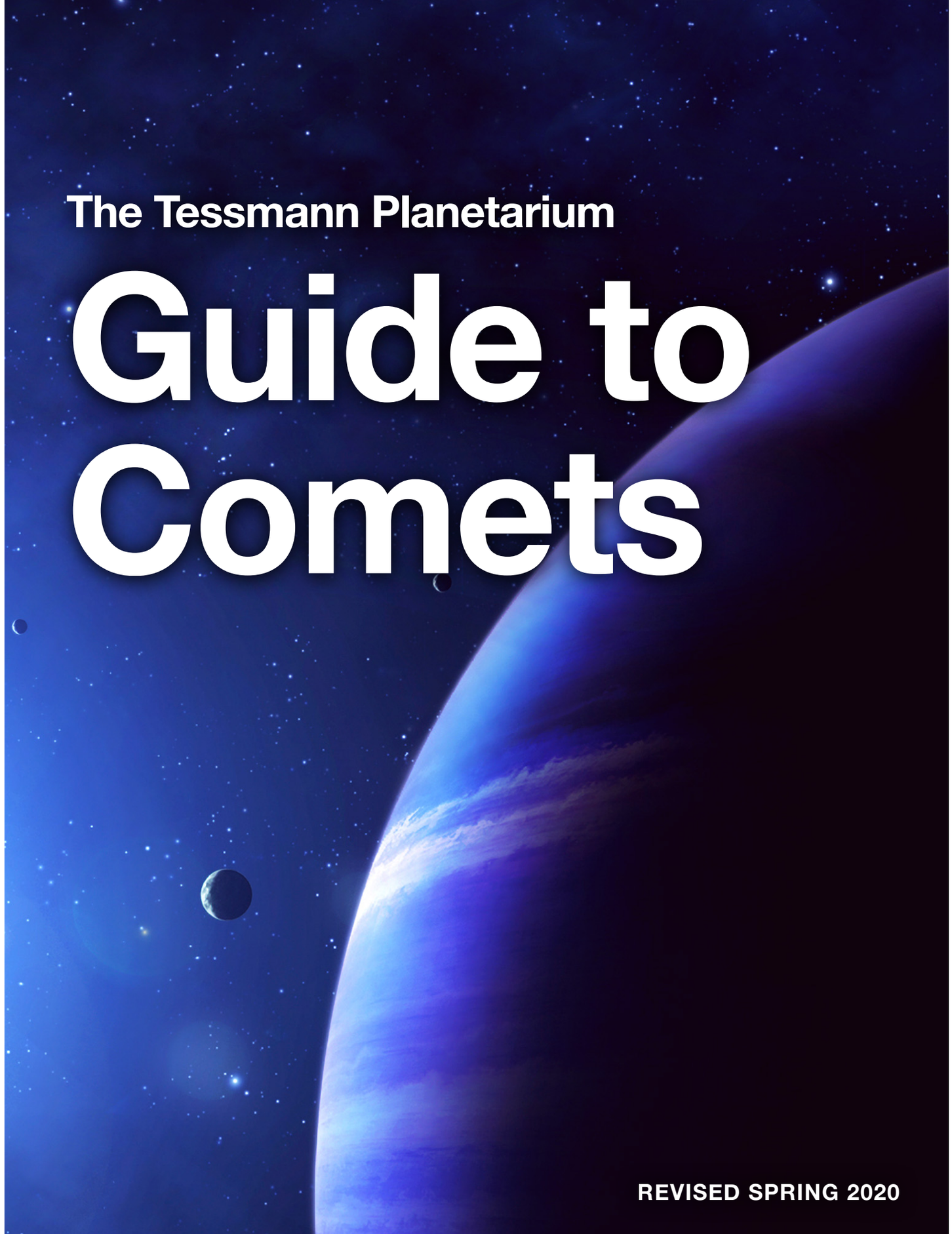
The Tessmann Planetarium

Guide to Comets



REVISED SPRING 2020

Comets are like cats: they have tails and they do precisely what they want. — David Levy

What is a Comet?

WHAT IS A COMET?

How Does a Comet Form a Tail?

A comet is a big, dirty snowball. Some comets have more ice and water than others. Comets are also made up of frozen gases, such as carbon monoxide, methane and ammonia, plus organic materials (materials that form life) such as hydrocarbons and amino acids. These materials were created during the birth of our solar system. The solar winds push some of this icy material out to the far regions of the solar system. These regions are known as the Kuiper Belt and the Oort Cloud.

