Comet Hale-Bopp

March 9, 1997

Comet Hyakutake

March 25, 1996

What We Will Learn Today

- What are comets made of?
- Why do comets have tails?
- How have we explored comets?
- What do we know about the Oort cloud?

What Are Comets?

- Comets are planetesimals that formed beyond the frost line
- Hence, they are ice-rich
  - Hydrogen compounds
  - Unlike asteroids, which formed inside the frost line and are rocky
- Live primarily in two places of the Solar System
  - Kuiper Belt
  - Oort Cloud
- Noticed when they come close to Sun and develop a tail
  - The word Comet comes the Greek word for hair

Comets in History

- Appear suddenly in night sky with a tail
- Many cultures believed that it was a sign of impending change or disaster
- Thought to be artifacts within Earth's atmosphere
- Tycho Brahe's observations in 1577 showed that they were much farther than the Moon
- Edmund Halley was the first to calculate a comet's orbit and predicted its return in 1758
  - Comet was named after him when the prediction came true
  - Next return of comet will be in 2061

SOHO Comet Discoveries

- SOHO is the spacecraft studying the Sun from the Lagrangian Point 1
- Has seen over 1,000 Sun-grazing comets
  - Most do not survive this close encounter

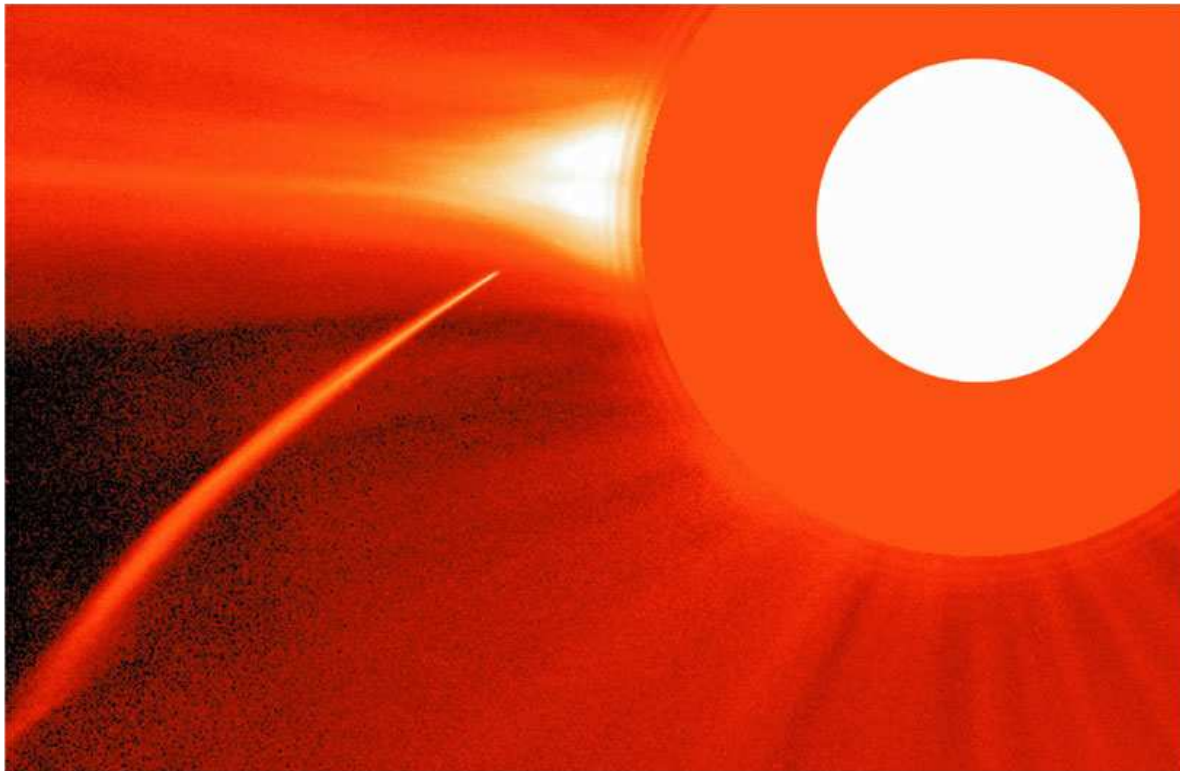


Fig 12.10

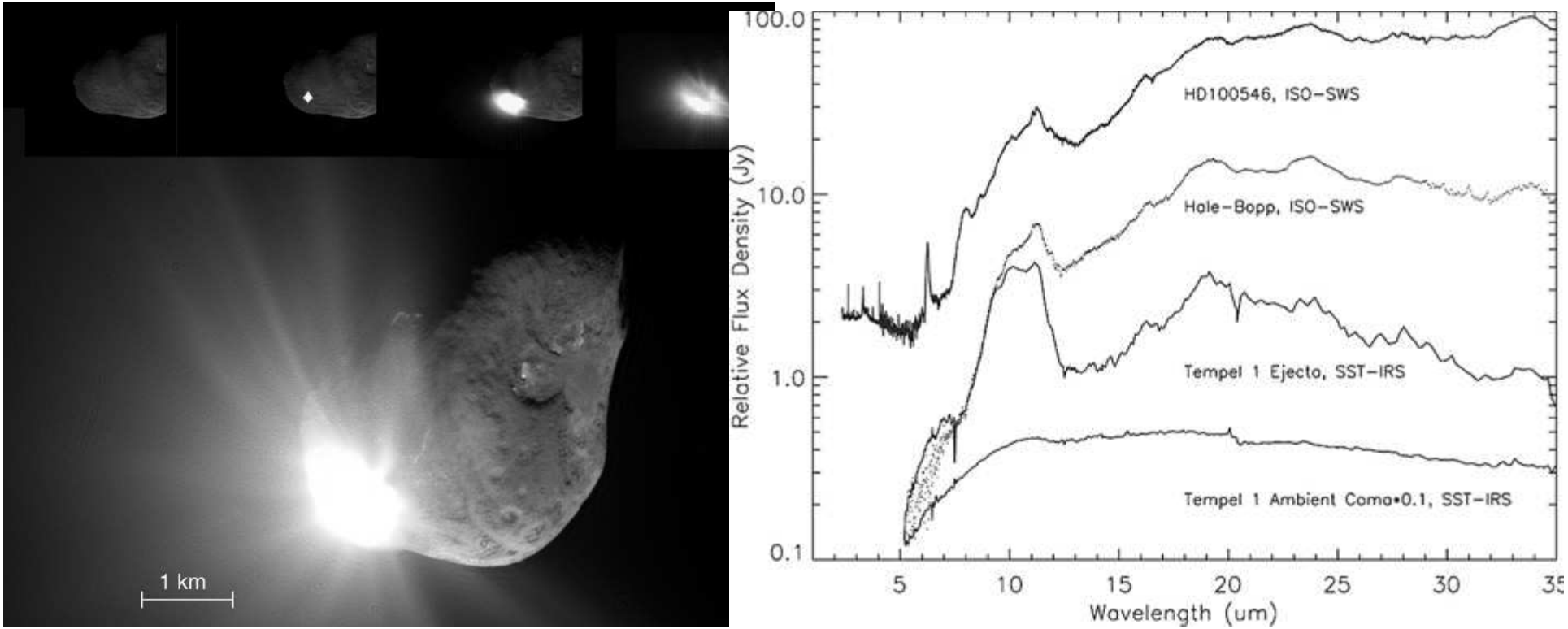
Comet Composition

- Comets are “dirty snowballs”
  - Water ice
  - Other hydrogen compounds
  - CO, CO_2
  - Organic compounds
- Comets brought water to Earth
- Perhaps also brought life?

