



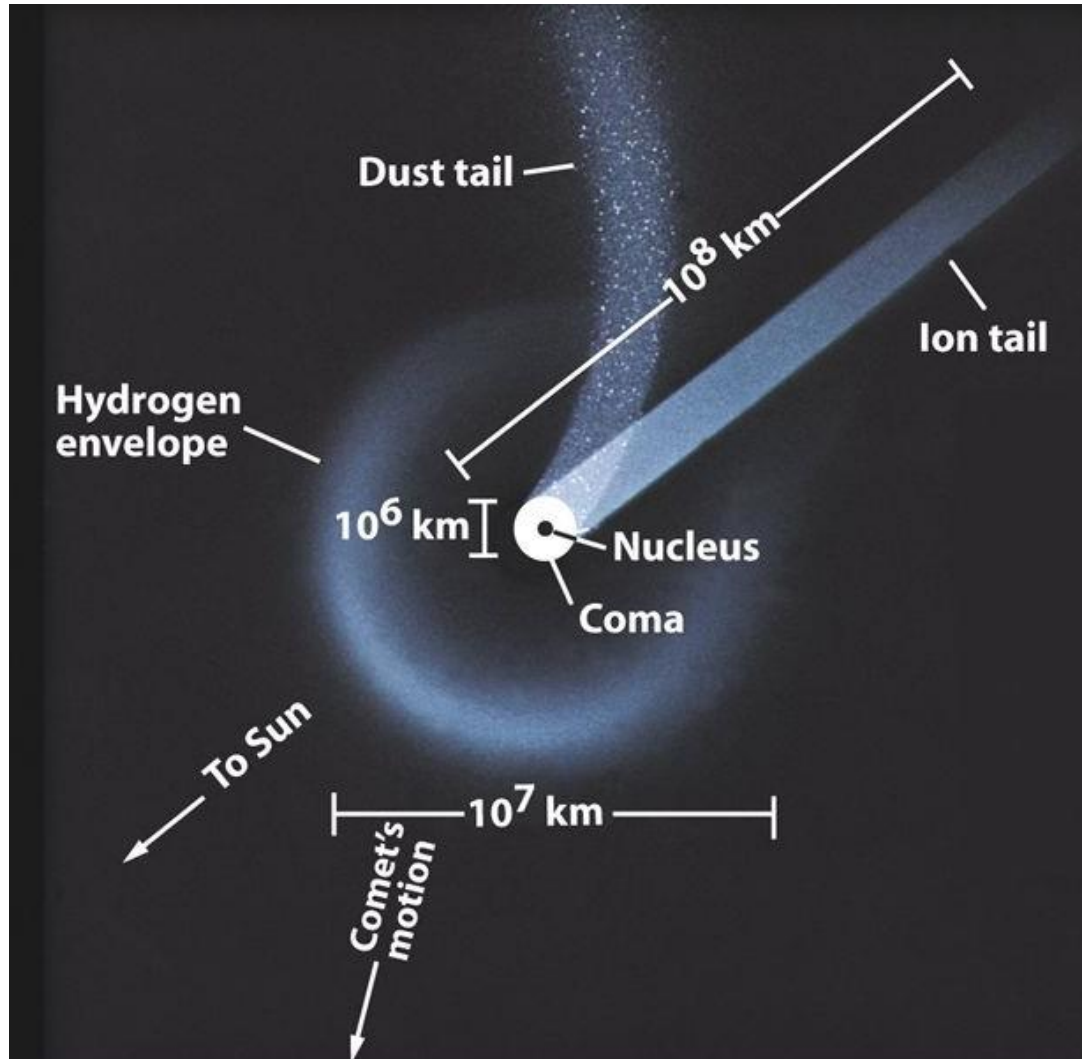
GUESTS FROM FAR FAR AWAY



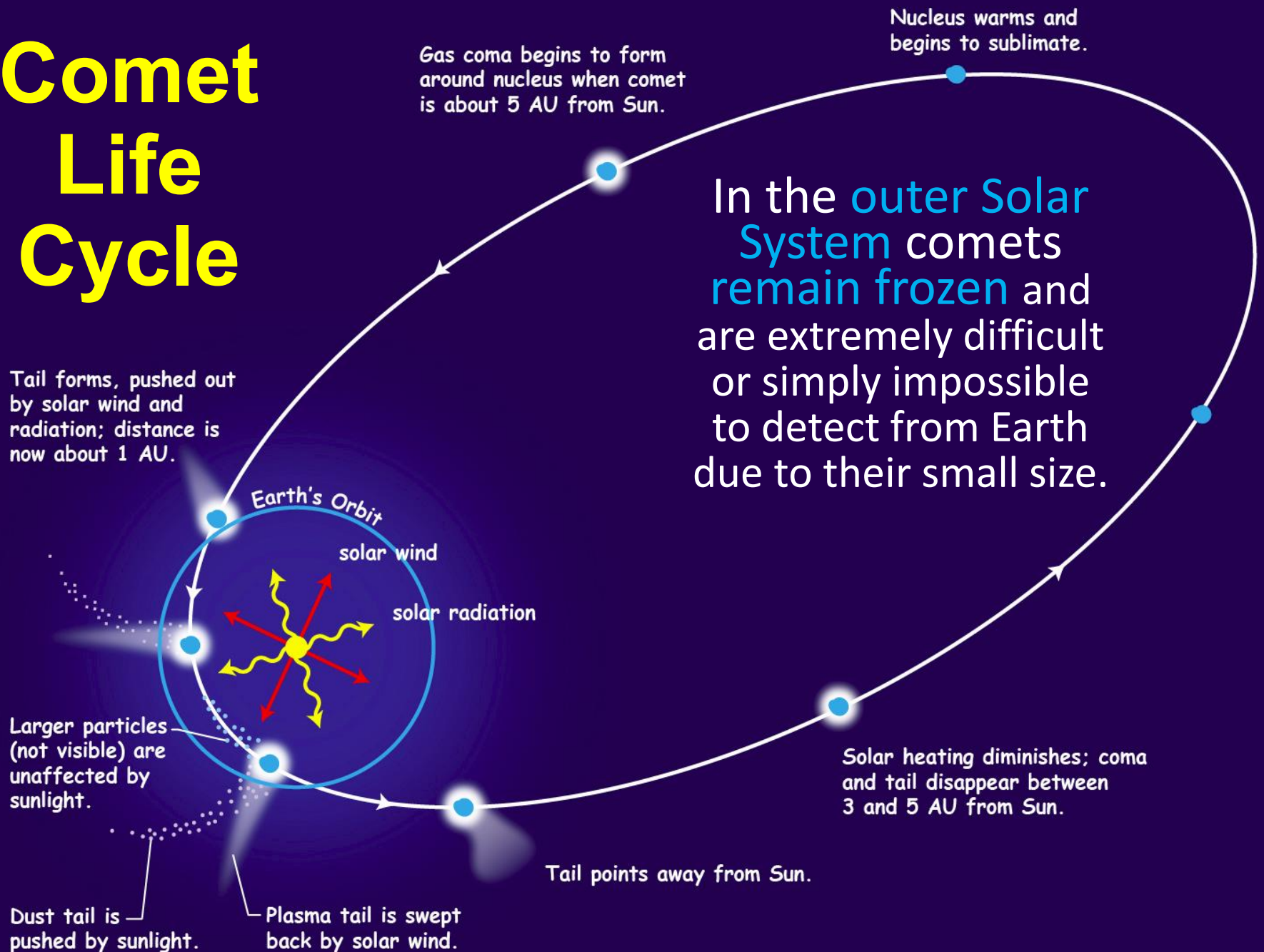
Comets are **small cosmic bodies** composed of **ice and dust** that often form tails as they approach the Sun.

- **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



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



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

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



- **Lyrids** - Comet Thatcher
(April 16-25 **TONIGHT!**)

What causes meteoroids to burn in the atmosphere?

- The fastest meteoroids travel through the Solar System at a speed of ~ 42 km/sec (~ 26 mi/sec).
- When a meteoroid enters Earth's atmosphere, it can travel **as fast as 70 km/sec**, much faster than a bullet leaving a gun barrel!

