

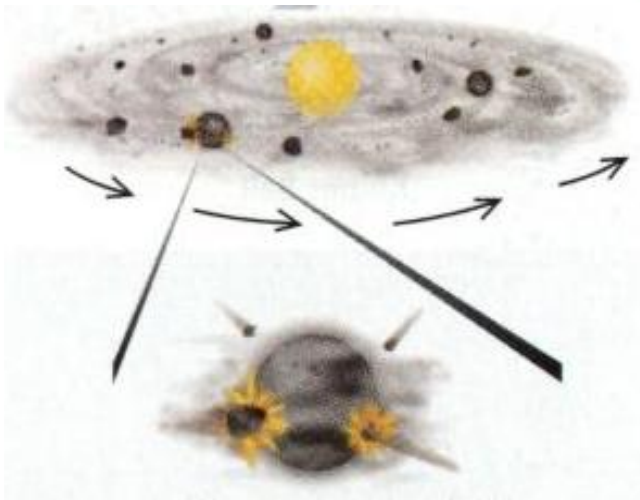


GUESTS FROM FAR FAR AWAY

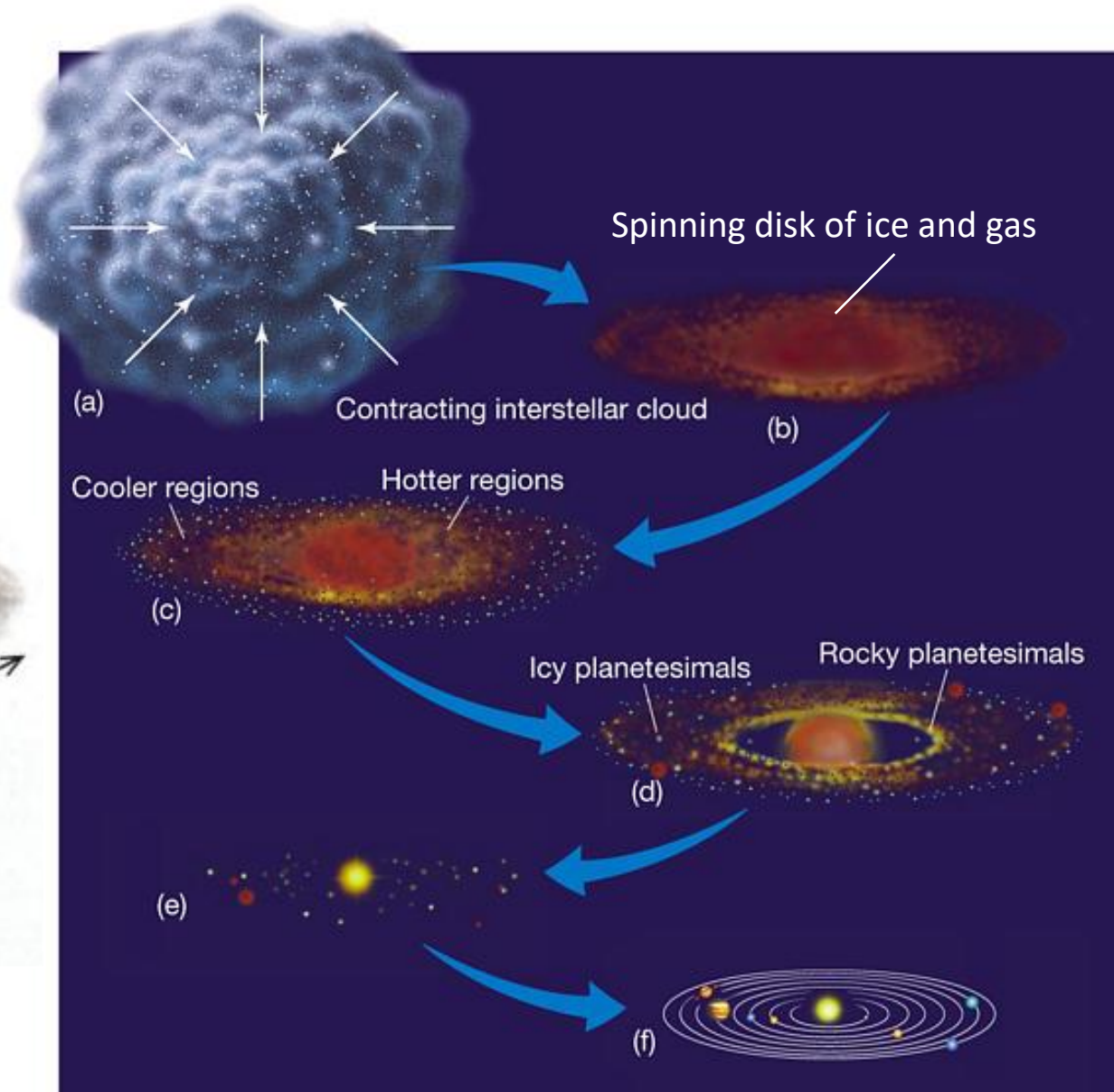


Review: Solar System Formation

The Earth and other planets of the Solar System were formed as a result of *planetesimals* colliding and sticking together.



Leftovers?



Definitions

Asteroid: A relatively small (>10 m size), inactive, **rocky body** orbiting the Sun. Also may be called “minor planets”.

