Terrestrial Planets

Week 5

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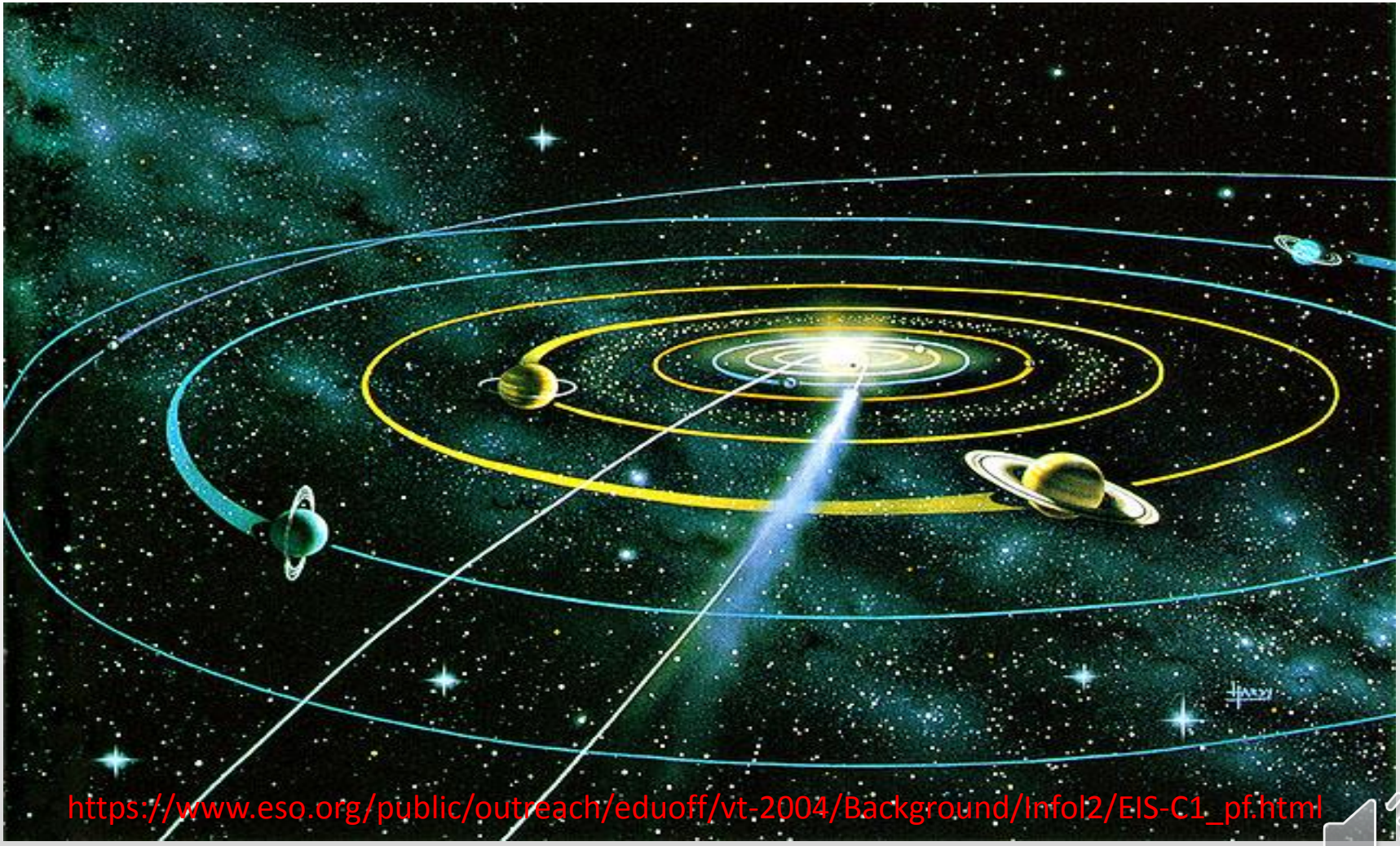
Earth and Planetary Sciences
FD Adams 131C