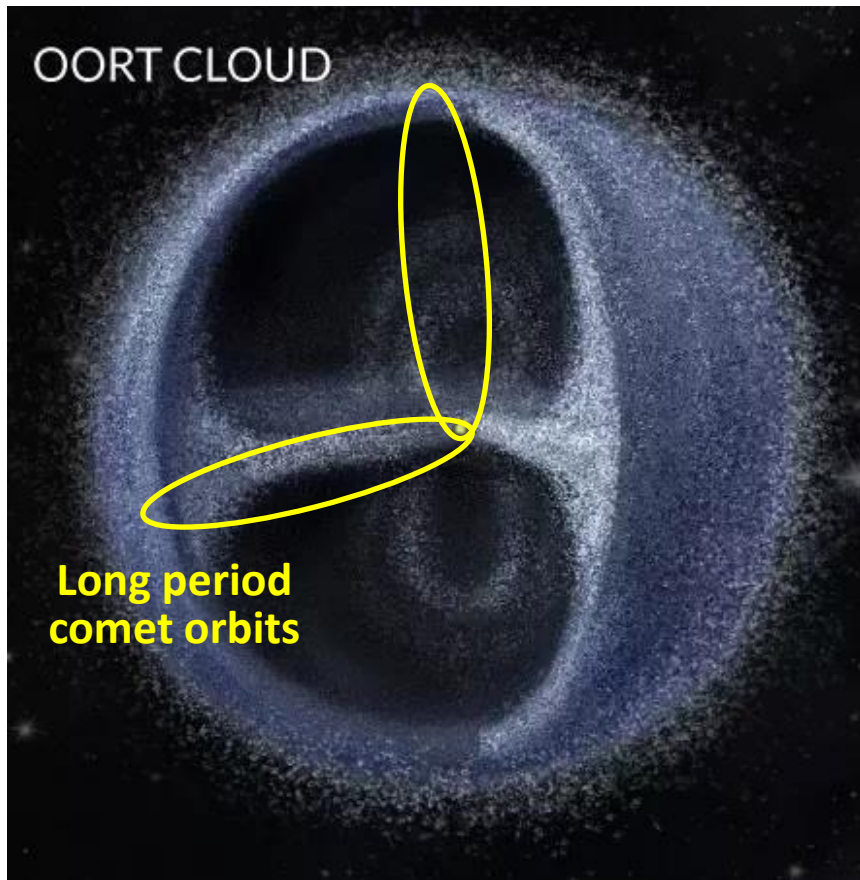
Friction? Not really!



- **Air** in front of meteoroid gets rapidly **compressed**: as it compresses, it **heats** and causes surface of the meteoroid to **melt** (producing **glow**) and **vaporize**, and sometimes **disintegrate** (that is, **blow up**).

