



Extreme Navigation

NASA's Discovery Missions: Stardust-NExT and EPOXI Missions

NASA's Discovery Missions:

Stardust-NExT

<http://stardustnext.jpl.nasa.gov>

EPOXI

<http://epoxi.umd.edu>

What Are Comets?

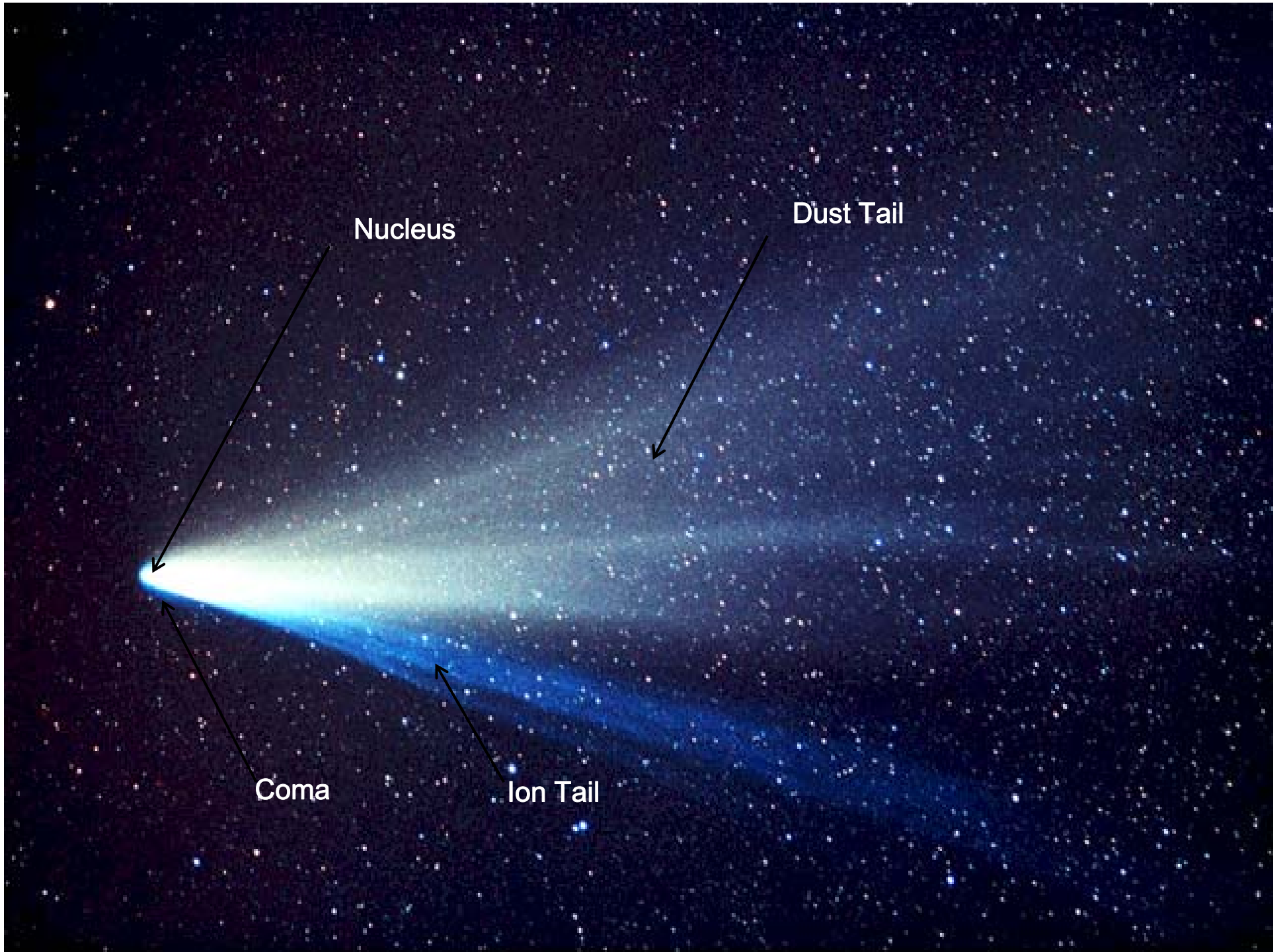
- They contain a high percentage of rocky organic materials and ices
 - Ices include: water (H₂O), carbon dioxide (CO₂), methane (CH₄)
- Solid nuclei are generally smaller than asteroids
 - On average a few km in diameter
- They are left over “bits” or remnants from the formation of the Solar System
 - Thought to originate in either the
 - Oort Cloud (long period)
 - Kuiper Belt (short period)