Comet: A relatively small, at times active, **icy object** whose ices can vaporize in sunlight forming an atmosphere (*coma*) of dust and gas and, sometimes, a tail of dust and/or gas.

Meteoroid: A small particle from a comet or asteroid that is on a collision course with Earth.

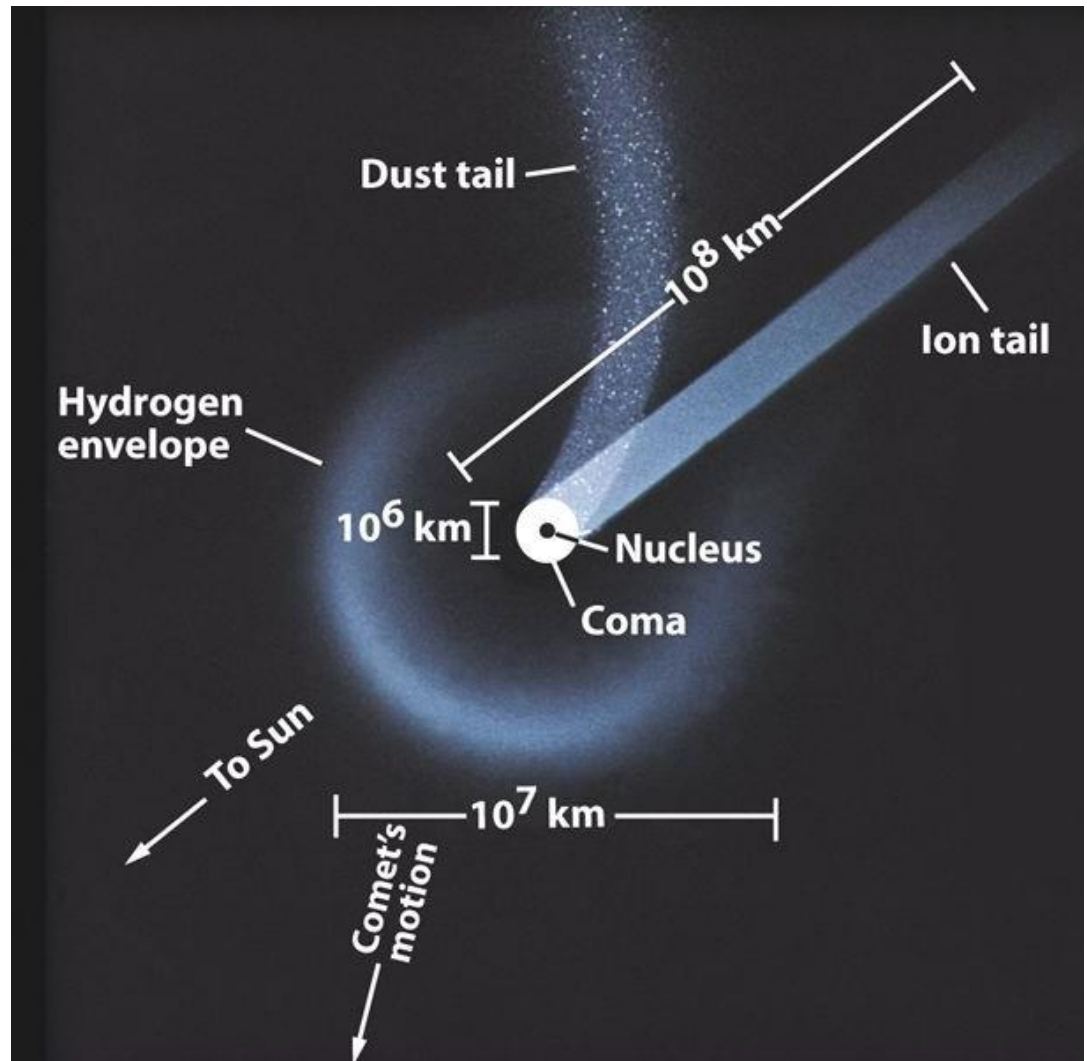
Meteor: The light phenomena which results when a meteoroid enters the Earth's atmosphere and vaporizes (a shooting star); **not an object!**