Comet Exploration: Deep Impact

- NASA Deep Impact mission
  - Impactor crashed into comet Tempel 1 on July 4, 2005 at 23,000 km/hr

Fig 12.11



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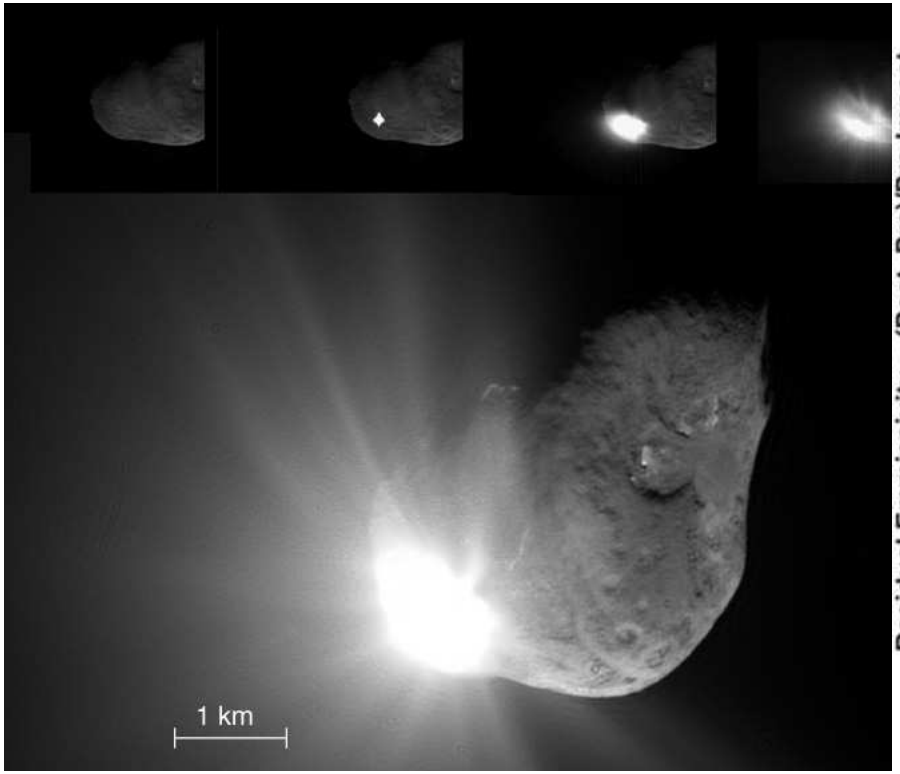