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

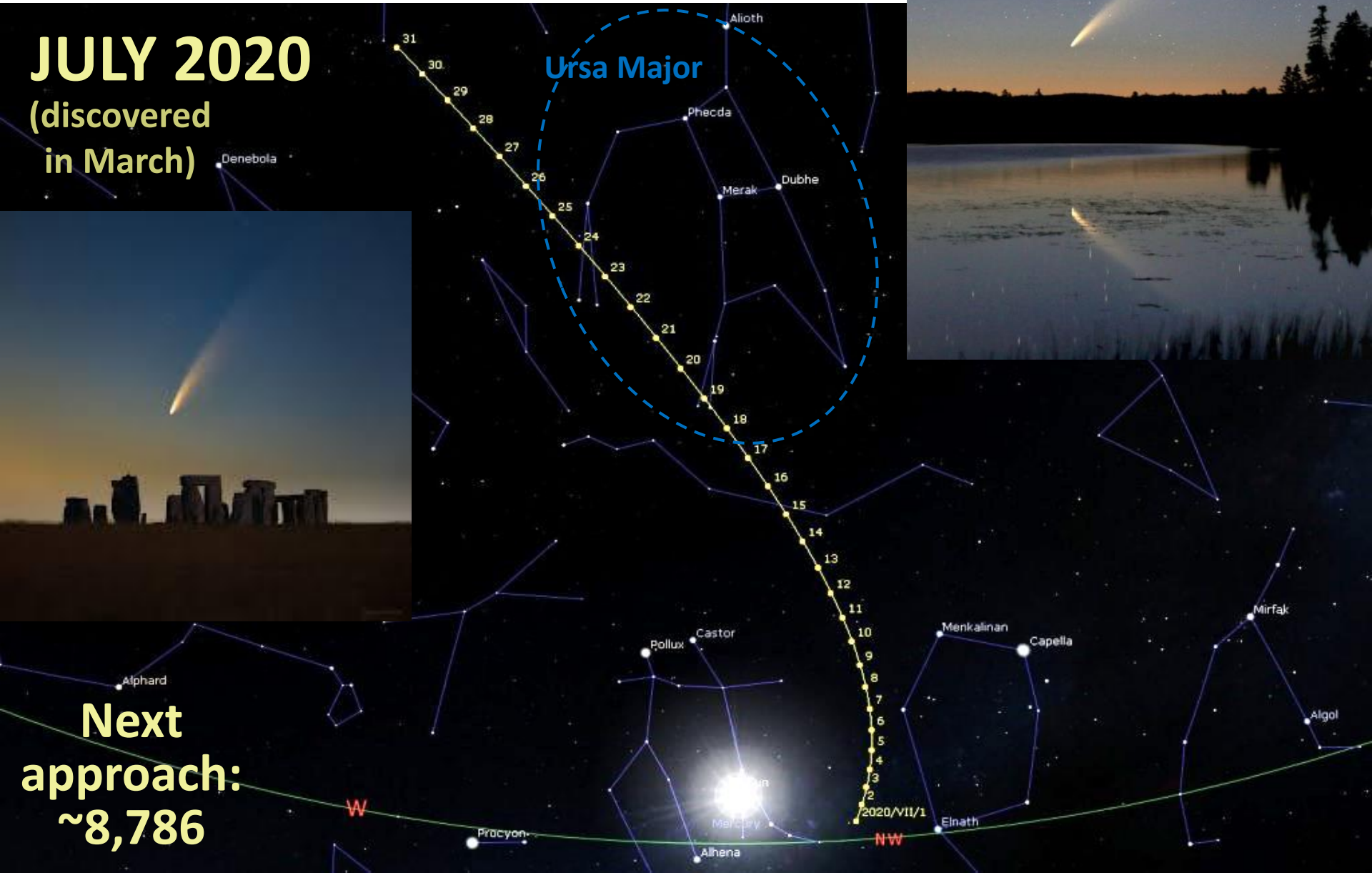


- The most widely observed comet of the 20th century: **“The Great Comet of 1997”**.
 - One of the brightest seen for many decades. It was visible to the naked eye for a record 18 months.
 - May have been observed by ancient Egyptians during the reign of pharaoh Pepi I (2332–2283 BC): “long haired star” mentioned in the text in his pyramid.
- Next approach: ~4385.**

Comet NEOWISE

JULY 2020

(discovered
in March)

