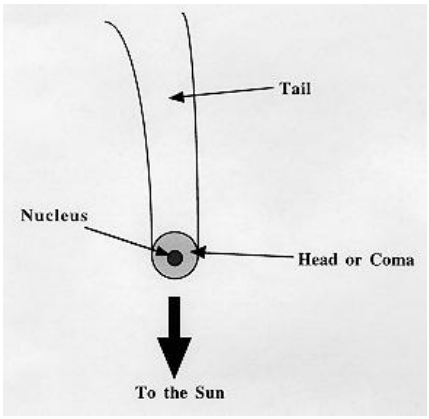
Comet - Anatomy of a Comet



This drawing might seem a bit simplistic because it merely describes the main parts of a much-more complicated object. What we see here are the main parts of a comet.

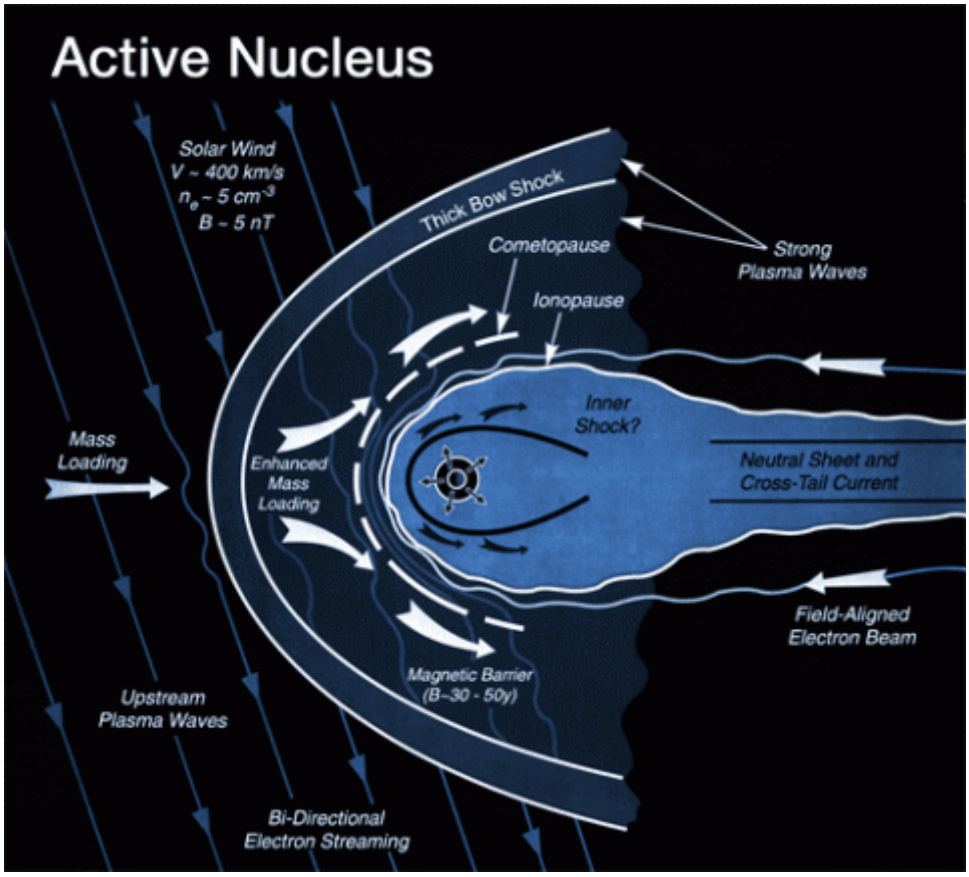
NASA and the ESA (European Space Agency) help us to put “flesh on these bones” with the following lesson about comets.

Anatomy of a Comet

The comet’s structure, or total environment, includes:

1. *The interior of the nucleus;*
2. *The surface of the nucleus which morphs as the comet approaches the sun*
3. *The coma that emerges from and surrounds the nucleus*
4. *The tails that eventually trail behind the comet as it approaches the sun.*

The nucleus



When far from the sun, comets are usually big, asymmetrical chunks of ice mixed with dust or rock, typically less than ten miles across. This is the comet's nucleus. Scientists used to think that it was solid and firm, but NASA’s Deep Impact mission (2005), in which Rosetta participated,

surprised them. They found that the nucleus of comet Tempel-1 was more silicate or dusty than they expected. It was also harder than they expected.

When a comet is in the deep freeze of space, very far from the Sun, it is completely frozen. But when it approaches to within about 140 to 280 million miles (about 225 million to 450 million km) of the sun, its ices begin to sublime.

They boil off of the surface or burst out of the interior as jets of gas, carrying dust with them. This spewing gas and dust create a huge "coma" around the nucleus. The coma can grow as large as 60,000 miles (100,000 km) or more in diameter! The nucleus and coma together are the "head" of the comet.

The coma

As the coma grows larger, it becomes an obstacle to the streaming solar wind, creating a bow shock in front of the coma. This bow shock is a bit like the reactive wave that forms off the bow of a ship as it plows against the waves pushing against it.

Similarly, the comet "plows" through the solar wind, and this confrontation expands the coma more and more as the comet approaches the sun. As the pressure of the coma begins to equal the pressure of the solar wind, the solar wind and its associated magnetic field lines slow down, compress against the coma, and then stream around the comet, carrying cometary ions and dust with them, eventually forming the comet's tails.

As the coma grows, different regions, similar to those found in Earth's own upper atmosphere and magnetosphere, form within it, including:

1. *The inner shock;*
2. *The ionopause and ionosphere; and*
3. *The cometosphere and cometopause.*

A particle leaving the surface of the comet will fly out, accelerate through the inner shock, and perhaps interact with light from the Sun. It may interact with other molecules, or possibly photoelectrons, and it may even continue accelerating even beyond the bow shock. For more on this process, see "How a Comet Works."

The tails

As the solar wind and magnetic field lines wrap around the coma, they push ionized gas and dust away from, and around, the head of the comet, to form tails that always stream directly away from the sun. The first kind of tail, the dust tail, contains microscopic dust particles which usually form a broad and gently curved tail that can stretch up to 60 million miles (100 million km)!

The second kind of tail, the ion tail, is straighter and thinner, and consists of ionized gas. Ion tails can become quite long. Comet Hyakutake's ion tail stretched an amazing 360 million miles! That's about four times the distance between the Earth and the sun, and the longest ever observed by humans. That's an amazing long tail to wag in space!

Scientists studying the comet Hale-Bopp also noted a faint sodium tail, something not seen frequently on visible comets. There's no doubt about it. Comets put on some of the most amazing shows you'll ever see.

Credits:

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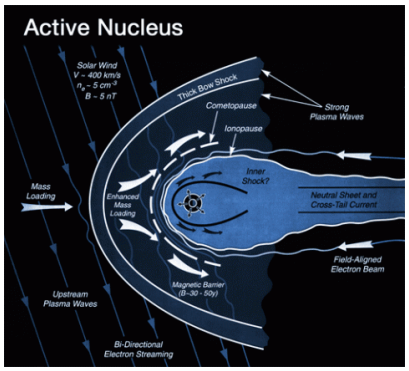

Comet Nucleus

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