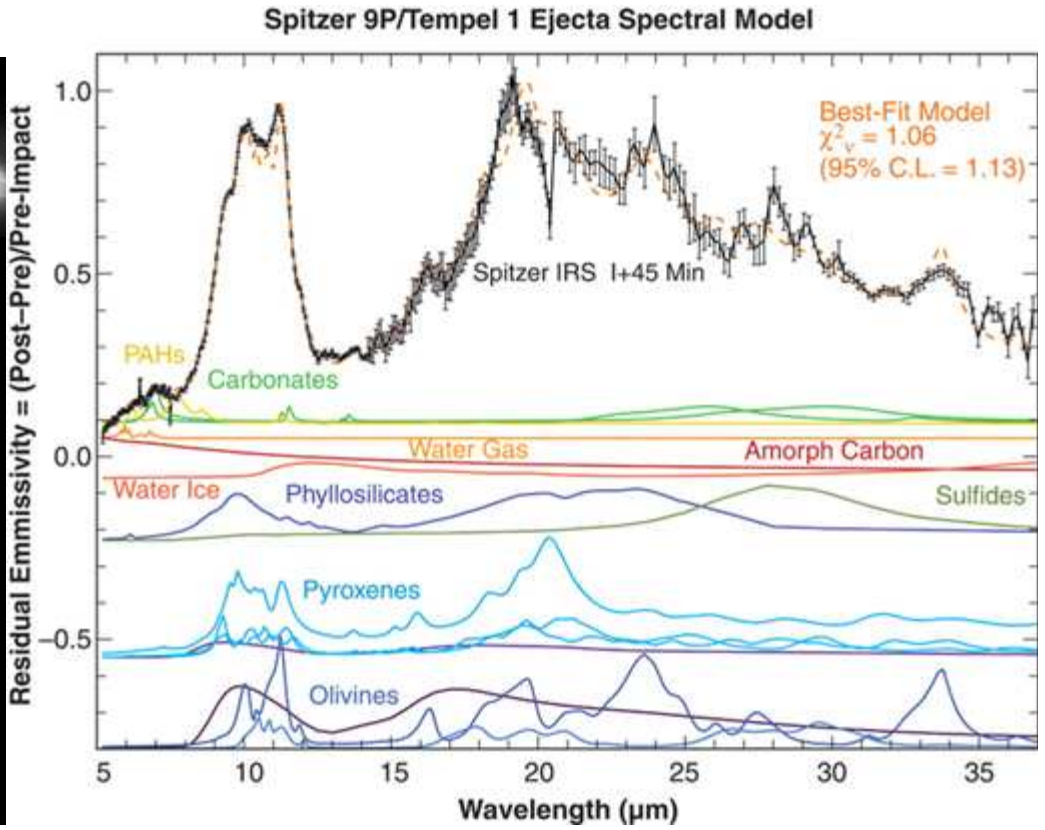

Comet Exploration: Stardust

- NASA comet sample return mission
  - Comet Wild 2
- Landed on Earth on January 15, 2006

A Comet's "15 Minutes" of Fame

- Nucleus is about 20 km across
- Partly ice, partly empty (loosely packed snowball)
- Usually very dark (darkened by Carbon)
- Coma: Dusty atmosphere
- Plasma tail
  - Pushed by solar wind
- Dust tail
  - Pushed by radiation pressure (weaker)
- Pebble sized debris left in orbit
  - Meteor showers