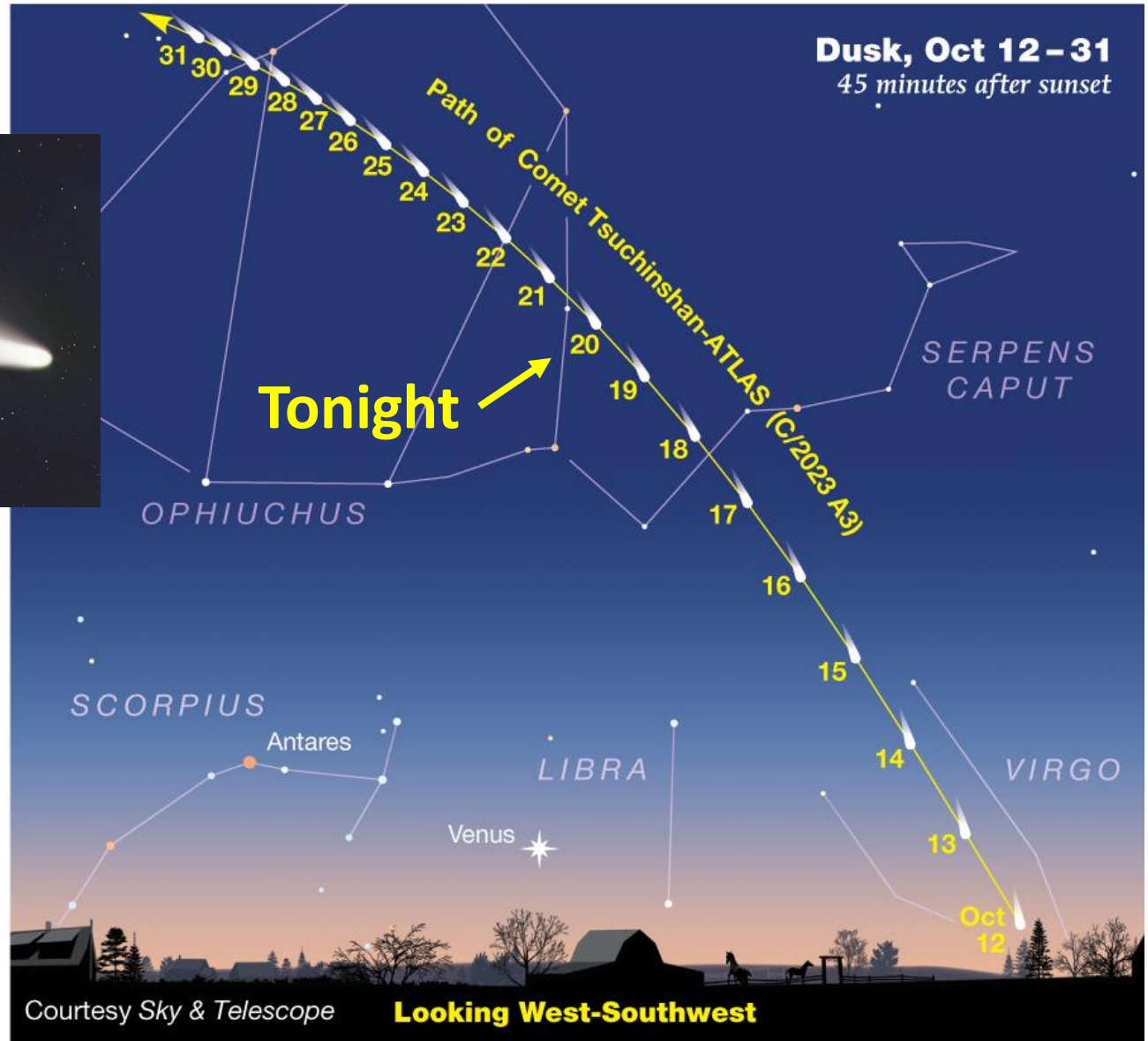


Next

**approach:
~8,786**

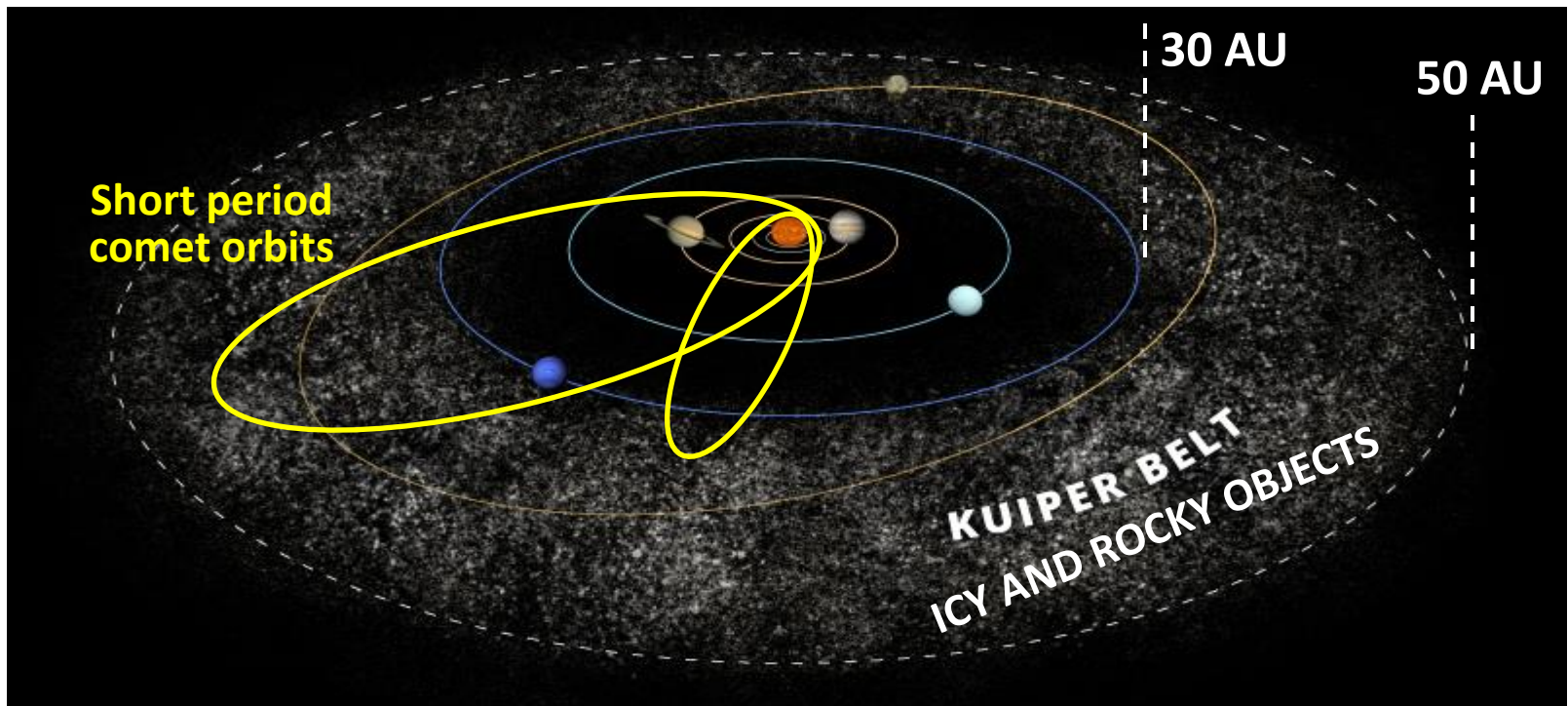
Comet Tsuchinshan-ATLAS 2024

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

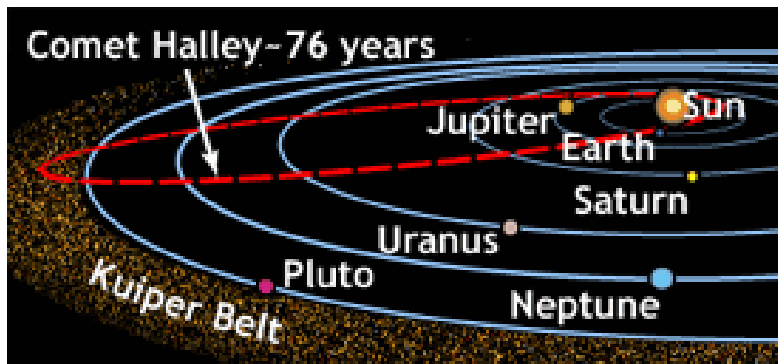


Comet Orbits: Short Period

