



## Predicting the Next Bright Comet

During the Deep Impact Mission, Comet Tempel 9P was just barely visible and even then, only from pristinely clear and dark skies. It certainly did not come anywhere close to approaching the eye-catching spectacle that Comet Hale-Bopp provided back in 1997.

### Handicapping our next bright comet

The interest in comets generated by Deep Impact likely will cause some to wonder if another similarly bright comet like a Hale-Bopp looms on the horizon in the foreseeable future.

The answer is “yes, there probably is.”

Unfortunately, there is no way to exactly predict in advance when another spectacularly bright comet will appear. As I write these words, there are no fewer than 16 comets that are currently under scrutiny by amateur and professional astronomers. But the average brightness of these 16 comets is just around 12th magnitude -- or roughly 250 times dimmer than the faintest star that can be seen without any optical aid. That's well out of the reach of most casual observers.

But every once in a while, a newly discovered comet will appear in our sky that is so spectacular that it captures the attention of a worldwide audience. Certainly, Hale-Bopp fell into that category. When it was at its brightest, in early April of 1997, this comet was readily visible even from light-polluted cities. It was later estimated that the number of Americans who witnessed Hale-Bopp surpassed those who watched the 1997 Super Bowl!

### The caste of comets

There are two varieties of comets.

“Common comets” are those that are only visible with optical aid or dimly with the unaided eye. The vast majority of the periodic comets -- whose orbits are well known and have been observed on more than one occasion -- fall into this category. These comets quietly come and go

and are known only to enthusiastic amateur astronomers who make a concerted effort to hunt them down with good binoculars or telescopes against the faint background stars. They are generally unimpressive, appearing as nothing more than faint fuzz balls, even in large telescopes.



*Comet NEAT, 2004 Courtesy: Wally Pacholka/www.astropics.com*

Then, there are the “Great Comets.”

If you somehow managed to miss out on seeing Hale-Bopp in 1997, or have only now just gotten started in the hobby of astronomy, then you've never seen a Great Comet. Such magnificent spectacles as these are set apart from all the other comets that are visible in a given year as being stupendously bright and/or fantastically structured, perhaps developing a tail that stretches a third of the way or more across the sky. Such a comet can rival the brightest stars and planets in brightness. And in very rare cases, a Great Comet might become so bright that it becomes briefly visible during the daytime either telescopically or even with the unaided eye!

Right now, somewhere out there in the depths of space, a Great Comet is approaching the Sun. Unfortunately, we can have no advance knowledge of when it will appear until it is discovered on the inbound leg of its solar journey. Most of the dim periodic comets travel in small elliptical orbits and regularly return to the Sun's vicinity at intervals of generally a dozen years or less. But Great Comets swing

out far beyond the orbit of Pluto and usually require many hundreds ... or even thousands of years between visits to the Sun.

### Anatomy of a comet

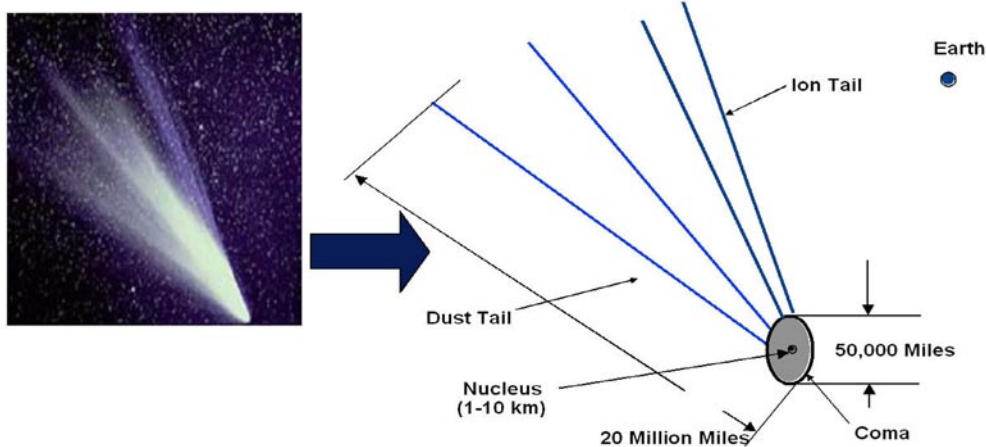
It has been said that a comet is the closest thing to nothing that anything can be, and still be something. Today we know them to be composed of frozen gases that are heated as they approach the Sun and are made to glow by the Sun's light. The only solid portion of a comet is a condensed, sometimes starlike point at the center of the comet's head or coma, known as the nucleus. It has been popularly referred to as a "dirty snowball," although its size would easily rival that of an iceberg. Most comet nuclei are probably no more than a few miles across. On the other hand, the nucleus of Comet Hale-Bopp was estimated to be far larger than most: perhaps on the order of 25 miles or more in diameter. As the frozen gases warm and expand, the solar wind -- a stream of subatomic particles rushing

formulas and models for comet brightnesses based on the observed behavior of many comets since the late 19th century, but comets, like people, have their individual quirks.