Planets of our Solar System



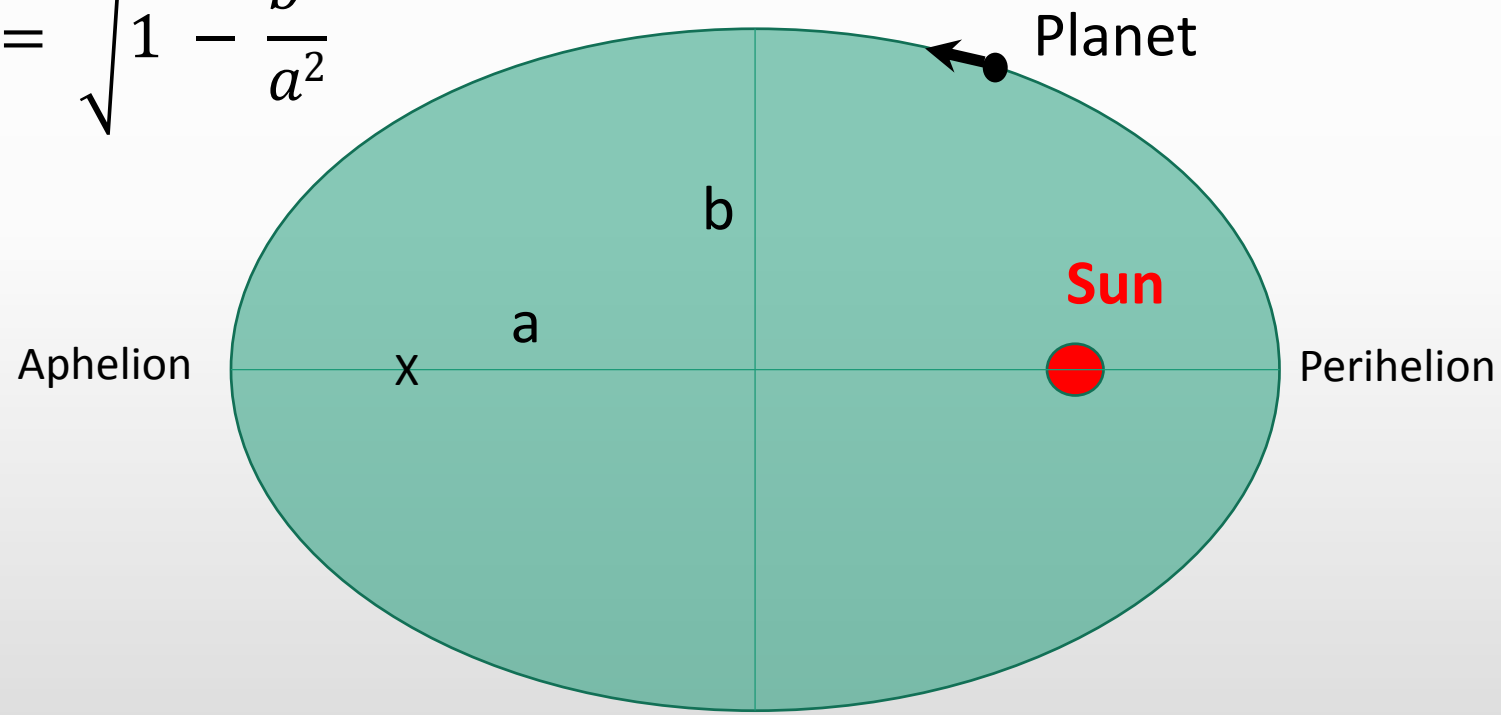
Let us learn something of these planets and their orbits.

The planetary system: orbital parameters				
Planet	Period (yr)	Distance (AU)	Eccentricity	Inclination º
Mercury	0.2408	0.39	0.206	7.0
Venus	0.6152	0.72	0.007	3.4
Earth	1	1	0.017	0
Mars	1.881	1.52	0.093	1.9
Ceres*	3.63	2.36	0.237	7.1
Jupiter	11.86	5.2	0.049	1.3
Saturn	29.46	9.54	0.056	2.5
Uranus	84.01	19.19	0.047	0.8
Neptune	164.79	30.0	0.009	1.8
Pluto*	248.5	39.48	0.25	17.2