Meteorite: A meteoroid that survives its passage through the Earth's atmosphere and lands upon the Earth's surface.

Comets are **small cosmic bodies** composed of **ice and dust** that often form tails as they approach the Sun.

- **Comet structure:**

- **Nucleus** (~10 km “Dirty Snowball”; usually <50 km)
- **Coma** (cloud of evaporated ices and ions; can be ~1,000,000 km in diameter)
- **Hydrogen envelope**
- **Tail** (*dust, curved* and ions, straight; always points away from the Sun)



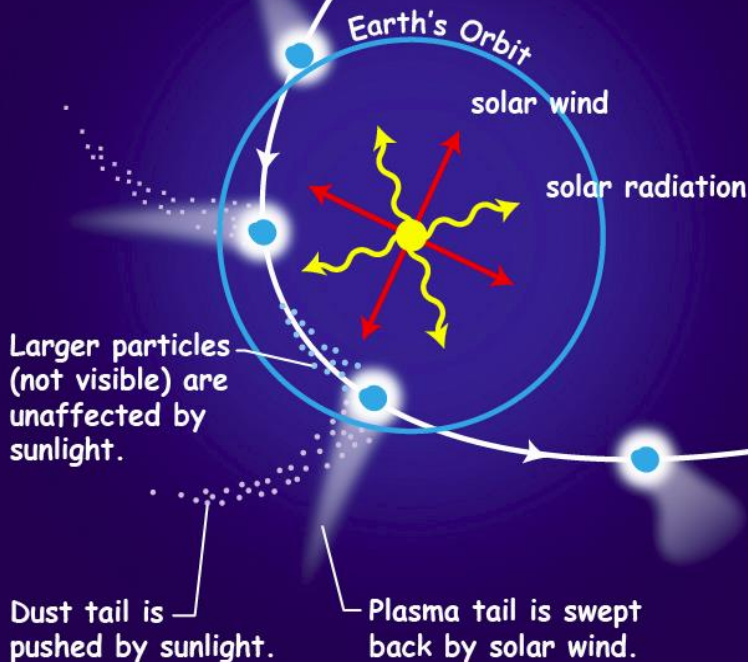
Comet Life Cycle

Gas coma begins to form around nucleus when comet is about 5 AU from Sun.

Nucleus warms and begins to sublimate.

In the **outer Solar System** comets remain frozen and are extremely difficult or simply impossible to detect from Earth due to their small size.

Tail forms, pushed out by solar wind and radiation; distance is now about 1 AU.



Solar heating diminishes; coma and tail disappear between 3 and 5 AU from Sun.

Comet Tail

- **Dust tail:** up to **10 million km long** composed of smoke-sized dust particles driven off the nucleus by escaping gases; the **most prominent part of a comet to the naked eye.**
- **Ion tail:** as much as **several hundred million km long** composed of plasma and laced with rays and streamers caused by interactions with the solar wind; points straight out.



When a comet is gone, is there anything left behind?

Meteor Showers

happen when the Earth passes through a stream of meteoroid debris, also known as a “dust trail”, spread along a comet’s orbit.



