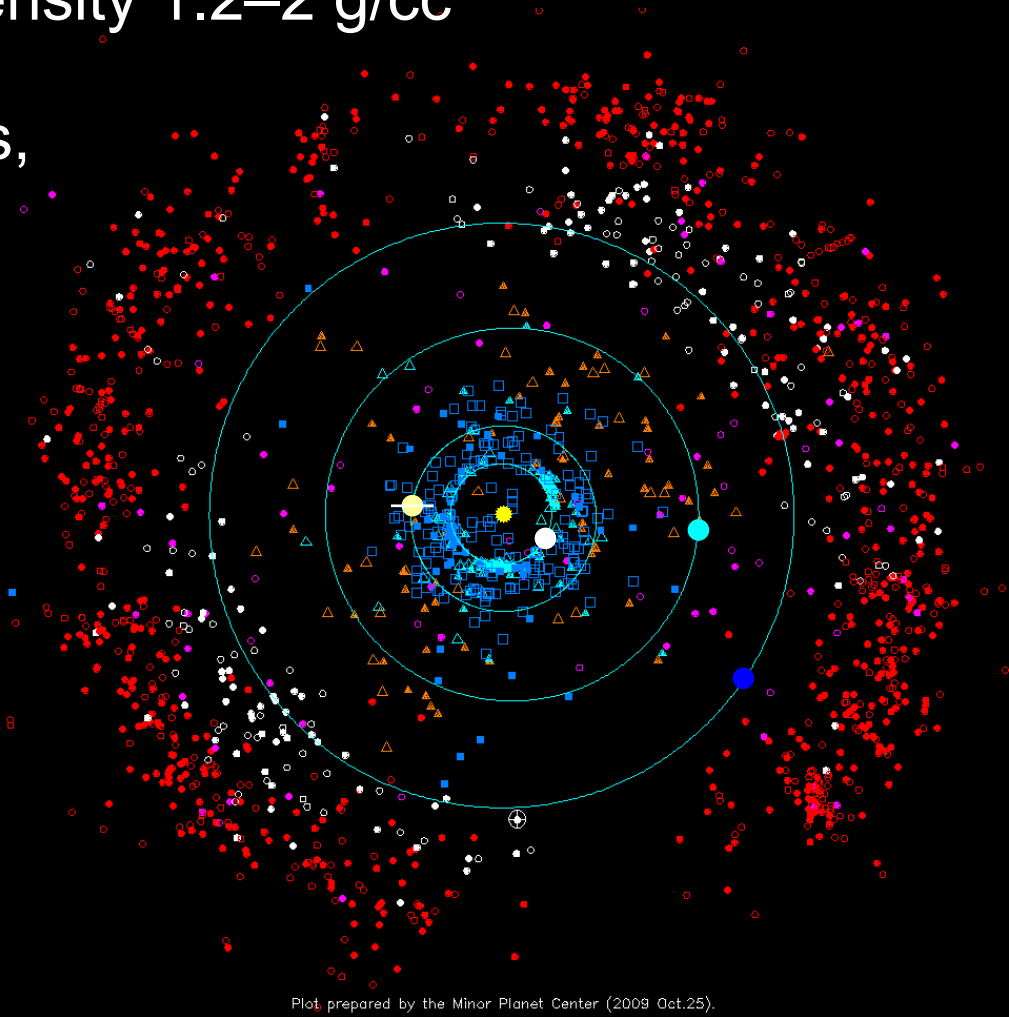
Composed mostly of ices: density 1.2–2 g/cc

Icy Dwarf Planets (Pluto, Eris, Haumea, & Makemake)

Kuiper Belt Objects (30 – 50AU)