* Dwarf planets

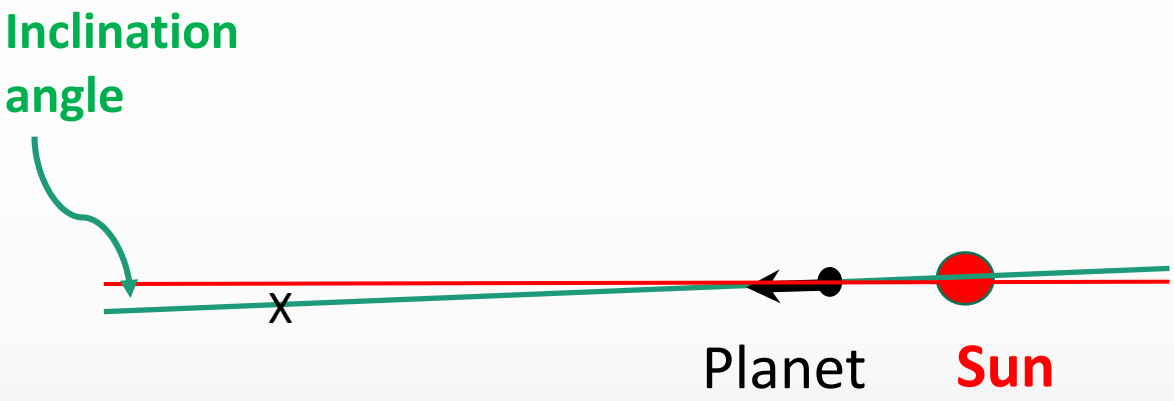
Orbital eccentricity

$$e = \sqrt{1 - \frac{b^2}{a^2}}$$

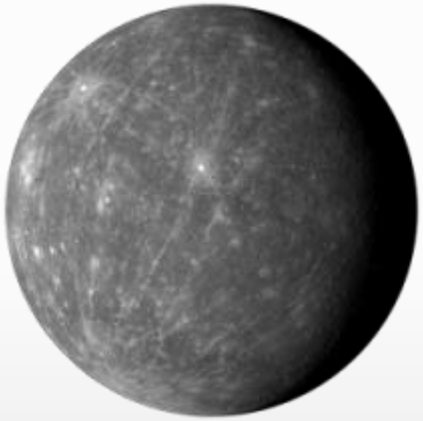


a is the semi-major axis,
b is the semi-minor axis

Orbital inclination



Mercury



Diameter:	4,879 km
Mass:	3.30 x 10^{23} kg (5.5% Earth)
Moons:	None
Orbit Distance:	57,909,227 km (0.39 AU)
Orbit Period:	88 days
Rotation Period:	58.7 days (3:2 spin-orbit couple)
Surface Temp:	-173 to 427°C
First Record:	14th century BC
Recorded By:	Assyrian astronomers

http://space-facts.com/mercury/

Venus

Diameter:	12,104 km
Mass:	4.87 x 10^{24} kg (81.5% Earth)
Moons:	None
Orbit Distance:	108,209,475 km (0.73 AU)
Orbit Period:	225 days
Rotation Period:	243 days (retrograde)
Surface Temp:	462 °C (almost constant)
First Record:	17th century BC
Recorded By:	Babylonian astronomers

http://space-facts.com/venus/

Earth

Equatorial Diameter:	12,756 km
Polar Diameter:	12,714 km
Mass:	5.97×10^{24} kg
Moons:	1 (The Moon)
Orbit Distance:	149,598,262 km (1 AU)
Orbit Period:	365.26 days
Rotation Period (solar):	86 400 seconds = 1 day
Rotation Period: (sidereal):	23.93 hours
Surface Temperature:	-88 to 58°C

http://space-facts.com/earth/

Moon

Diameter:	3,475 km (0.27 Earth's)
Mass:	7.35×10^{22} kg (0.01 Earth's)
Orbital eccen.:	0.055
Orbit Distance:	384,400 km
Orbit Period:	27.3 days (Tropical month)
	29.53 days (Synodic month)
Surface Temp:	-233 to 123C