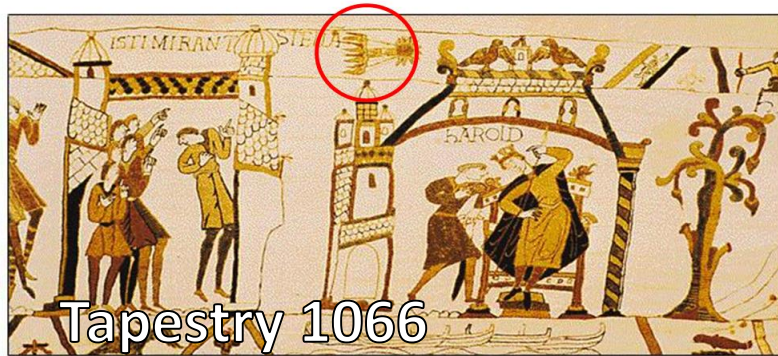
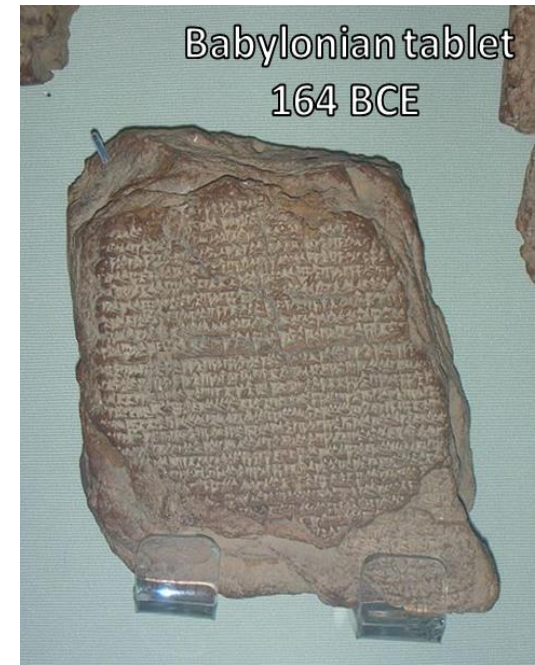
- **Short period comets** (those having orbital period less than 200 years) originate in the **Kuiper belt**, a donut-shaped cloud of icy and rocky objects located beyond the orbit of Neptune.