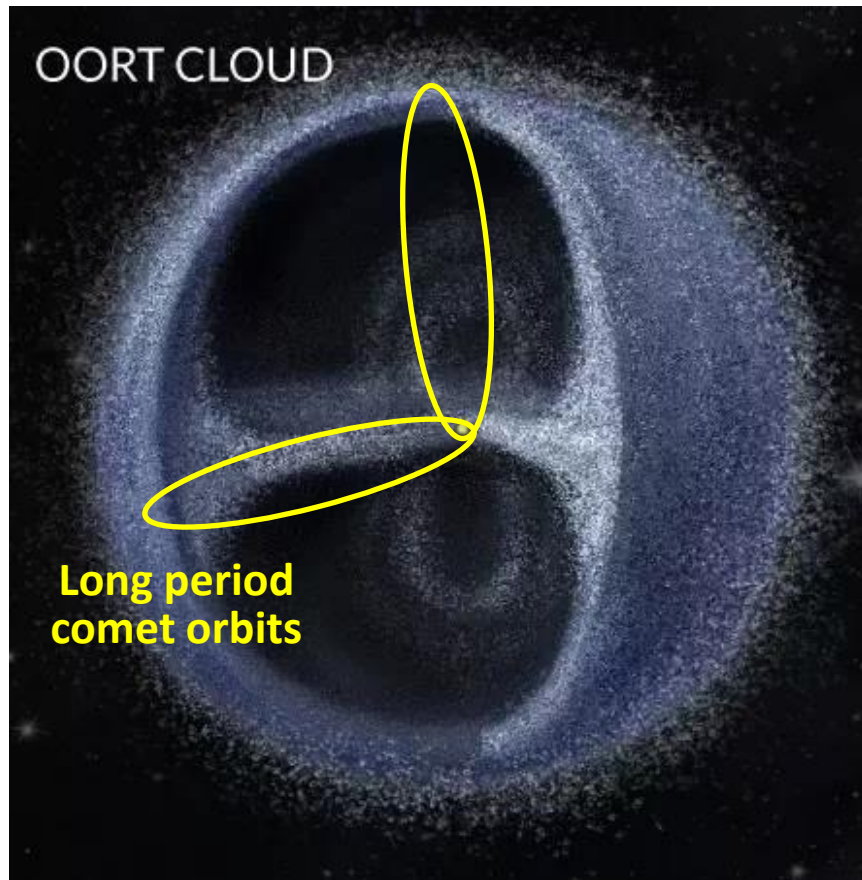
- **Leonids** (November)
Comet Tempel-Tuttle
- **Perseids** (July-August)
Comet Swift-Tuttle



- **Orionids** - Comet Halley
(October 20-21 **TONIGHT!**)

Comet Orbits: Long Period

- **Long period comets** (orbital period more than 200 years, usually thousands and possibly millions of years) come from the **Oort cloud**, a huge *hypothetical* spherical cloud of icy bodies that is located roughly one light-year from the Sun.



- Long-period comets tend to be the **most spectacular comets** we see in the night sky!
- Their brilliance is due to the fact that they have not made many (if any) passes through the inner Solar System, and so **still retain a large percentage of their ices** – they simply have more material with which to put on a show!

Comet Hale-Bopp



- The most widely observed comet of the 20th century: **“The Great Comet of 1997”**.
- One of the brightest seen for many decades. It was visible to the naked eye for a record 18 months.