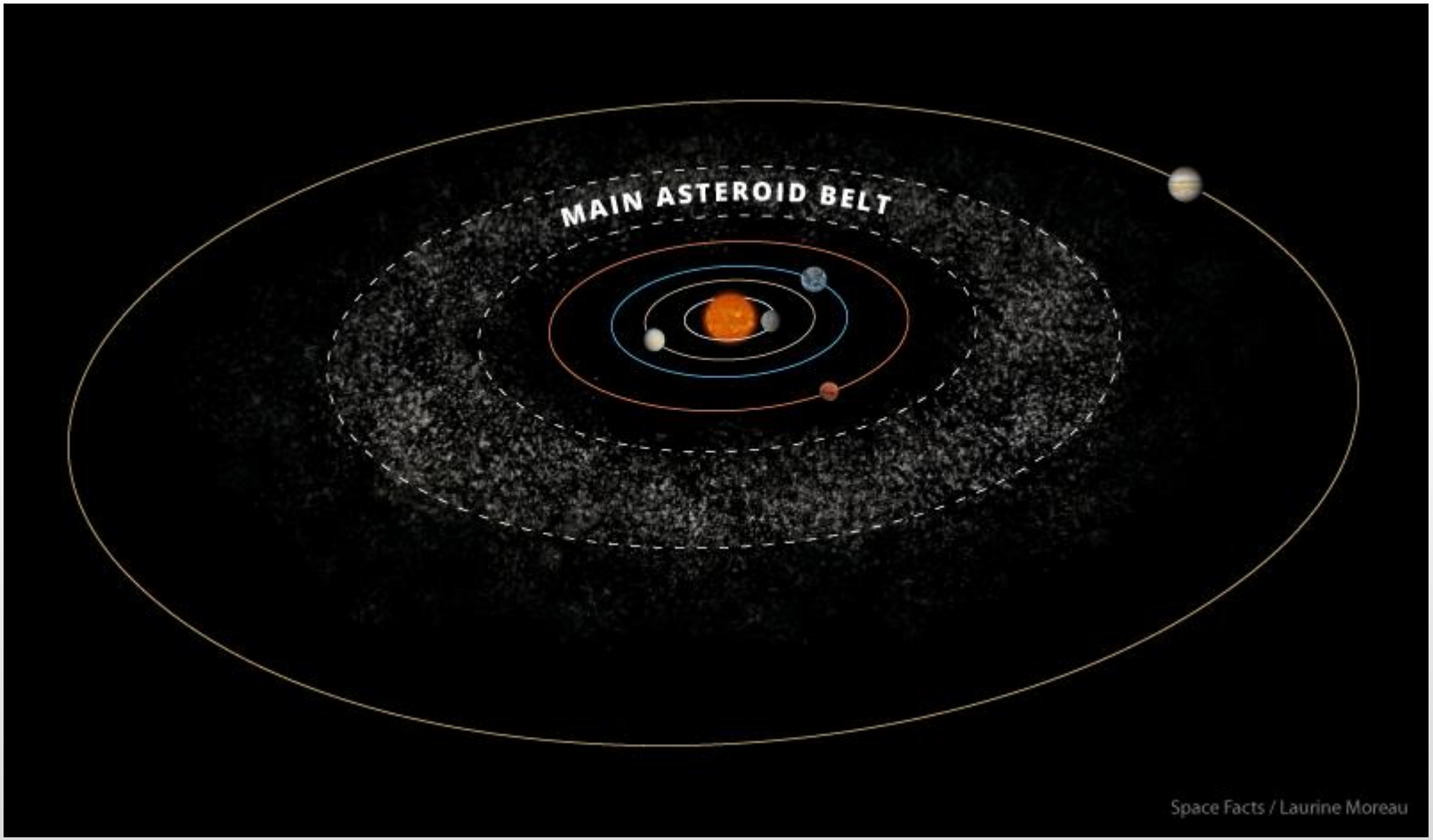
http://space-facts.com/the-moon/

Mars

Equatorial Diameter:	6,792 km
Polar Diameter:	6,752 km
Mass:	6.42×10^{23} kg (11% Earth)
Moons:	2 (Phobos & Deimos)
Orbit Distance:	227,943,824 km (1.52 AU)
Orbit Period:	687 days (1.9 years)
Rotation Period:	24.62 hours
Surface Temp:	-153 to 20 °C
First Record:	2nd millennium BC
Recorded By:	Egyptian astronomers

http://space-facts.com/mars/

Asteroids



Asteroid Belt – artwork: laurinemoreau.com

The Major Asteroids			
Name	Size (km)	Mass x 10^{15} kg	Distance (AU)
Ceres	960x932	870000	2.767
Pallas	570x525x482	318000	2.774
Juno	240	20000	2.669
Vesta	530	300000	2.362
Eugenia	226	6100	2.721
Siwa	103	1500	2.734
Kleopatra	217x94	4640	2.79

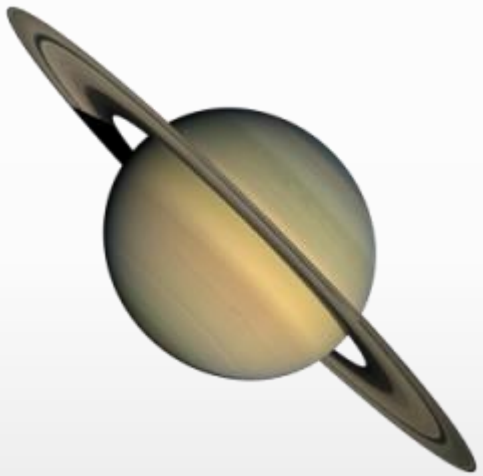
Orbits in the solar system and other stellar systems:
http://janus.astro.umd.edu/SolarSystems/

Jupiter

Equatorial Diameter:	142,984 km (11.2 Earth's)
Polar Diameter:	133,709 km
Mass:	1.90×10^{27} kg (318 Earths)
Moons:	67 +
Galilean Moons:	Io, Europa, Ganymede, Callisto
Rings (number):	4
Orbit Distance:	778,340,821 km (5.20 AU)
Orbit Period:	4,333 days (11.9 years)
Rotation Period:	9.925 hours
Effective Temp:	-148 °C
First Record:	7th or 8th century BC
Recorded By:	Babylonian astronomers

http://space-facts.com/jupiter/

Saturn



Equatorial Diameter:	120,536 km (9.45 Earth's)
Polar Diameter:	108,728 km
Mass:	5.68×10^{26} kg (95 Earth's)
Moons:	62 + Titan, Enceladus, Iapetus, Rhea
Rings:	30+ (7 Groups)
Orbit Distance:	1,426,666,422 km (9.54 AU)
Orbit Period:	10,756 days (29.5 years)
Rotation Period:	10.55 hours
Effective Temp:	-178 °C
First Record:	8th century BC
Recorded By:	Assyrians

