WHAT ARE THE COMETS?

• A comet is an icy small Solar System body that, when passing close to the Sun, heats up and begins to outgas, displaying a visible atmosphere or coma, and sometimes also a tail. These phenomena are due to the effects of solar radiation and the solar wind upon the nucleus of the comet.

• As of August 2014 there are 5,186 known comets
HOW DO THEY LOOK LIKE?

They look like a star with a ghostly white tail.

The term "comet" derives from the Greek aster kometes, which means "long-haired star"---a reference to the tail.
HOW DID COMETS FORM?

- Astronomers are not certain how comets formed, but most believe that comets formed at the same time our solar system did, perhaps even in among the planets.

- Comets are made of a mixture of ices and dust. These are precisely the materials that probably existed when the solar system was forming.
WHERE DO COMETS COME FROM?

• Comets are in orbit around the Sun as are our planets.

• Comets are composed of ices, dust and rocky debris carried from the early formation of the solar system about 4.5 billion years ago.

• Comets are remnants from the cold, outer regions of the solar system, areas where materials left over from the formation of our solar system have condensed into icy objects. Both regions extend beyond the orbits of Neptune and Pluto but are still part of our solar system and much closer to us than the closest star.
Kuiper belt: On orderly orbits from 30-100 AU in disk of solar system

Oort cloud: On random orbits extending to about 50,000 AU

Only a tiny number of comets enter the inner solar system - most stay far from the Sun

Kuiper belt: On orderly orbits from 30-100 AU in disk of solar system
COMET ORBIT AND SIZE

• Comet orbits are elliptical. It brings them close to the sun and takes them far away.

• Short period comets orbit the Sun every 20 years or less. Long period comets orbit the Sun every 200 years or longer. Those comets with orbits in between are called Halley-type comets.

• We see a comet's coma and tail because sunlight reflects off the dust (in the coma and dust tail) and because the energy from the Sun excites some molecules so that they glow and form a bluish tail called an ion tail and a yellow one made of neutral sodium atoms.

• Scientists have seen comets range in size from less than 1 km diameter to as much as 300 km, although the 300km (called Chiron) does not travel into the inner solar system.
Gas coma begins to form around nucleus when comet is about 5 AU from Sun.

Nucleus warms and begins to sublimate.

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

Earth's orbit

Larger particles (not visible) are unaffected by sunlight.

Dust tail is pushed by sunlight.

Plasma tail is swept back by solar wind.

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

Tail points away from Sun.
PARTS OF A COMET

• Comets have three parts:

  • the nucleus - the solid center component made of ice, gas and rocky debris

  • the coma - the gas and dust atmosphere around the nucleus, which results when heat from the Sun warms the surface of the nucleus

  • the tails - are formed when energy from the Sun turns the coma so that it flows around the nucleus and forms a fanned out tail behind it extending millions of miles through space
Characteristic features of comets
• We know a comet could impact Earth and that it is important to understand the nature of comets so we can design better methods to protect ourselves from them should one be on a collision path with Earth.
Comets eject small particles that follow the comet around in its orbit and cause meteor showers when Earth crosses the comet’s orbit.
DEEP IMPACT

• NASA mission to impact comet nucleus.
• Use spectroscopy to determine composition of nucleus.
WHY DO WE SEE THEM?

They can be seen by us only when they pass by the sun and the sun’s heat melts them.

The comet's tail is made of material from the comet; gas from the ices and dust that is mixed in with the ice. They escape as the comet melts.

The tail always points away from the sun due to the solar winds (movement of heat away from sun).
<table>
<thead>
<tr>
<th>COMETS</th>
<th>ASTEROIDS</th>
<th>METEORS</th>
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<tbody>
<tr>
<td>Made of ice</td>
<td>Made of rock and metal</td>
<td>Made of rock and metal</td>
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<tr>
<td>have tails</td>
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<tr>
<td>Stay in space</td>
<td>Stay in space</td>
<td>Fall into Earth’s atmosphere</td>
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<tr>
<td>Orbit the sun</td>
<td>Orbit the sun</td>
<td>Gravity pulls to Earth; they burn up as they fall</td>
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</table>
Comet Halley on March 21, 1986, after having rounded the Sun, and on its way out of the inner Solar System.
In 1705 Edmund Halley found that the bright comets of 1531, 1607, and 1682 had almost the same orbits and returned every 76 years. He concluded that they were, in fact, one and the same comet. He then predicted the return of this comet in 1758, which indeed took place.

Thus, Halley showed that comets orbit the Sun in elliptical orbits with variable periods.
COMETS OF 2014

Looking to 2014 there are three comets beside Lovejoy that are expected to wax bright enough to see in binoculars and possibly with the naked eye: **C/2012 K1 PanSTARRS**, **C/2013 V5 Oukaimeden** and **C/2013 A1 Siding Spring**

The first lurks in Hercules but come early April should bulk up to magnitude 9.5, bright enough to track in a small telescope for northern hemisphere observers. Watch K1 PANSTARRS amble from Bootes across the Big Dipper and down through Leo from mid-spring through late June hitting magnitude 7.5 before disappearing in the summer twilight glow. K1 will be your go-to comet during convenient viewing hours.
Comet C/2013 R1 Lovejoy starts the new year as the brightest comet in the sky at around magnitude 6. In this photo taken on Dec. 31, two tails are visible. The longer one is the ion or gas tail; the broader pale yellow fan is the dust tail.
Early in September K1 PANSTARRS reappears in the morning sky, traveling westward from Hydra into Puppis.

Southern hemisphere observers are now favored, but northerners won’t suffer too badly.

The comet is expected to crest to magnitude 5.5 in mid-October just before it dips too far south for easy viewing at mid-northern latitudes.
FINDING CHARTS - K1 PANSTARRS
C/2013 V5 (OUKAIMEDEN)

- Preliminary estimates place the comet at around magnitude 5.5 in mid-September. It should reach binocular visibility in late August in Monoceros the Unicorn east of Orion in the pre-dawn sky before disappearing in the twilight.
2014’s most anticipated comet has to be C/2013 A1 Siding Spring, expected to reach magnitude 8 and climb into the evening sky by way of Scorpius and Sagittarius early October.

As October ticks by, A1 Siding Spring creeps closer and closer to Mars until it overlaps the planet on the 19th. Normally, a comet will only appear to pass in front of stars and deep sky objects because it’s in the same line of sight. Not this time. Siding Spring may actually “touch” Mars for real.
MARS AND C/2013 A1 SIDING SPRING

“Teapot” of Sagittarius

Mars and Comet A1
Oct. 19, 2014

S.West
Every year new comets are discovered, some of which can swiftly brighten and put on a great show like Comet Lovejoy did last fall and continues to do.

In 2013, **64 new comets** were found, 14 of them by amateur astronomers.

Comets with the potential to amaze us are out there – we just have to find them.
SKY ORIENTATION

The Meridian is an imaginary line which passes from North to South through a point directly above the observer's head (known as the zenith).

A celestial body reaches its highest point in the sky when it crosses the meridian; this is known as the meridian transit or culmination.

The meridian line is essentially the observer's line of geographical longitude projected from the Earth's centre out into space.
Angular Altitude

- **Angular altitude** (or elevation) is measured as 0° at the horizon (when an object is at the point of rising or setting), 45° when 'half way up the sky' and 90° when directly above the observer's head (at the zenith).

- Note that the altitude is measured from the theoretical (astronomical) horizon, and not from the local horizon, which in many instances will be elevated by mountains, hills, etc. the observer.