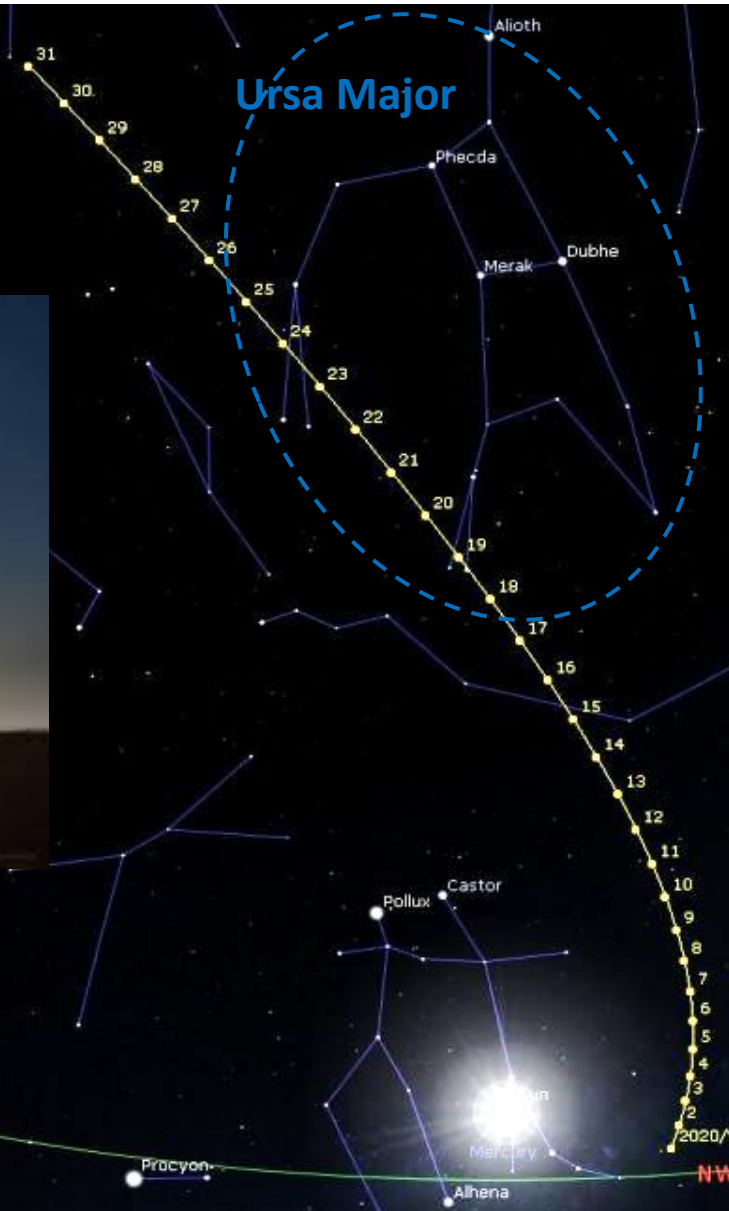
- May have been observed by ancient Egyptians during the reign of pharaoh Pepi I (2332–2283 BC): “long haired star” mentioned in the text in his pyramid.

Next approach: ~4385.

Comet NEOWISE

JULY 2020

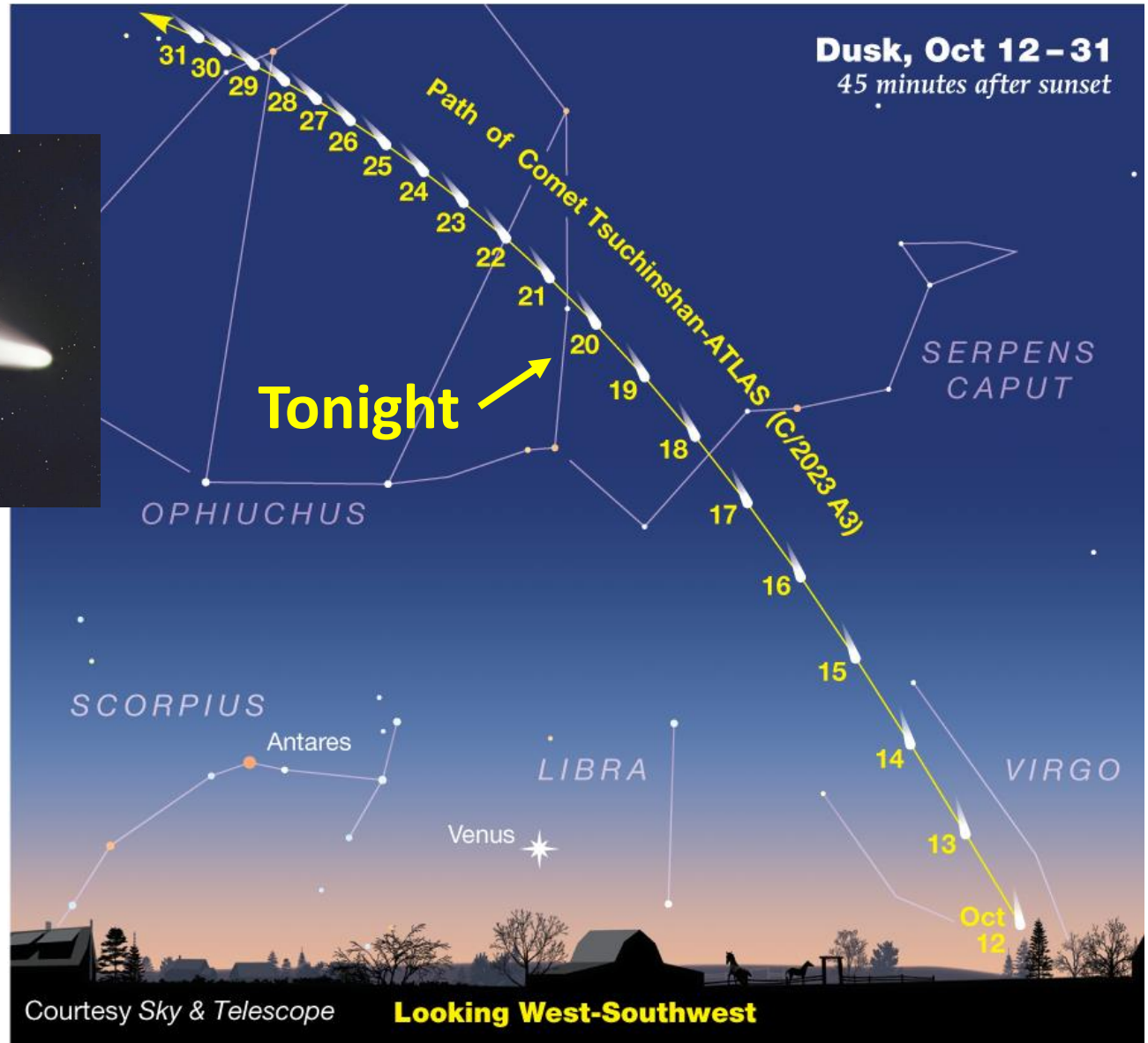
(discovered
in March)