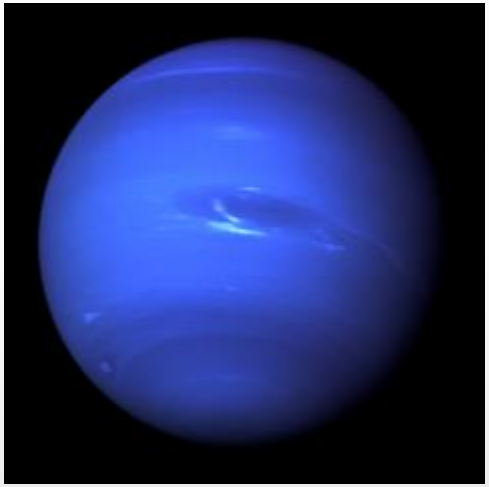
http://space-facts.com/saturn/

Uranus

Equatorial Diameter:	51,118 km (4.0 Earth's)
Polar Diameter:	49,946 km
Mass:	8.68×10^{25} kg (15 Earth's)
Moons:	27 + Titania, Miranda, Ariel, Umbriel
Rings:	13
Orbit Distance:	2,870,658,186 km (19.19 AU)
Orbit Period:	30,687 days (84.0 years)
Rotation Period:	17.2 hours
Effective Temp:	-216 °C
Discovery Date:	March 13th 1781
Discovered By:	William Herschel