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



Comet Halley



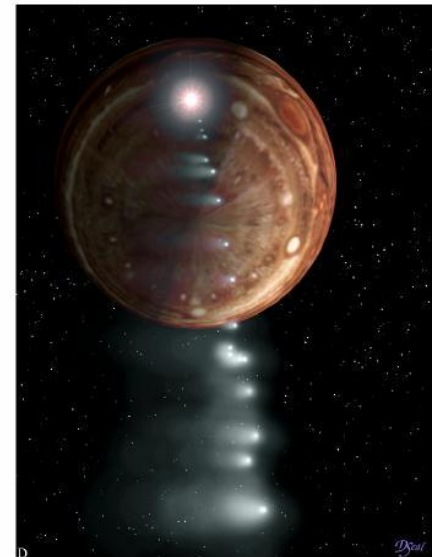
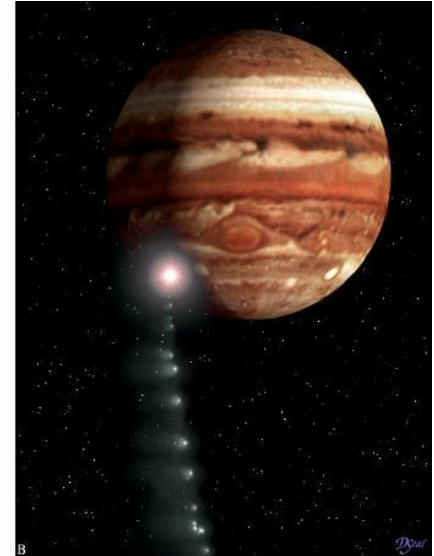
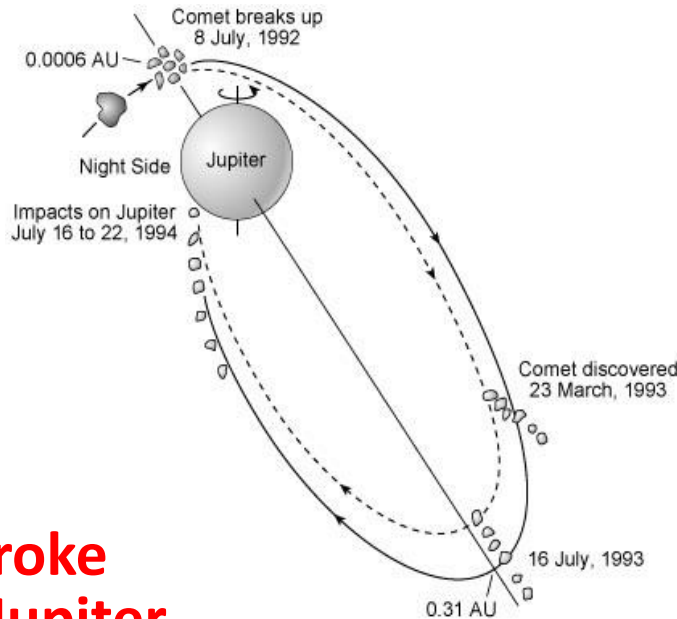
- The best-known of the *short-period comets* is visible from Earth every 75–76 years.
- First historical record: description from 240 BC (Chinese chronicle Shiji).