The solid core of a comet is called the nucleus. When a comet comes close to the Sun, closer than the orbit of Jupiter, it forms a tail. The Sun's radiation begins to vaporize the comet. A cloud of a gas, called a coma, forms around the nucleus. Then gases and dust stream from the comet. The solar wind pushes some of the material away from the coma and a tail forms. The tail is made up of mostly water and dust.

What is the Solar Wind?

The sun sends out streams of charged atomic particles made up of electrons and protons. This is known as the solar wind. This stream has a lot of energy and is called plasma. Plasma moves faster than the speed of sound. It is responsible for the Northern and Southern Lights, and pushes the tail of a comet so that it always points away from the Sun.

What is a Comet?

HOW LONG IS A COMET'S TAIL?

Are Comets Bad Luck?

Some comet tails have been observed to extend more than 93 million miles – the distance between the Earth and the Sun. This distance is known as one astronomical unit or AU. (Comet Hyakutake, image left).

Did you know that comet comes from a Greek word meaning "having long hair," which is a fitting way to describe the tail of a comet.

It was once believed that comets were signs that terrible events would soon occur. An appearance of a comet in the sky might foretell the death of a king, a defeat in battle or a natural disaster like an earthquake. No one really knew what comets were until a few hundred years ago. Now we know that comets are just one of the building blocks of our solar system. They are the material left over from the birth of our Sun.

Do Comet's Fly Past Our Planet More Than Once?

Yes! Probably the most famous comet to return is Halley's Comet. Halley's Comet returns every 76 years like clockwork. Comets that return in 200 years or less are called short period comets.

Some comets don't return for hundreds or even thousands of years. Comet McNaught's next visit will be in 92,000 years and Comet Hale-Bopp will return again in two or three millennia. Some comets, such as Comet Encke, circle the Sun, but barely get as far out as the orbit of Jupiter. Ecnke-like comets may return in less than 20 years.

Hence I dare venture to foretell, that it will return again in the year 1758.

- E. Halley

Halley’s comet, photographed in1910

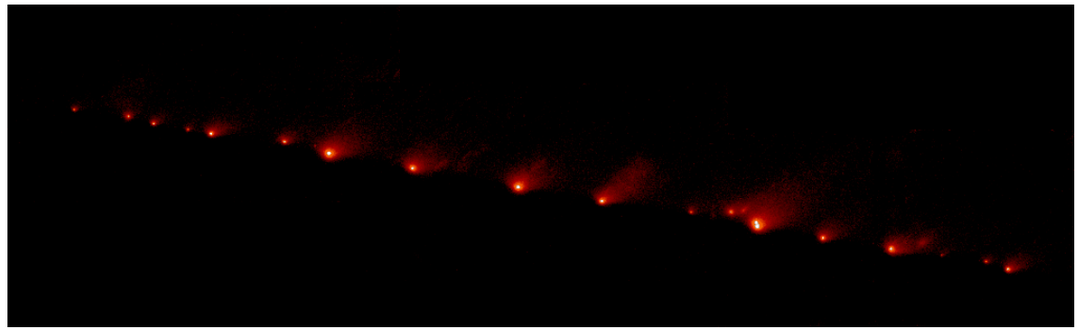
Some Famous Comets

Halley's Comet

Almost everyone has heard of Halley's Comet. It wasn't actually discovered by Edmond Halley, but he was the first scientist to predict that comets could return on a regular basis. Halley's Comet is well remembered as it was widely visible in 1910. What is not generally known is that another comet, known as the Great Comet of 1910, was even more impressive. Somehow, as the years passed, people began to mistakenly think that the Great Comet was Halley's comet

Comet Shoemaker-Levy 9 (SL9)

Almost as famous as Halley's Comet is SL9 (Shoemaker-Levy 9), also known as the String of Pearls comet (see image below). SL9 occupies an important position in the history of comets. It broke into 23 pieces in 1993. It resembled a long string of pearls as it hurtled through space. Each fragment struck Jupiter the following year, and the world watched with awe as the Hubble telescope captured images of the impacts. The collision with Jupiter and its aftermath was one of the most observed astronomical events in human history up to that date. Every backyard astronomer aimed his or her telescope at Jupiter to see the dark splotches left behind by the collision. A few of the impact zones were easily visible in small telescopes. It was the first time a major cometary planet strike was ever observed in our solar system.