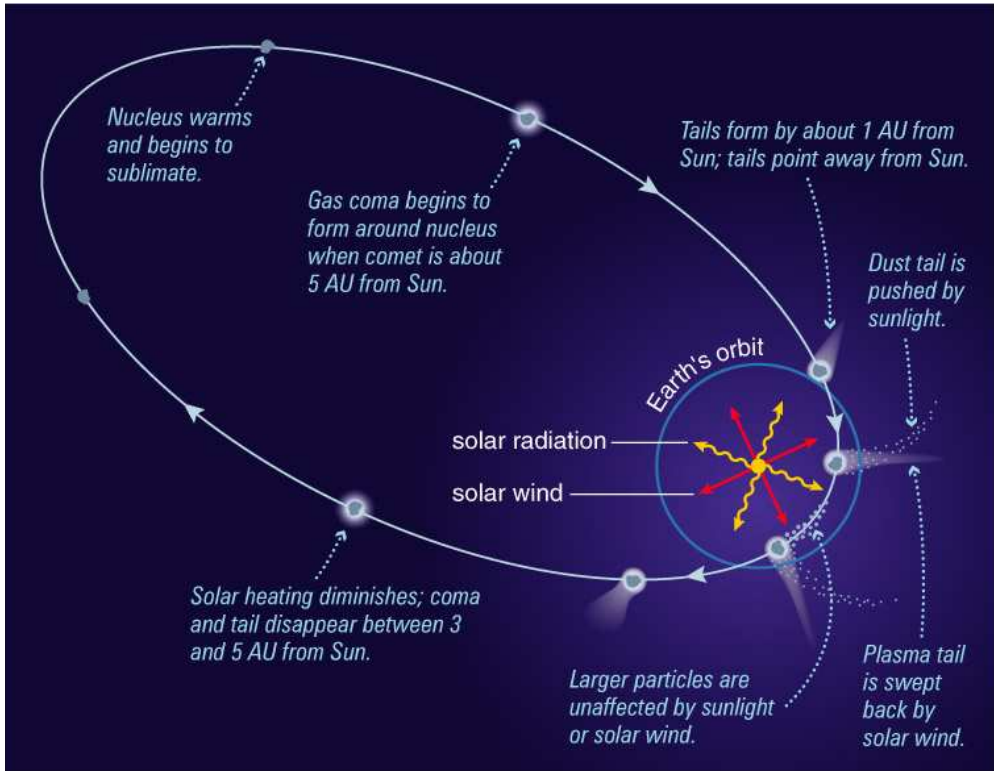

Fig 12.12

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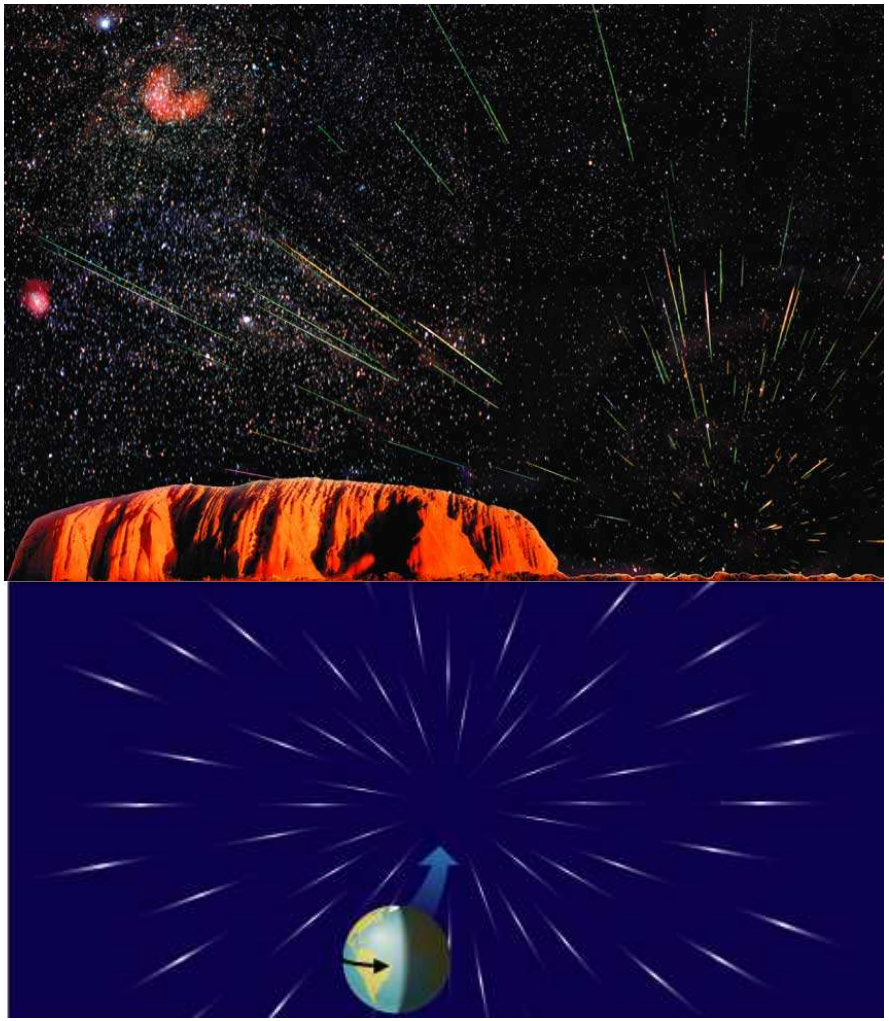

Fig 12.13

Where Do Comets Come From?