Comet McNaught in 2007 over Australia
by Akira Fujii

Comet Anatomy

- **Nucleus:** “dirty ice ball” (ice, dust, and rocky debris)
 - ✓ The nucleus is relatively small, usually only 1-50 km across
- **Coma:** a cloud of dust, water vapor, carbon dioxide, and other gases which sublimed off the nucleus and contain very little mass.
 - ✓ The coma and tail can be as large as Jupiter (about 10x Earth’s diameter).
- **Tails:**
 - **Dust tail:** composed of small (smoke-sized) dust particles driven off the nucleus by escaping gases, making it the easiest to see.
 - **Ion Tail:** composed of plasma (ionized gases) and created by interaction with solar winds.
 - ✓ A comet’s tails can be as long as 1-2 AU (150-300 million km) when the comet is near the Sun.
 - **Sodium Tail:** composed of sodium ions, yellowish
 - ✓ Only recently discovered, the sodium tail requires special filters to perceive.



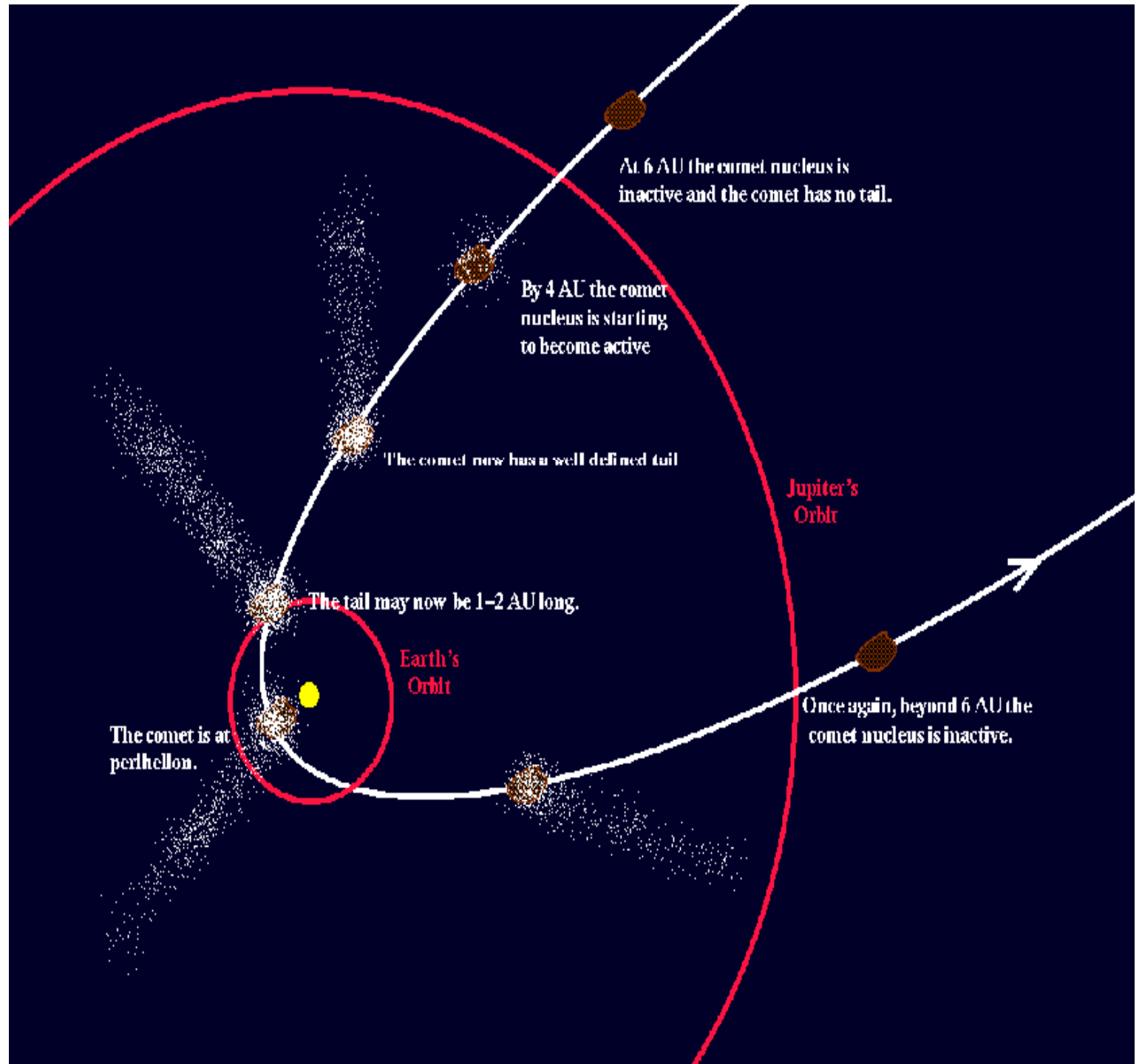
Nucleus

Dust Tail

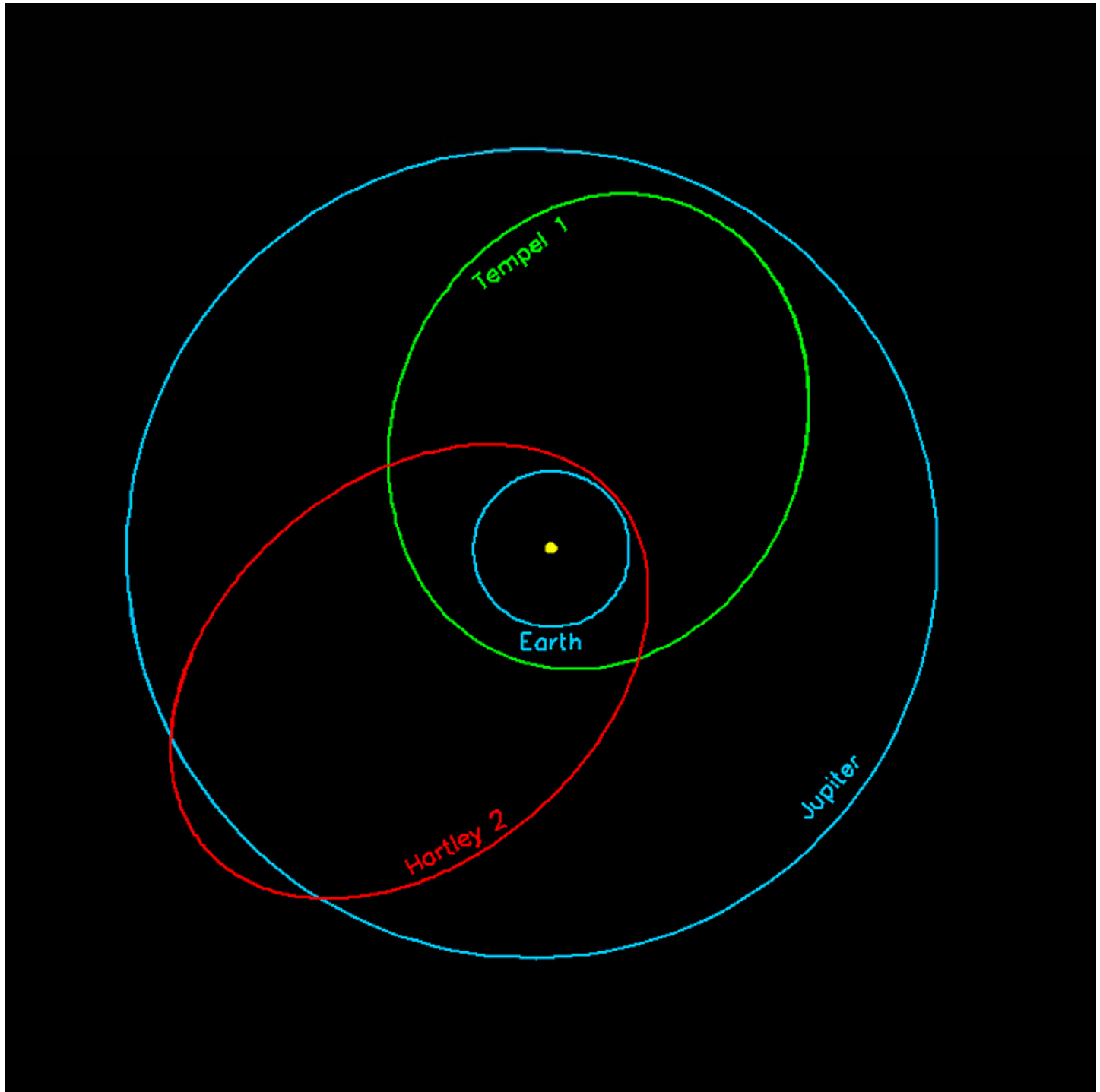
Coma

Ion Tail

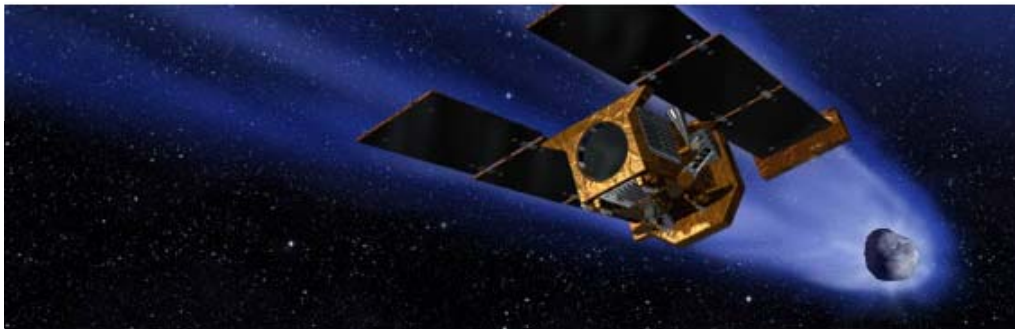
Comet Action



The orbital paths
of the comets
EPOXI and
SD-NExT
are visiting in
2010 and 2011



NASA Comet Explorations: Two Spacecraft, Three Comets, Four Missions, *Oh My!*



Stardust Spacecraft

First mission to comet Wild 2 ("vilt 2")
second mission to comet Tempel 1

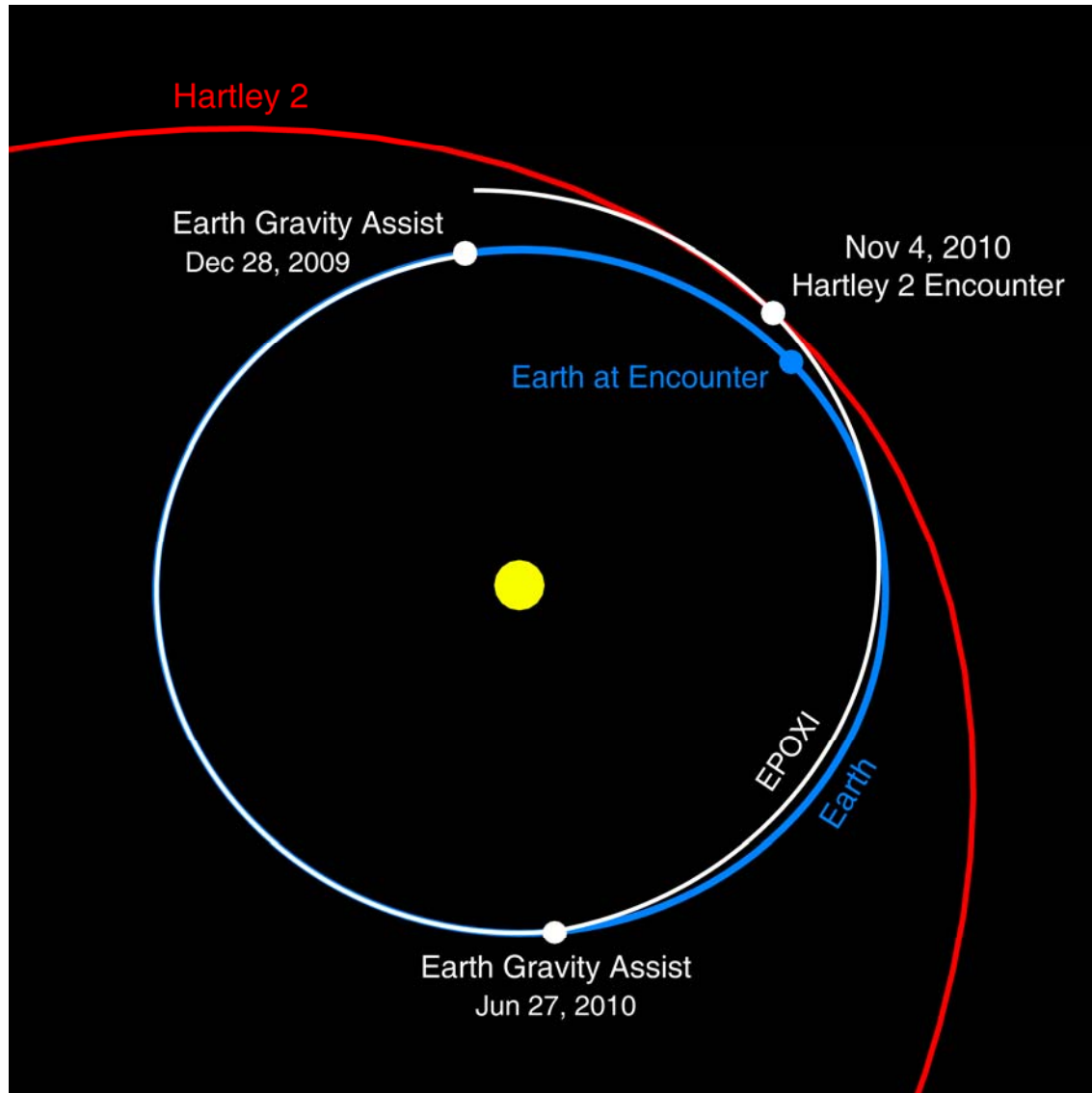


Deep Impact Spacecraft

First mission to Tempel 1,
second mission to comet Hartley 2



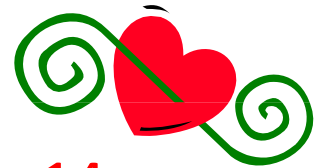