Some Famous Comets

Comet Hale-Bopp

Comet Hale-Bopp was one of the most impressive comets of the latter part of the 20th century and was visible to the naked eye for 18 months. It may have been only the fourth time it circled our Sun. Hale-Bopp was the first great comet of the internet age, and astronomers posted photographs daily on the web.

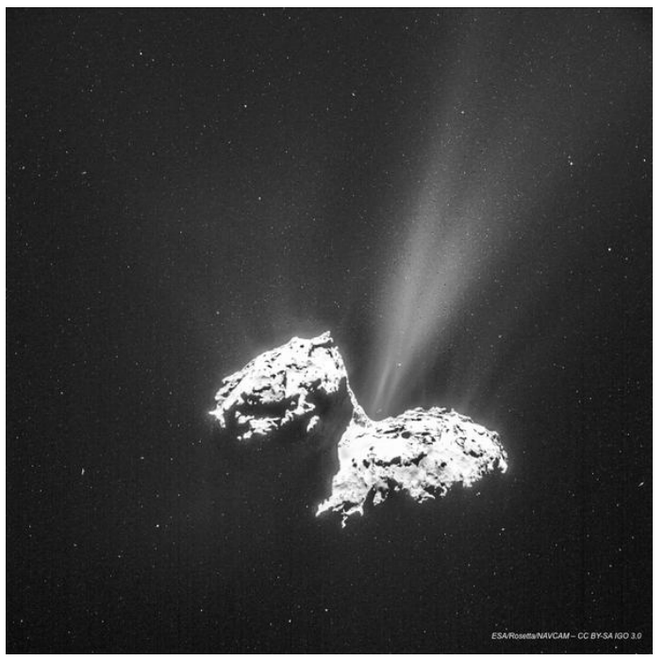
Comet McNaught, The Great Comet of 2007

Comet McNaught was one of the brightest comets of recent memory and was easily visible with the naked eye to observers in the southern hemisphere in 2007.

Comet Tempel 1 and the Deep Impact Mission

In 2005, the NASA's Deep Impact spacecraft launched a probe to collide with comet Tempel 1. The mission helped uncover some of the material locked below the surface of the Tempel 1. This comet had less water ice than expected.

Orbiting a Comet: The Rosetta Mission



After a 10 year voyage, the European Space Agency's (ESA) Rosetta probe orbited a comet called 67P/Churyumov–Gerasimenko, more commonly called the Rosetta comet. Sometimes nicknamed the "rubber duckie," due to its unusual shape (image at left), it sent back high resolution close up images of a comet for the first time. As the comet neared the Sun, ice began to melt and jets erupted, giving scientists the first glimpse of how a cometary tail is formed. It attempted a landing with a small module called Philae, but the lander bounced and tumbled as it struck the comet's surface, and it ran out of energy before it could be located.

Rosetta detected the presence of an amino acid, glycine, a building block of life, on the comet. Some scientists speculate that comets may have brought the building blocks of life to the planets during the early formation of the solar system.

If you must bet, bet on a horse, not a comet — Fred Whipple

Comets and Meteor Showers

Meteor Shower Connection to Comets

As a comet passes through space, dust and rock from the comet's tail is scattered behind and left in swaths or patches around the solar system. When the earth passes through a patch, small particles of this dust and rock burn up in streaks of light when they enter our atmosphere, producing meteors or "shooting stars." The larger particles produce impressive streaks, called bolides. Some of the larger particles may reach the Earth in the form of meteorites. The Earth passes through these patches at regular intervals and meteor showers can be predicted. For example, every August, the Earth travels through the particles left behind by Comer Swift-Tuttle. This meteor shower is known as the Perseids. Each October, we pass through the material left behind by Halley's Comet.

The Lesson of Kohoutek

In 1973, astronomers predicted that Comet Kohoutek would be a great comet. The comet had a very active nucleus and would orbit close to the Sun, leading comet hunters to believe that it would be spectacular. It was anxiously awaited by the public and intensely covered by newspapers and television before the age of the internet. But Kohoutek didn't live up to expectations and fizzled out in the media. However, two years later, another comet, Comet West (image at left), that had little expectation of being visible from Earth, did put on a dramatic show. However, because Kohoutek turned out to be such a dud, the media failed to report on it and the general public missed out on a chance to see an impressive comet.

In 1994, the Hubble Telescope capture images of the impact zones on Jupiter created by Shoemaker-Levy 9.

Will We Ever Be Hit By a Comet?

Can We Still Be Hit By Comets?