**Next
approach:
~8,786**

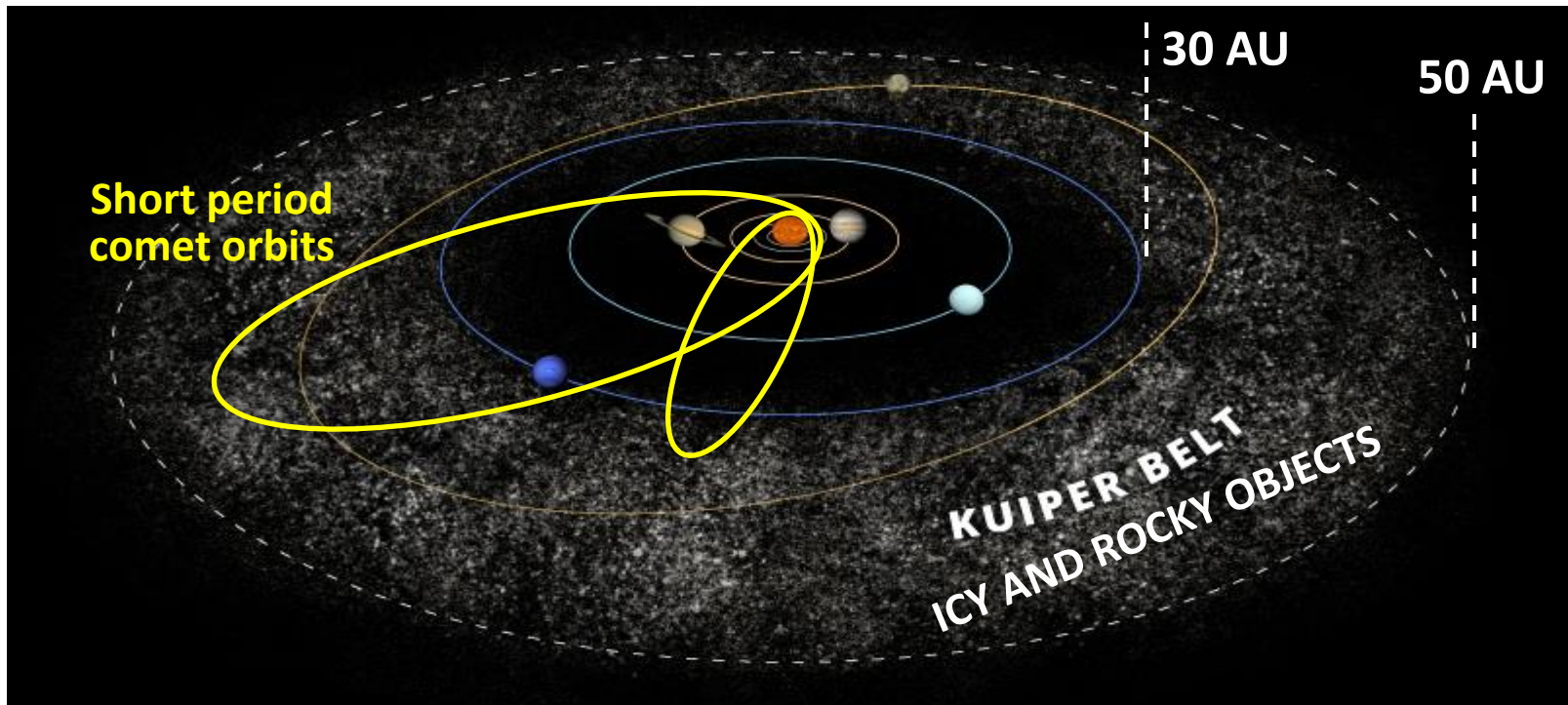
Comet Tsuchinshan-ATLAS now!