EPOXI's trajectory to comet Hartley 2



EPOXI Deep Impact Extended Investigation Objectives

- Understand the impact of Hartley 2's gas jets by
 - ✓ Searching for and map outbursts of gas from the comet's surface
 - ✓ Tracking the outburst as the comet rotates
 - ✓ Matching outbursts with surface feature
 - ✓ Looking for frozen volatiles on the surface of the comet
- Produce broad band images of the comet and a model of its shape
- Map the *brightness* and *color* variations of the surface; locate topographical features that reveal what processes formed the comet; compare the distribution of various crater sizes with craters on other comets, asteroids and moons
- Map the *temperature* of the surface to assess the thermal conductivity of the interior and the migration of subsurface volatiles

Stardust-NExT Mission Objectives



Stardust-NExT will flyby comet Tempel 1 on **February 14, 2011**, to complete the exploration initiated by Deep Impact by:

- obtaining images of the coma, nucleus, and jet at resolutions as high as 12 m/pixel
- measuring the composition, size, distribution, and flux of dust emitted into the coma

The mission plan offers high probabilities of viewing significant portions of the hemisphere studied by Deep Impact in 2005 and imaging the crater made by its impactor.

Discover More!

Stardust-NExT

<http://stardustnext.jpl.nasa.gov>

EPOXI

<http://epoxi.umd.edu>

NASA's Discovery and New Frontiers

<http://discoverynewfrontiers.nasa.gov>