### Judging the future by the past

So when will another bright comet come our way? Perhaps we can try to answer that question using the law of averages. In the table below, I've listed all of the comets that appeared during the 20th century, which attained a brightness of at least second magnitude (as bright as Polaris, the North Star). Two chief sources of reference were "The Bright Comet Chronicles" compiled by the noted comet observer, John E. Bortle ([http://encke.jpl.nasa.gov/bright\\_comet.html](http://encke.jpl.nasa.gov/bright_comet.html)) and "Comets -- A Descriptive Catalog" by Gary W. Kronk (1984, Enslow Publishers, Inc., Hillside, NJ).

## Anatomy of a Comet



Anatomy of a Comet. Comet Tempel 1. Image Credit: NASA/JPL

out from the Sun -- blows the expanding material out from the coma, into the comet's beautiful tail. To observers of antiquity, the tail resembled a head of long hair, so they called comets "hairy stars."

The unpredictability of how bright a comet might become is no surprise to those who study these enigmatic objects. What we'll ultimately see depends on a number of variables -- the comet's orbit, the relative locations of the comet, Earth and Sun, and of course the size and composition of that icy clumping of solar system debris that forms the comet's nucleus. Astronomers have developed general

The first column gives the year of appearance and the name of the comet. The maximum number of names that can be assigned to a comet is three. In some cases, however, the comet is so bright when it is first seen, and initially reported by so many people that it becomes known by a generic name (For example, "Great January Comet"). If the listing is in bold type, then the object was generally considered to be a "Great" comet.

The second column provides the date when the comet appeared at its brightest, along with its magnitude. Usually, though, the comet was visible for some days -- or even weeks -- before or after the date given.

The third column provides some short remarks of interest about the comet. In two cases, for instance, a reference is made to "Kreutz sungrazer" indicating that the comet is a member of the Kreutz group of comets, characterized by orbits which take them to within just a few hundred thousand miles of the Sun. They are all believed to originate from the fragmentation of one very large comet several centuries ago, and are named for the astronomer Heinrich Kreutz, who first demonstrated that they were related.

**Bright Comets of the 20th Century**

Year/Name	Brightest Date/ Magnitude	Remarks
<b>1901 Viscara</b>	May 2/ -1.5	Yellowish; may have split in two
1907 Daniel	August 15/ +2.0	Photographed more than any comet before it
<b>1910 Great January Comet</b>	January 17/ -5.0	Visible in daylight; "Like Venus with a 10 1/4 tail."
<b>1910 Halley</b>	May 20/ 0.0	Tail stretched 120 1/4 across the sky!
1911 Beljawsky	October 15 / +1.0	Golden yellow; simultaneously visible with Comet Brooks.
1911 Brooks	October 28/ +2.0	Distinct bluish tinge. Visible with Beljawsky from Oct. 10-22.
<b>1927 Skjellerup-Maristany</b>	December 18/ -6.0	Visible in daylight; faded rapidly thereafter
1941 De Kock-Paraskevopoulos	January 30/ +2.0	Visible only from Southern Hemisphere
<b>1947 Great Southern Comet</b>	December 7/ 0.0	Orange with 25 1/4 tail; faded rapidly
<b>1948 Eclipse Comet</b>	November 1/ -2.0	Discovered next to the Sun during a total solar eclipse
<b>1957 Arend-Roland</b>	April 21/ 0.0	Displayed sunward pointing "anti-tail" April 20-May 3
1957 Mrkos	August 1/ +1.0	Visible both in evening and morning sky
1962 Seki-Lines	April 3/ -2.5	Extremely bright; faded quickly
<b>1965 Ikeya-Seki</b>	October 21/ >-15!	Brightest of 20th century; Kreutz sungrazer, visible in daylight. Split into 3 pieces.
<b>1970 Bennett</b>	March 19/ 0.0	"Stunning" Exhibited spiraling jets of gas in head
1970 White-Ortiz-Bolelli	May 18/ +1.0	Kreutz sungrazer; faded rapidly
1973 Kohoutek	December 28/ -3.0	Spectacular as seen from Skylab, but then faded very rapidly; big disappointment
<b>1976 West</b>	February 25/ -3.0	Glimpsed in daylight; split into 4 pieces; had 5 tails
1983 IRAS- Iraki- Alcock	May 12/ +1.6	Passed within 2.9 million miles of Earth.
<b>1996 Hyakutake</b>	March 27/ 0.0	Displayed "immense" tail 70 to perhaps 100 1/4 long
<b>1997 Hale-Bopp</b>	April 1/ -0.5	Visible to unaided eye from July 1996 thru October 1997, an all-time record