http://space-facts.com/uranus/

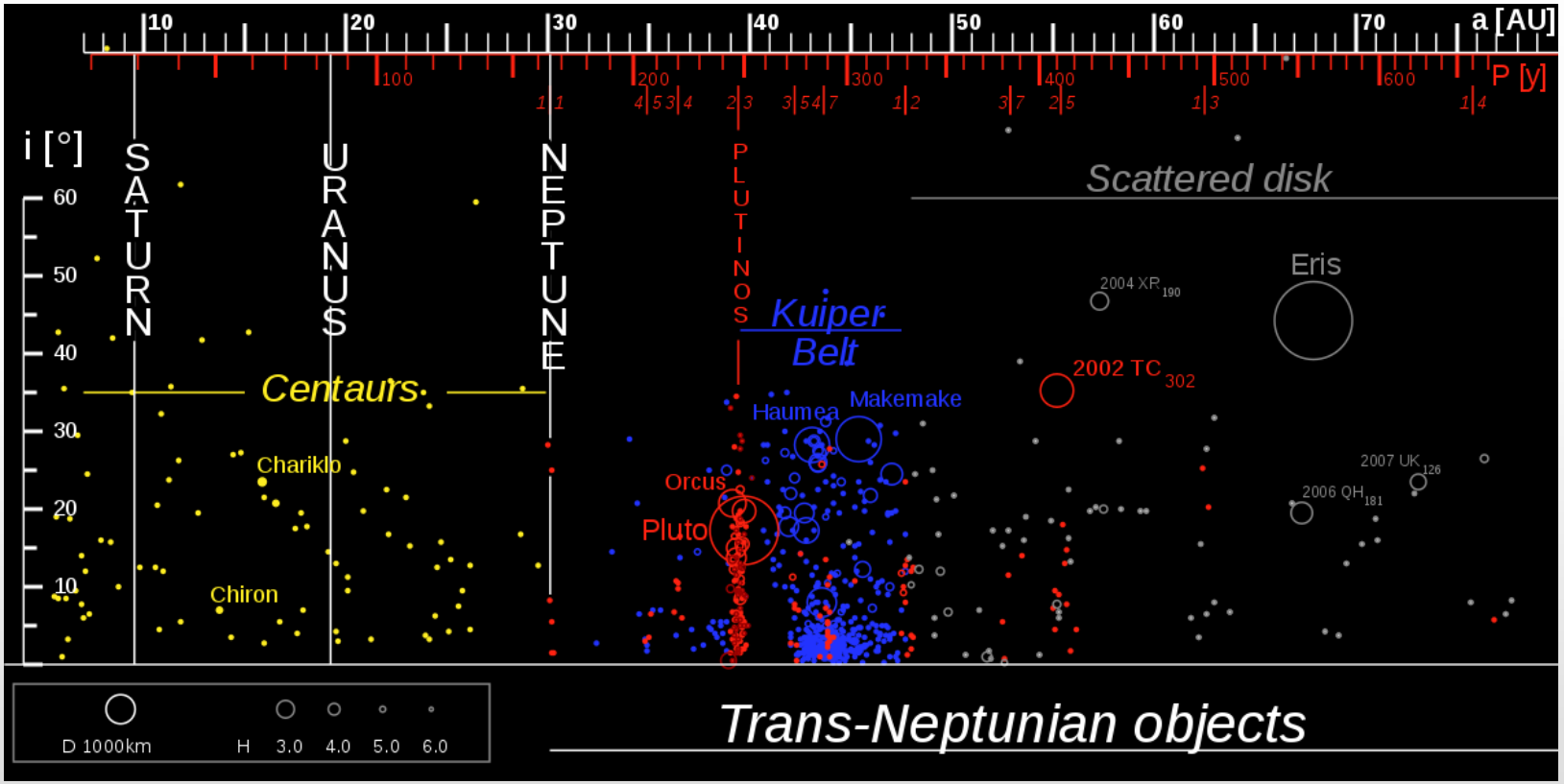
Neptune



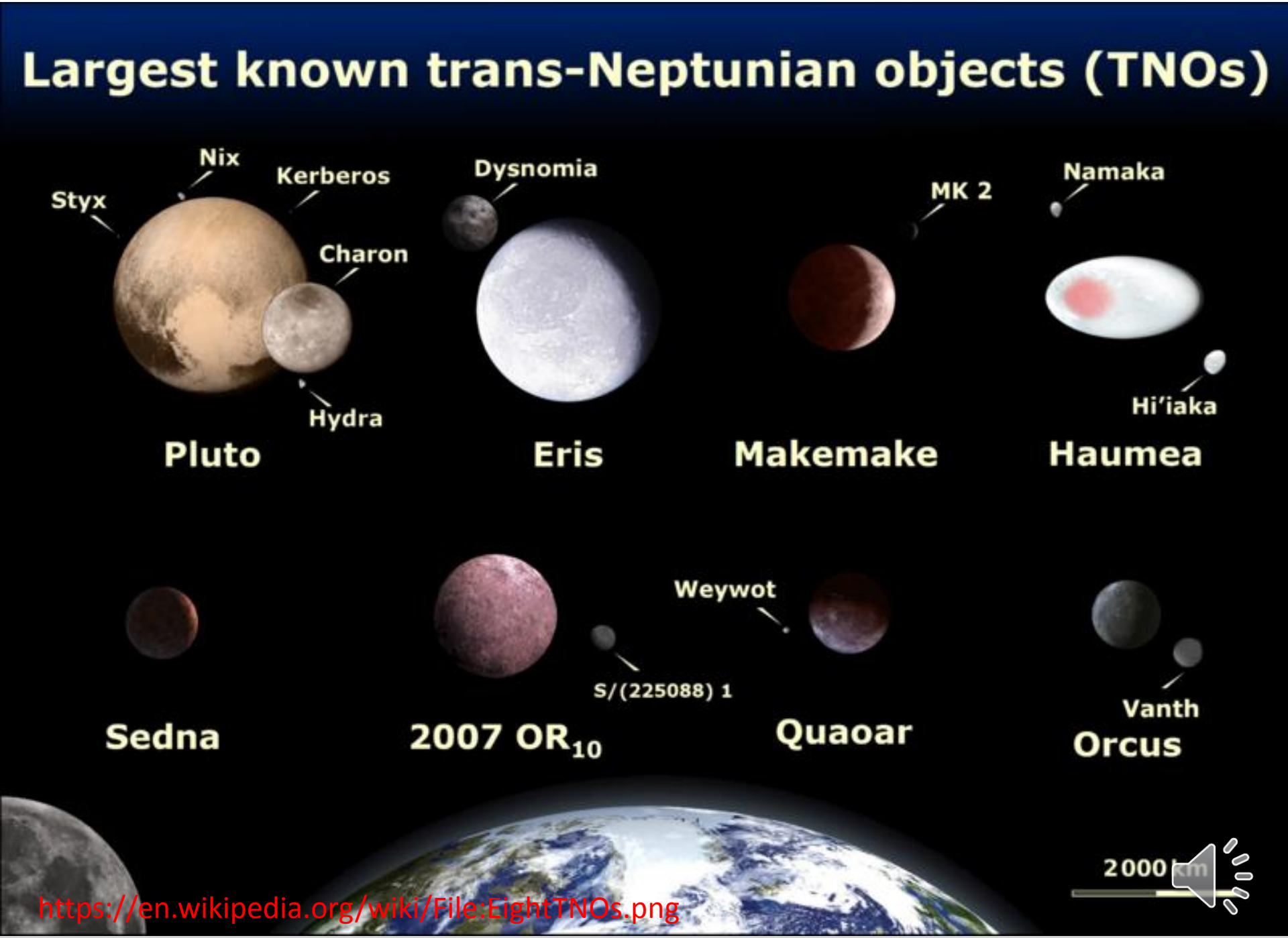
Equatorial Diameter:	49,528 km (3.89 Earth's)
Polar Diameter:	48,682 km
Mass:	1.02×10^{26} kg (17 Earths)
Moons:	14 (Triton)
Rings:	5
Orbit Distance:	4,498,396,441 km (30.10 AU)
Orbit Period:	60,190 days (164.8 years)
Rotation Period:	16.1 hours
Effective Temp:	-214 °C
Discovery Date:	September 23rd 1846
Discovered By:	Urbain Le Verrier, Johann Galle