Next appearance: mid-2061



Comet Shoemaker-Levy 9

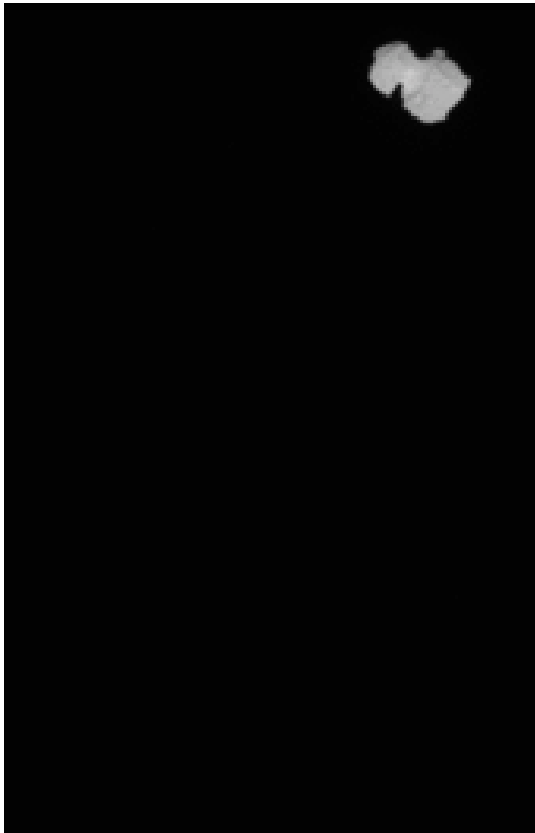
- Discovered in March 1993.
- Orbital studies of the comet revealed that it was *orbiting Jupiter* (captured about 20-30 years earlier) *rather than the Sun*, unlike all other comets known at the time.
- In July 1994 the comet **broke apart** and **collided with Jupiter**, providing the first direct observation of an extraterrestrial collision of Solar System objects.
- Hypothesis: Jupiter's huge mass acts as a "*cosmic vacuum cleaner*" to provide increased protection against asteroids and comets for the inner planets.



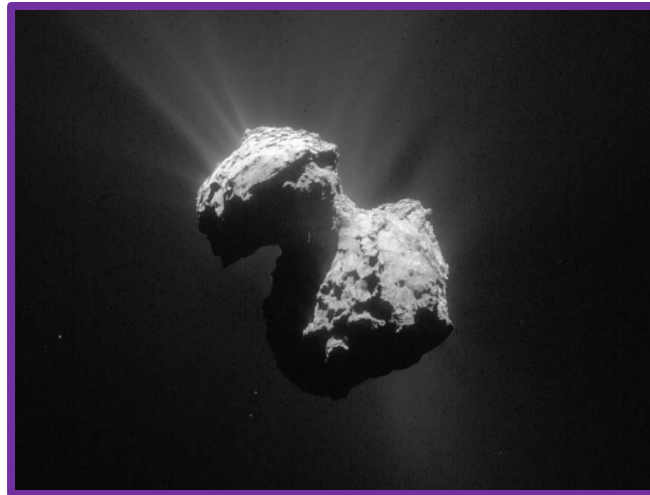
Comet Churyumov-Gerasimenko

The first comet to welcome a spacecraft to land on!

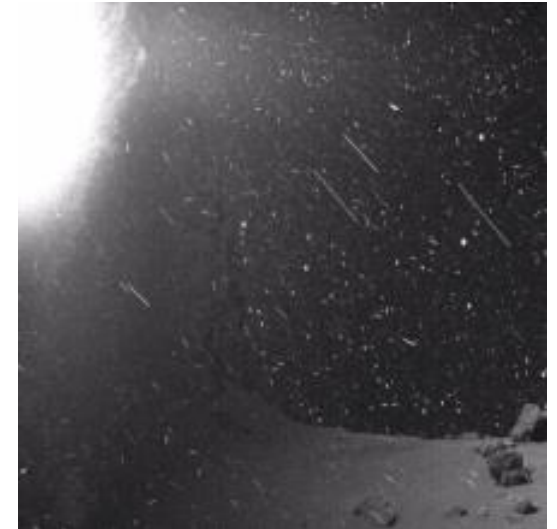
European Space Agency's **Rosetta** mission:
launched on 2 March 2004, entered the comet's
orbit on 10 September 2014, sent **Philae lander**
on 12 November 2014, Rosetta itself landed on
the comet's surface on 30 September 2016.



What is it like
approaching
a comet?



“Rubber Duck”
outgassing



Dust and cosmic rays