The collision of SL-9 striking Jupiter revealed that comets can still strike planets in our solar system. Fortunately for us, Jupiter and the Sun, because they have a great deal of gravity, act like giant vacuum cleaners and often attract comets that travel through the inner solar system.

However, a giant comet or asteroid struck the Earth 65 million years ago, and may be responsible for the death of the dinosaurs. Other comets have also struck the Earth. If a comet struck the Earth again, it could cause a major catastrophe. Fortunately, scientists have not discovered any comets that, at present, are headed toward our planet. We now have several robotic telescopes around the world searching the sky for comets and asteroids that might endanger us.

Videos have recently appeared on the internet claiming that a comet collision is imminent. A lot of these videos claim the government or NASA is covering up the truth. But as we say to people getting medical advice, always get a second opinion. Keep in mind, that if a large object is spotted in our solar system, telescopes and cameras used by backyard astronomers can observe these objects as well – not just the big telescopes, as was the case in centuries past. If a large comet is heading toward us, you can be sure a lot of ordinary amateur astronomers around the world would see it and spread the word, and it certainly wouldn't be a secret for long.

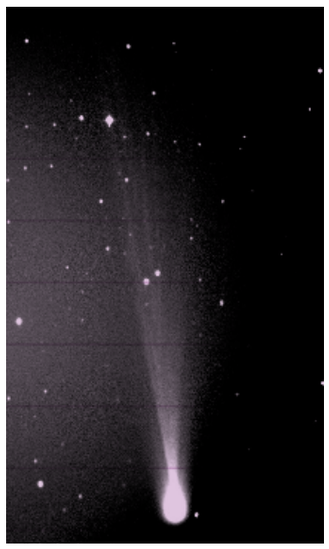
There is always a danger that we might be struck by smaller asteroids, but so far, the robotic telescopes haven't discovered any asteroids or comets that are heading our way.

Or Llike Icarus, flying close to the Sun; forgot his wings were made of wax — D. Longnecker

Sungrazers

A Tale of Two Comets

Comets and Wine?



Some comets travel close to the Sun. Some just barely skim past and others meet a fiery fate.

A comet named C/2011 W3 (Lovejoy, see image left) appeared to plunge into the Sun in December of 2011. But the comet survived the plunge and reappeared on December 25. The comet was observed in Chile, where the people called it “the Christmas miracle.”

Comet Ison was not so lucky. ISON appeared to have the makings of a great comet. On Thanksgiving Day 2013, it had a close encounter with the Sun and was reduced to a cloud of debris. Scientists carefully observed the debris of ISON, which added to our knowledge of the composition of comets. (Comet ISON before its plunge into the Sun, lower left; photo courtesy of David Levy).

Did you know that some winemakers once believed that the appearance of a comet just before the grape harvest made a great wine? For example, winemakers in 1811 believe that the appearance of the Great Comet of 1811 helped weather conditions produce great champagne and cognac that year. These days, we know that there’s no connection between comets and the weather, but winemakers put images of stars on their labels back then to honor the great comets!

We are star stuff - Carl Sagan

Why Comets are Important

WHY WE STUDY COMETS

You might wonder why we study comets. Well, for one thing, material in comets – ice, rock and gas – is material left over from the very beginnings of our solar system. It is material ejected from the Sun when it was born. And because some of material is in a deep freeze, it may be still be pure enough for us to find out what the original solar system was really made of. These survivors from the birth of our solar system give us clues about how our solar system was formed. Comets are fossils of our early solar system.

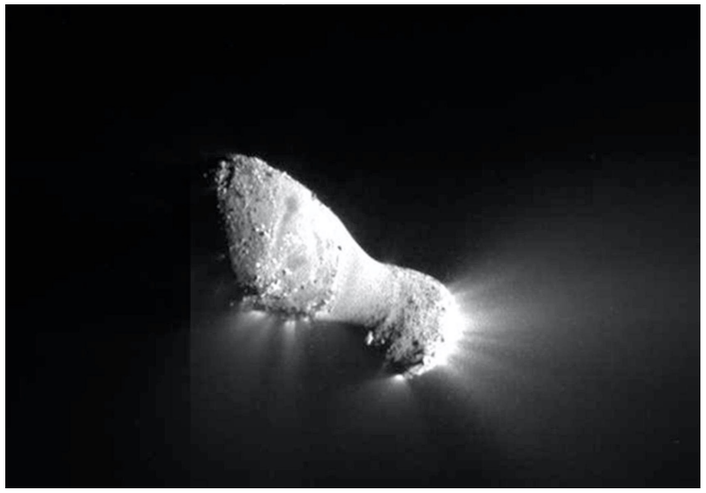
Another reason is that some scientists believe that some or all of the water on Earth may have come from comets. So we want to learn about how comets have struck the Earth. Perhaps comets may have brought life to Earth long ago.