Pluto's large moon Charon

Distant large icy bodies like Sedna & Quaoar



Largest known Trans-Neptunian Objects

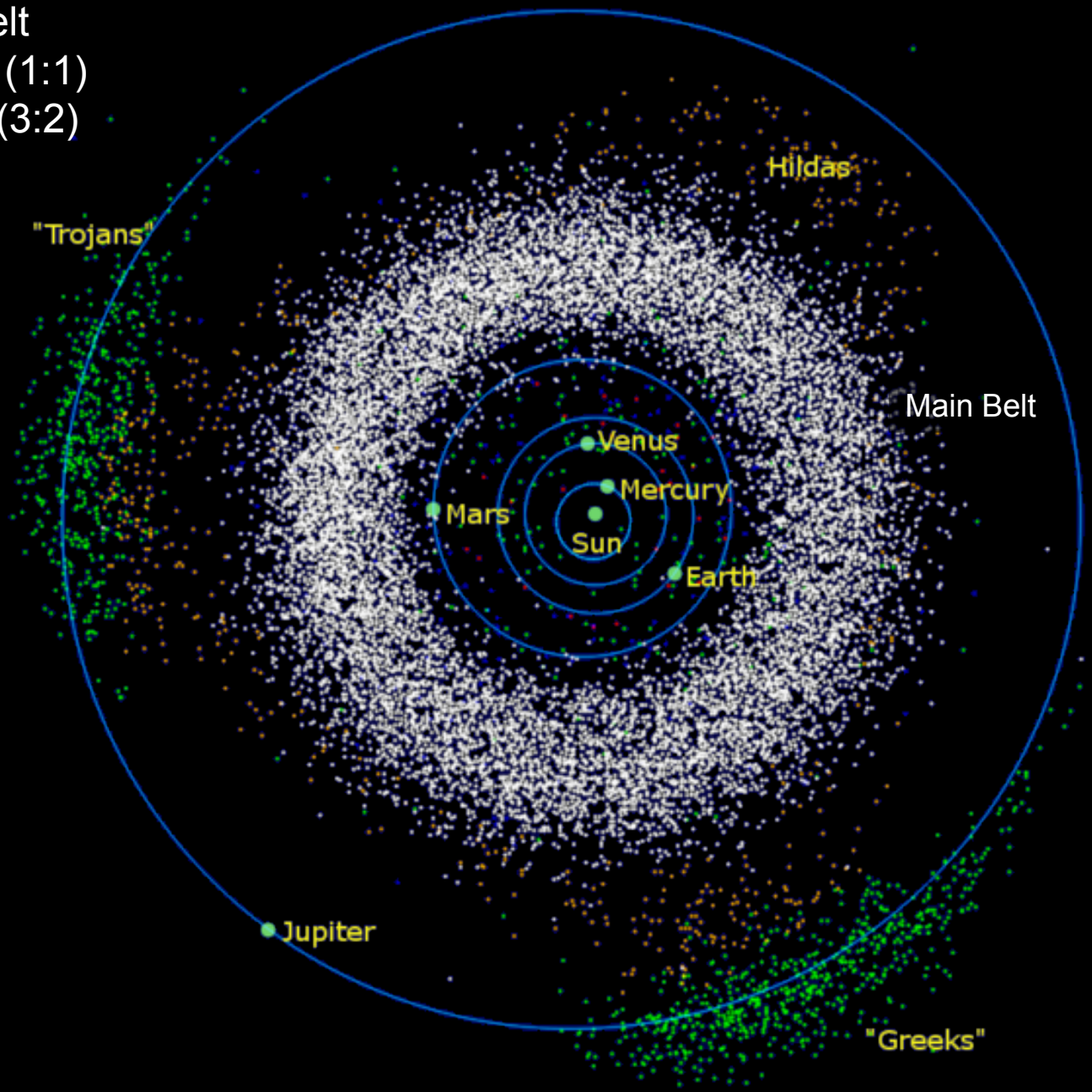
Asteroids are rocky or rock/metal aggregates found mostly in the Main Belt between Mars and Jupiter.

Made of rock & metal, some with ices (density 2–3 g/cc)

Range in size from a few 100km to large boulders (few meters)

Major Asteroid Families

Main Belt
Trojans (1:1)
Hildas (3:2)



Meteors are small bits of rock and/or metal ranging in size from grains of sand to boulders.