http://space-facts.com/neptune/

Outer regions



https://commons.wikimedia.org/wiki/File:TheTransneptunians_73AU.svg



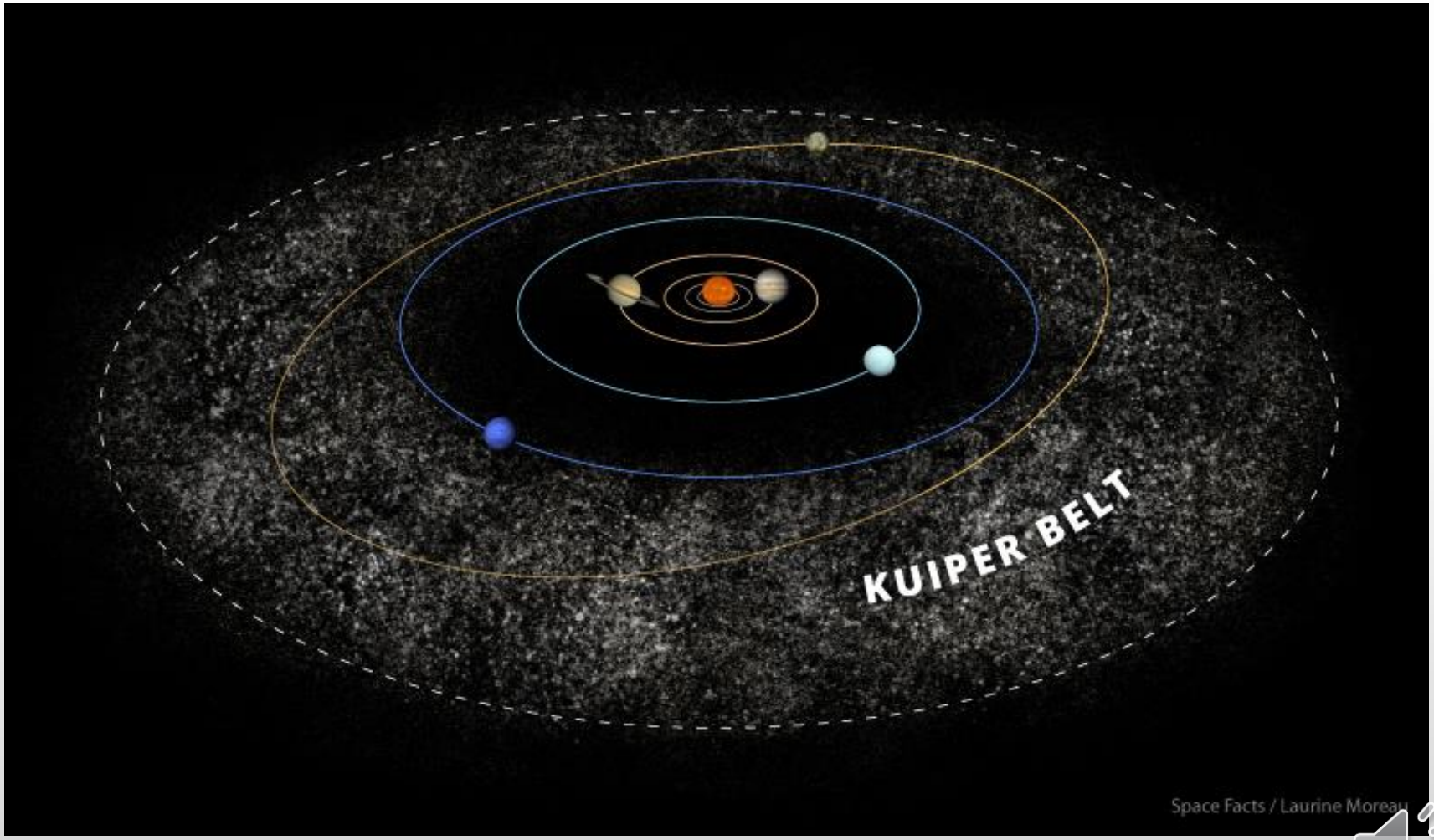
https://en.wikipedia.org/wiki/File:EightTNOs.png