NASA and other space agencies around the world like ESA (European Space Agency) and JAXA (Japanese Space Agency) are planning more missions to visit and land on comets.

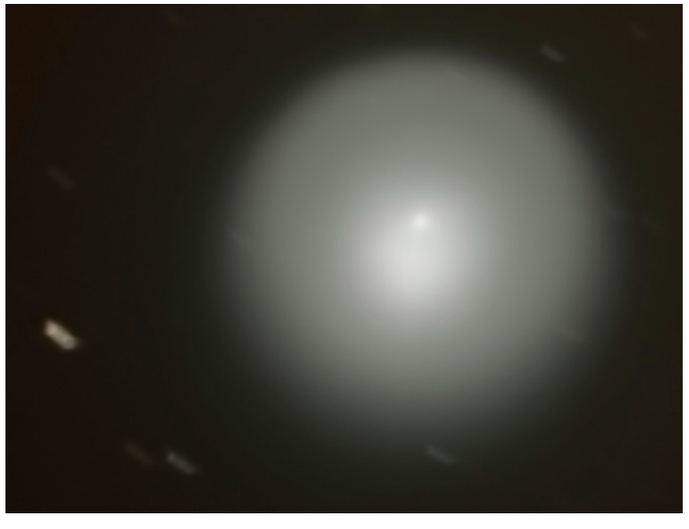
We still have much to learn about these icy visitors. Keep watching the skies.

(Tapestry at left depicts the appearance of Halley's comet in 1066 AD).

Comet Gallery



Comet Hartley photographed by the Deep Impact spacecraft in 2010.

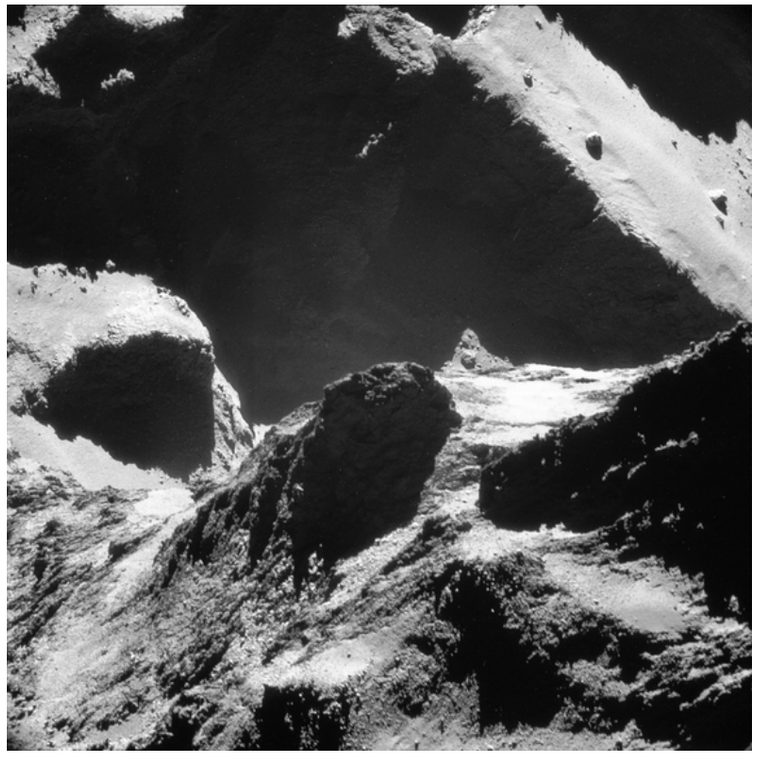


Comet Holmes looked like a flower in bloom. In 2007, its brightness increased by a factor of one-half million!

Comet Hale-Bopp, the first great comet of the internet age. It was visible for 18 months beginning in 1997.

Close up of surface of the Rosetta comet, (right) taken by the Rosetta spacecraft. After a 10 year journey, the spacecraft remained in close orbit (from 6 to 19 miles) around the comet for over two years. It reached Rosetta in 2014.

Comet McNaught over Australia in 2007.