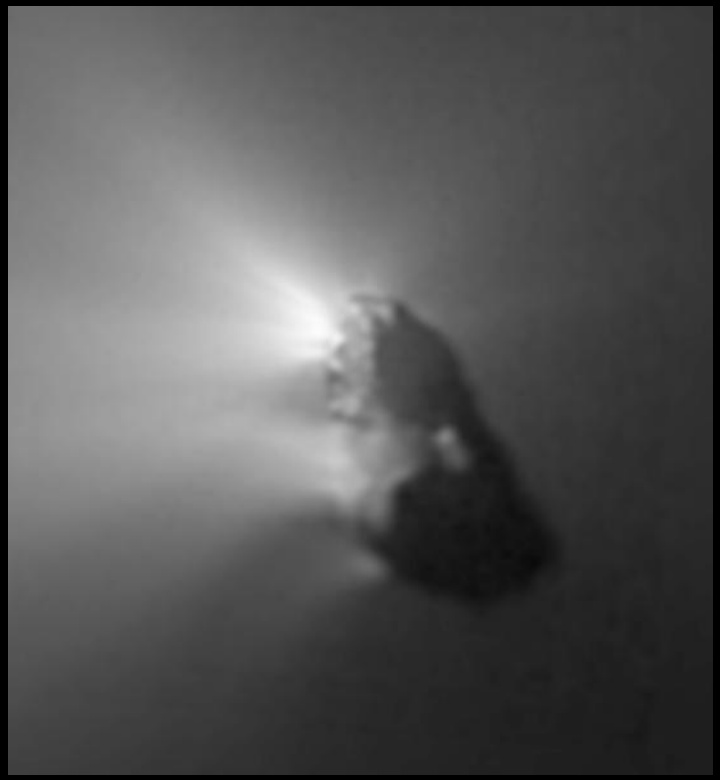
Stony Meteors:
mostly silicates

Iron Meteors:
mostly iron

Chondrites:
high Carbon content
and organic compounds
including amino acids

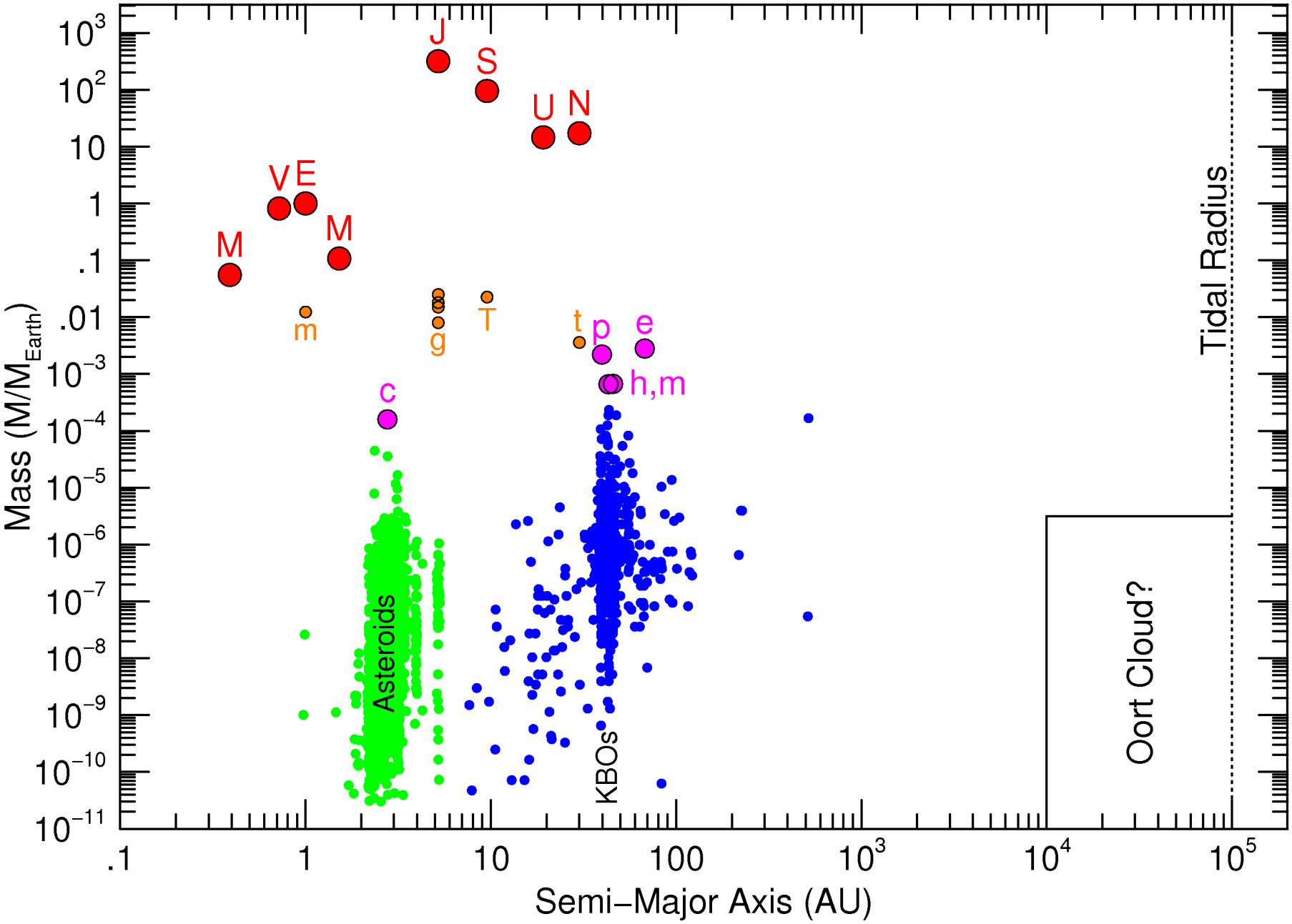
Meteor burning up in the Earth's atmosphere.