Period >1 million yrs
– may be *ejected!*

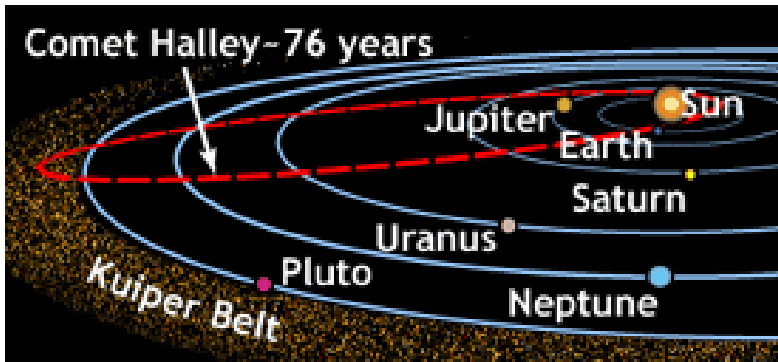


Comet Orbits: Short Period

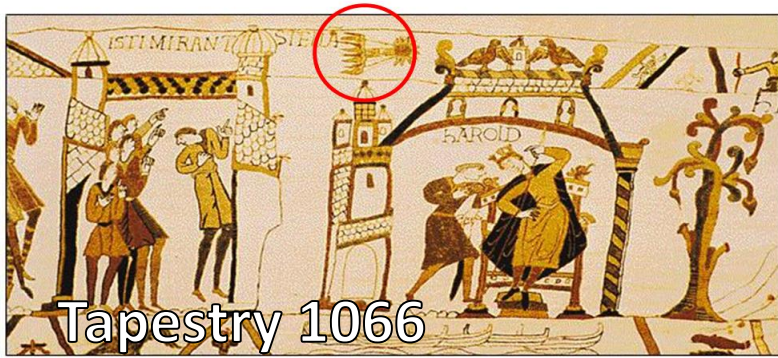
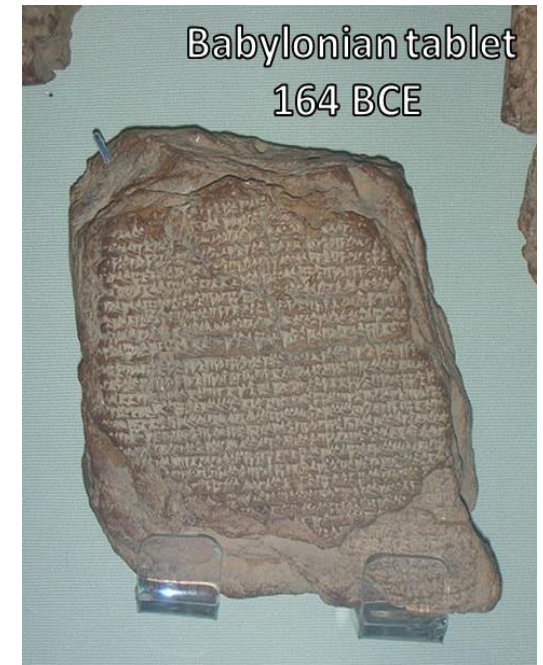
- **Short period comets** (those having orbital period less than 200 years) originate in the **Kuiper belt**, a donut-shaped cloud of icy and rocky objects located beyond the orbit of Neptune.



- About **60 Halley-type** (between 20-200 years) and more than **400 Jupiter-family** (orbital period <20 years) comets are known.



Comet Halley



- The best-known of the *short-period comets* is visible from Earth every 75–76 years.
- First historical record: description from 240 BC (Chinese chronicle Shiji).

Next appearance: mid-2061