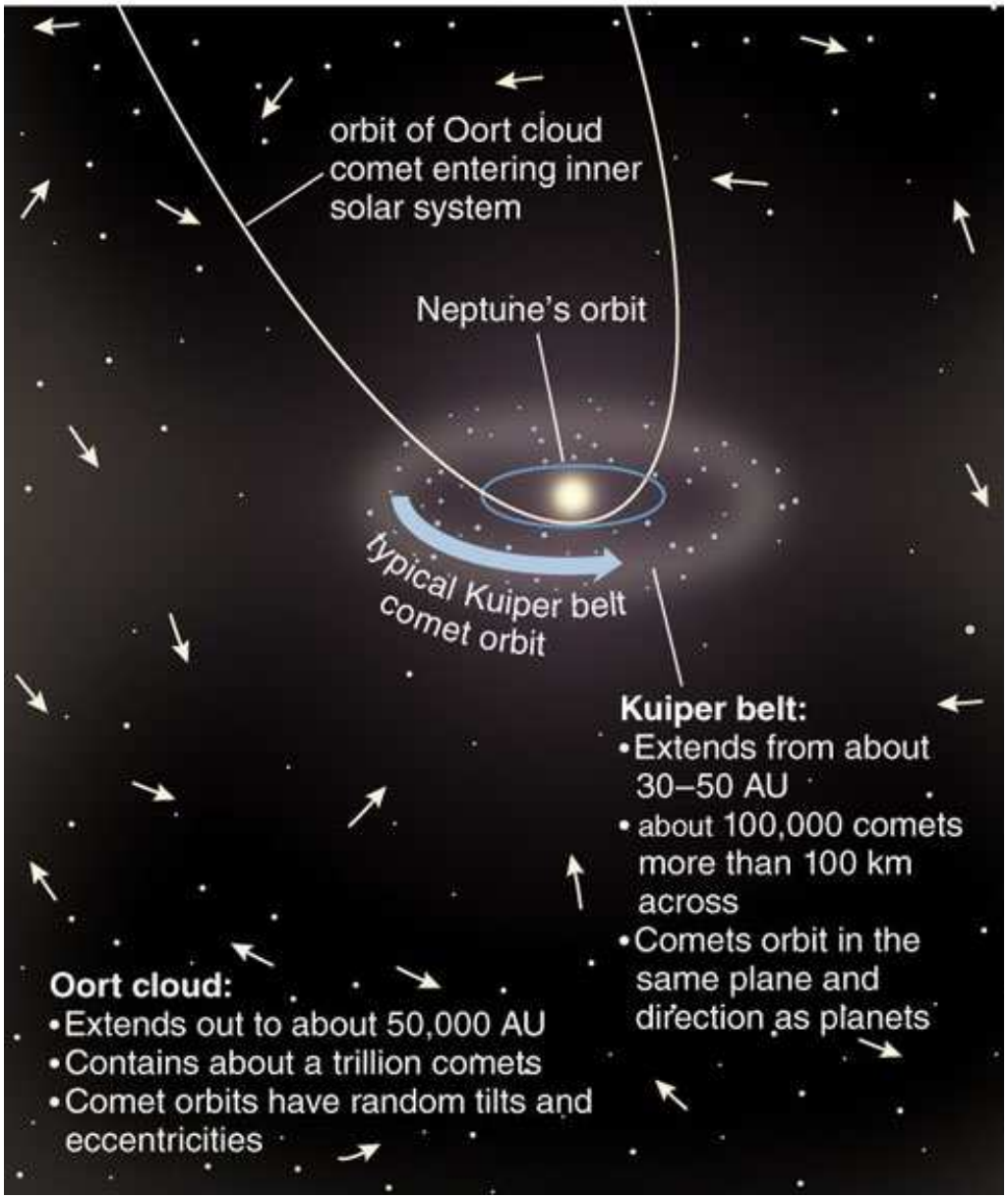

Fig 12.14

Comet Holmes is in the Sky Now!

- October 24, 2007: Comet Holmes suddenly brightens over a million times!
- Easily seen with the naked eye
- Comet expands to a spherical disk
  - Photo shows comet's growth in 3 day intervals
- This is the second outburst event for this comet
  - Last one was 115 years ago