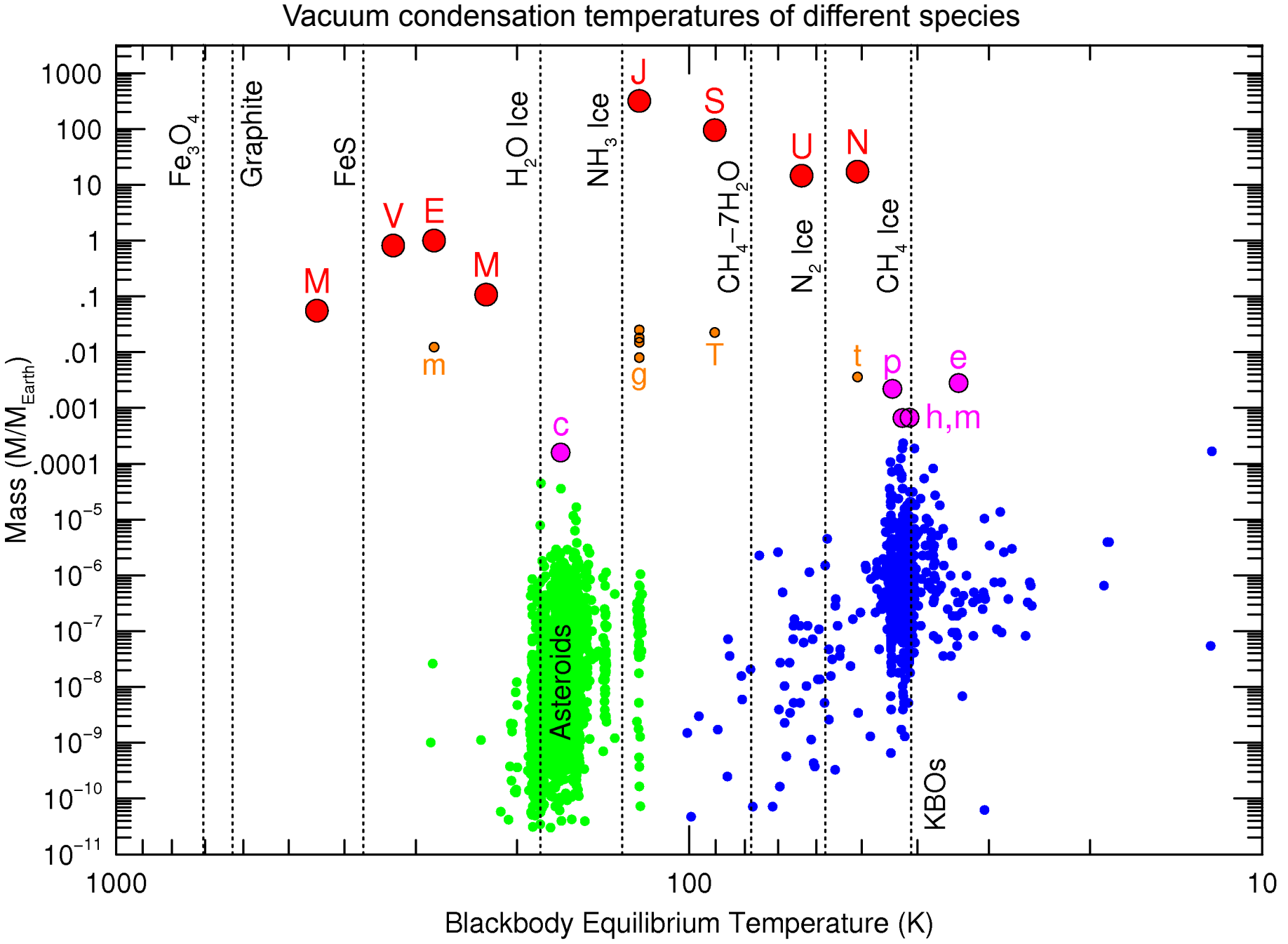
Comets are low-density composites of rock and ice ("Dirty Snowballs").