*Transneptunian Ice Dwarf Planets			
Name	Size (km)	Mass (kg)	a Distance (AU)
Pluto	2375	1.30×10^{22}	39.48
Eris	2326	1.66×10^{22}	67.78
Makemake	1502x1430	$< 4.4 \times 10^{21}$	45.72
Haumea	1,920 × 1,540 × 990	4.00×10^{21}	43.22
Sedna	~ 1000	No satellites	506.2**
Quaoar	1110	1.4×10^{21}	43.37
“Snow White"	1535x1280	$\sim 1.5 \times 10^{21}$	66.99

* https://en.wikipedia.org/wiki/Trans-Neptunian_object

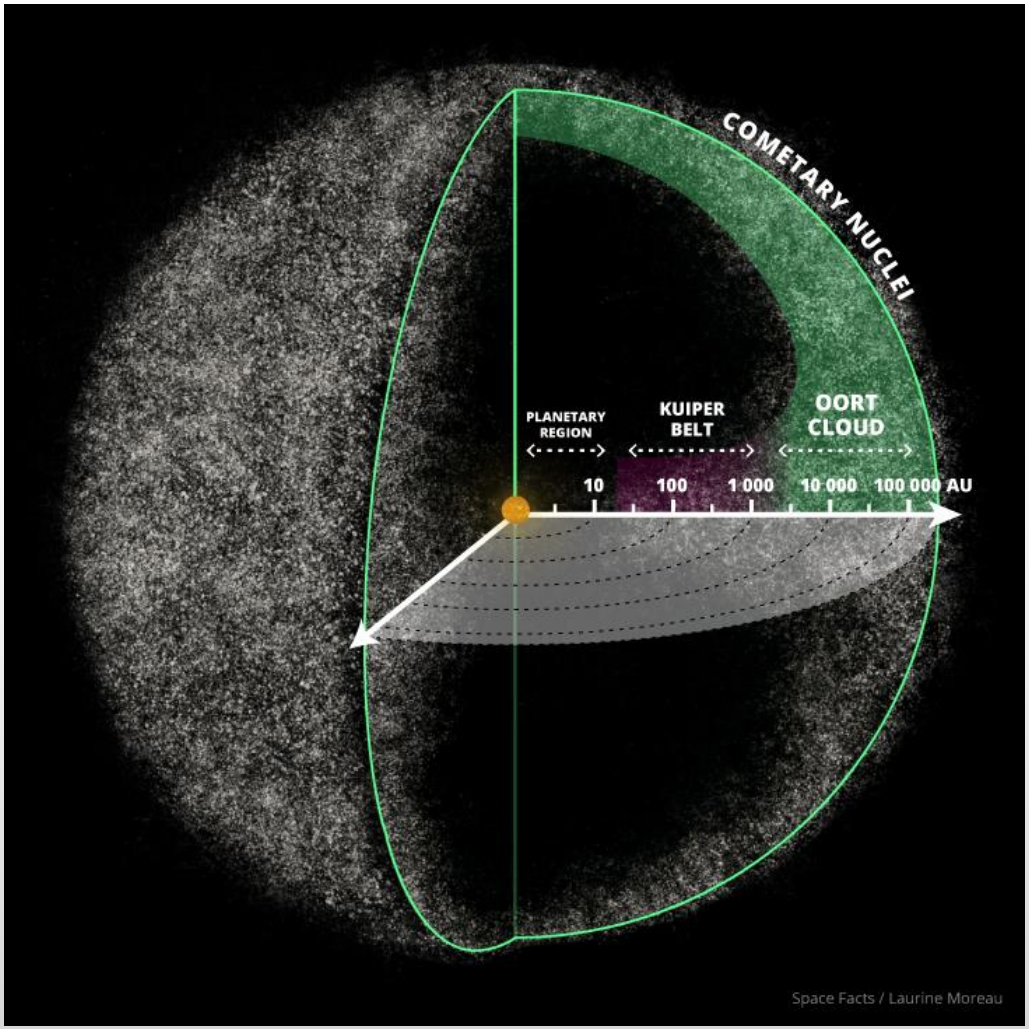
**eccentricity 0.855 (presently near perihelion)

Kuiper belt



Kuiper Belt – artwork: laurinemoreau.com

Oort cloud



Oort Cloud – artwork: laurinemoreau.com