Resources

Astronomy Picture of the Day

Many images of comets. Click the Archive link.

http://apod.nasa.gov/apod/astropix.html

Wikipedia

Use the search engine to look up individual comets (e.g., Comet ISON) or other information (e.g., Sungrazers)

http://en.wikipedia.org/wiki/Comet

NASA

NASA posts an enormous amount of on-line resources. Here's a link that's a good place to start:

http://www.nasa.gov/multimedia/videogallery/Video_Gallery_Archives.html

Magazines

Astronomy

website: http://www.astronomy.com

Sky and Telescope

website: http://www.skyandtelescope.com

Sky's Up (free on-line magazine)

website: https://explorescientificusa.com/pages/skys-up-electronic-magazine

Books

COMETS!: Visitors from Deep Space

by David J. Eicher and David H. Levy

Comet

by Carl Sagan

Comets, Meteors and Asteroids

by Seymour Simon

Comets, Stars, the Moon, & Mars

by Douglas Florian

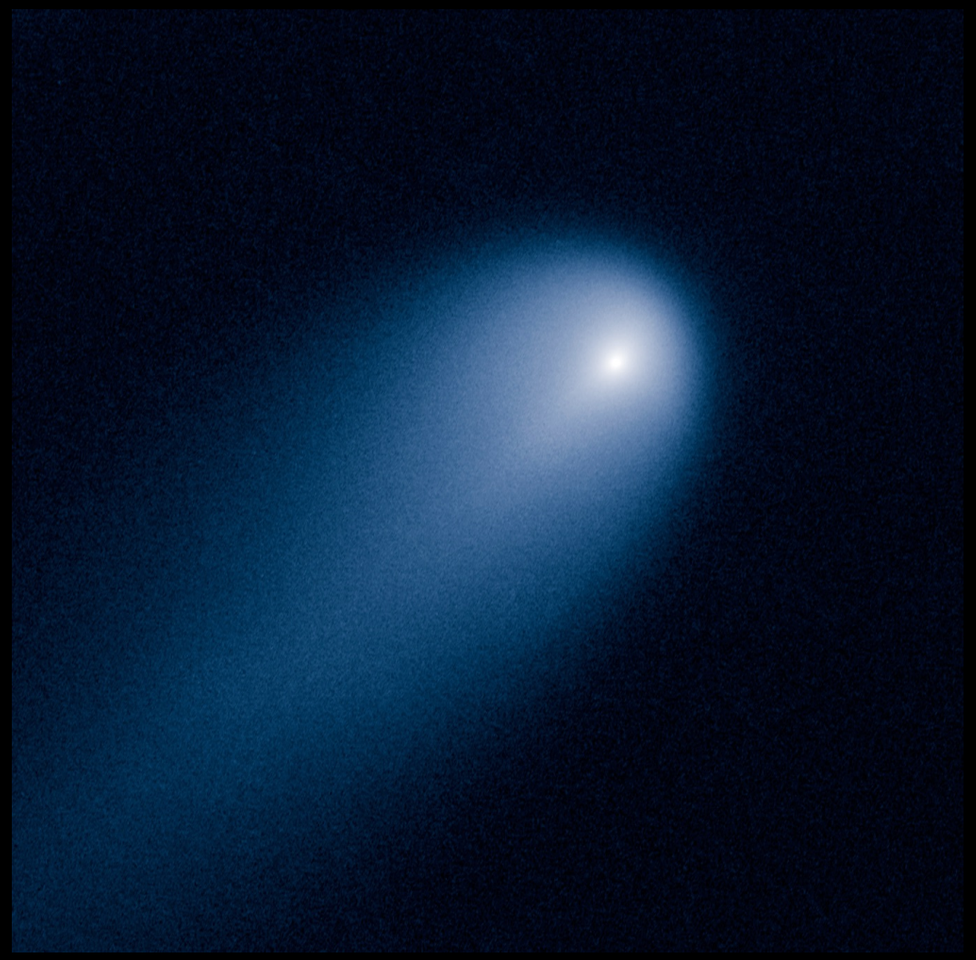
The Everything Kids' Astronomy Book

by Kathi Wagner Sheryl Racine

Visit your local library! Search on-line for your local astronomy club!

Information and photos used in this document courtesy of NASA, ESA and JAXA websites, Wikipedia, and from books mentioned on this page.

Special thanks to David Levy for his photo and suggestions.



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You might also like to check our Guide to the Solar System and Guide to Exoplanets, also available for free on our Teacher Resource page.