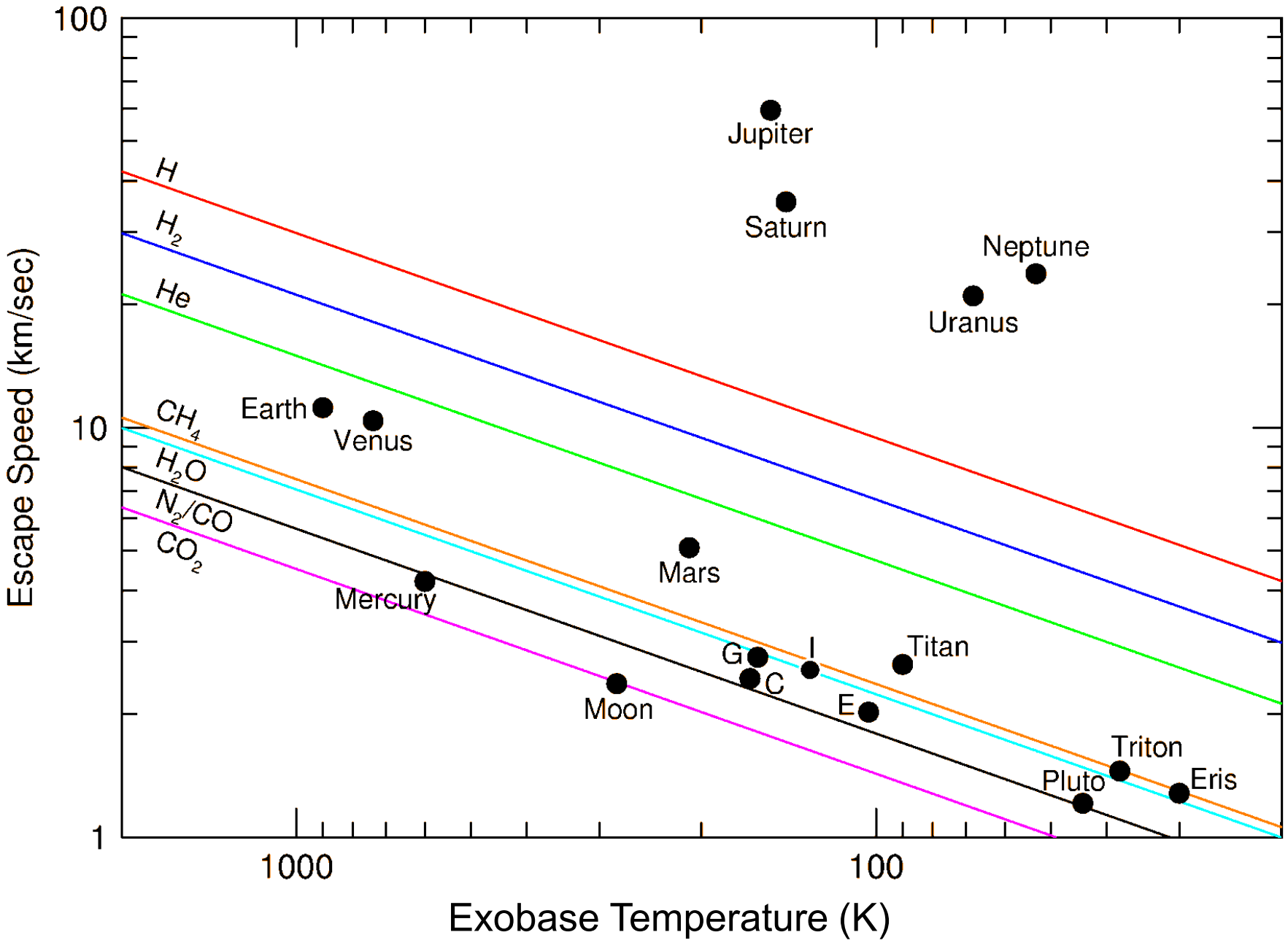
Originate in the outer solar system (Kuiper Belt and Oort Cloud)

Develop longs tails of gas & dust swept off them by sunlight and the solar wind when they pass near the Sun.


Mass (M/M_Earth)
Semi−Major Axis (AU)
J
S
U
N
V
E
M
M
m
g
T
t
p
e
h,m
c
Asteroids
KBOs
Tidal Radius
Oort Cloud?



Condensation Temperatures from Lodders 2003, ApJ, 591, 1220


100
10
1
1000
100
Escape Speed (km/sec)
Exobase Temperature (K)
H
H2
He
CH4
H2O
N2/CO
CO2
Jupiter
Saturn
Neptune
Uranus
Earth
Venus
Mars
Mercury
Moon
G
I
C
E
Titan
Triton
Pluto
Eris