Pluto and friends

Why did Pluto become a “dwarf planet”

Where we left off last time…..

Orbital characteristics of Pluto

- A=39.53 au
- P=248.5 years (how do we know that?)
- Eccentricity=0.248
- Inclination to plane of ecliptic= 17.15 degrees
- Any reaction to these numbers?

The eccentricity and inclination are large relative to other planets. Results known since the discovery of Pluto.

Physical characteristics of Pluto

- Diameter = 2300 km
- Mass =0.002 Earth masses
- Question: how do we know the mass of Pluto?
- Any reaction to these numbers?

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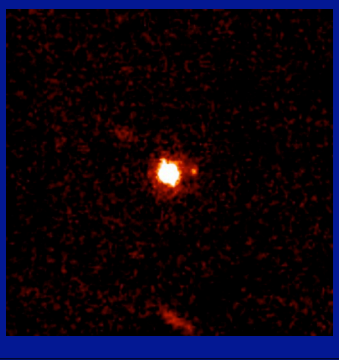
Moral of the story: with just these data, Pluto is substantially different from the other major planets we have discussed. In physical characteristics, it is more like a satellite of the outer planets

Pluto and the Kuiper Belt

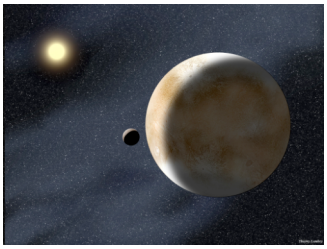
- In 1951, Gerhard Kuiper suggested a “belt” of comets in the plane of the ecliptic and outside the orbit of Pluto
- Around 1990, the first of these were discovered. Some are fairly large
- At the present 1200 have had their orbits determined, and it is estimated that there are 100,000 (almost all not yet discovered) with diameters > 100km

Discovery of Eris (2003)

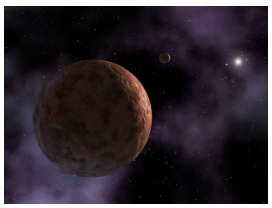


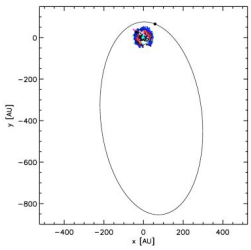
Characteristics of Eris

- A=67.7 au
- P=560 years
- Eccentricity=0.443
- Inclination = 44 degrees
- D=2400km
- M=0.0025 Earth masses
- Surface temperature=30K



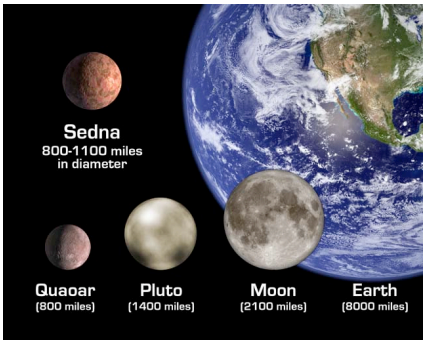
The orbit of Sedna





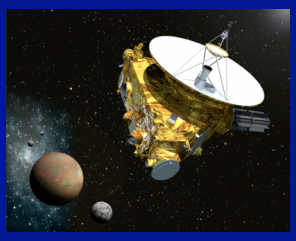
The solar system beyond Neptune must be filled with cold, dark, and strange worlds. Pluto is just one of them, and the first discovered

A collection of Dwarf Planets

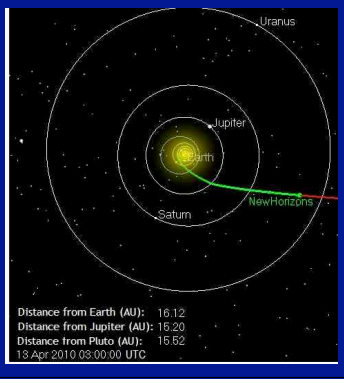


In the future: the New Horizons spacecraft

- Launch: January 2006
- Arrival at Pluto: July 2015
- Subsequent visits to other Kuiper Belt objects



Where is New Horizons now?



What might NH find at Pluto?

Next topic: small solar system objects--- Chapter 15

Despite small size, some of the most impressive solar system objects to see

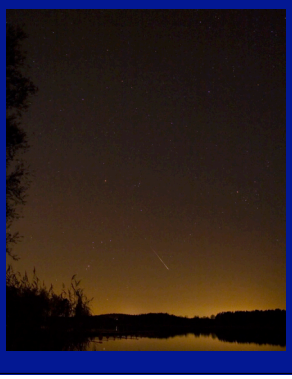
Comet Hale-Bopp, spring 1997

Obviously an astronomical object, but different from the others we have discussed, and that you can see from night to night

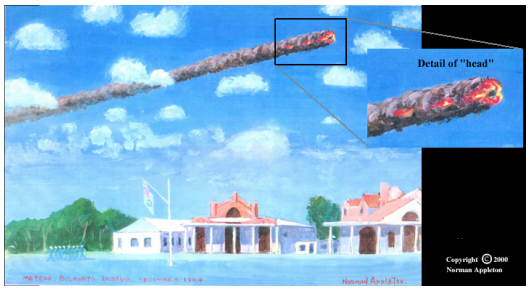
First topic: meteors and meteorites

- Read introduction to chapter; sightings of the Homestead meteor, 1875
- Meteors…the technical term for shooting stars
- What we see is the column of plasma behind a piece of solid matter entering the atmosphere

Appearance of meteors



What the Homestead meteor may have looked like

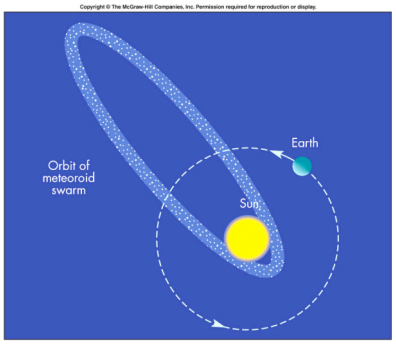


Meteor showers…large numbers of meteors observed at the same time every year

Meteors seen to come from the same location on the sky, termed the **radiant**

What is happening in a meteor shower

See table of prominent meteor showers in Table 15.1



Meteorites…when the piece of solid matter causing the meteor makes it to the ground

- Were noticed in deep antiquity
- There is probably one in the Kaaba Shrine in Saudi Arabia
- A knife made of meteoric iron was found in the tomb of Pharaoh Tutankhamun

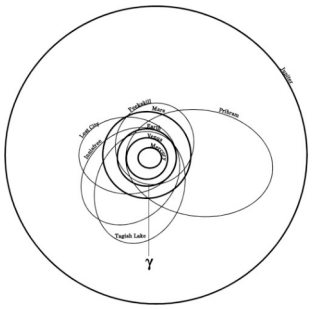
Types of meteorites

- Stony meteorites (about 94%), usually *chondrites*
- Iron-nickel (about 5 %)
- Relatively rare but extremely important *carbonaceous chondrites* ("objects that have the consistency of dirt clods")

Tagish Lake meteorite

Orbits of meteorites: where do they come from?

A powerful hint as to the nature of meteorites: stay tuned



Presentation of the *hagioliths*

A picture is worth a thousand words, and a real thing is worth a thousand pictures