During the last century 21 bright comets appeared. That's an average of one about every 4.8 years.

Of course, as you can surmise from the table, they didn't appear precisely at 4.8-year intervals. In fact, during October 1911, it was possible to see two of these comets in the sky at the same time! On the other hand, there was as much as 14-year wait between the bright comets of 1927 and 1941.

And some of these comets were at their best chiefly for those living in the Southern Hemisphere, as was the case in 1941, 1947 and 1948; northern observers saw little or nothing. Because of this, there were no really fine and bright comets available from the Northern Hemisphere for more than four decades (1911 through 1957). Sometimes, unfortunately, that's the way it goes with comets.

## How frequent?

Statistically, we can state with some confidence that a comet as bright as second magnitude can be expected on an average of about once every 4 to 12 years.

For a comet at least as bright as zero magnitude (equal to the stars Capella or Vega), the wait might end up being about twice as long -- perhaps running 8 to as much as 24 years in length.

And for a comet that attains an extreme brilliance of at least minus 3 magnitude or brighter (approaching/exceeding Venus in brightness), it could be even longer; for such dazzlers, we might have to wait roughly 25 to 50 years between appearances.

The last bright naked-eye comet was Hale-Bopp, in 1997. The last truly dazzling comet, even visible briefly in broad daylight, was Comet West back in 1976 -- nearly 30 years ago. So, according to the law of averages, we could be about due for another similarly spectacular comet. Indeed, just such an interplanetary vagabond could burst onto the celestial stage literally at anytime.

## Wait till next year?

Certainly, we're overdue for a comet at least as bright as second magnitude, and interestingly, we might just have such a comet available to us next spring.

Back in December 1995, the periodic comet Schwassmann-Wachmann-3, which travels in a 5.3-year orbit around the Sun, unexpectedly fragmented into several pieces, expelling massive amounts of dust into space and making this comet appear much brighter than normal.

The largest fragment ("C") is predicted to skim just 6.8 million miles from the Earth on May 13, 2006. Sky watchers during that week will hopefully be able to see this comet race rapidly through



the constellations Cygnus, Pegasus and Pisces. According to Japanese comet expert, Seiichi Yoshida, Schwassmann-Wachmann-3 could possibly brighten up to become second magnitude as it passes Earth, which would make it the brightest comet to appear in our skies in nine years.

Comet West (C/1975 V1) photographed in early March 1976 by Peter Stättmayer of the Munich Public Observatory.



Notice, however, that I used the word "hopefully" since there is a major unknown: since Schwassmann-Wachmann-3 is apparently in the process of disintegrating, does this comet and its accompanying smaller fragments still exist? We'll just have to wait and see.

## Capricious comets

Sometimes, even comets that become very bright can still end up being disappointing. Take Comet Kohoutek, which during most of 1973 was widely touted as potentially "The Comet of the Century" as it approached the Sun. It reached its peak that year a few days after Christmas. For the crew of Skylab III, Kohoutek was described by astronaut Edward Gibson as "... a very elegant and impressive sight" as it rounded the Sun. Less than a week later, however, the comet had unexpectedly diminished to a fraction of its former brilliance, and many, who eagerly looked for it, especially from light-polluted cities, saw nothing.

In stark contrast, just a couple of years later, when Comet West swept past the Sun, it far exceeded all brightness forecasts. It rapidly developed into a glorious predawn spectacle, but ironically, was mostly ignored by the same news media that was "burned" by the poor performance of Kohoutek, and hence was mostly missed by the general public.

If there's a moral here, perhaps we should end this discussion on potentially bright comets with a quote from the legendary comet expert Fred L. Whipple (1906-2004): "If you must bet, bet on a horse, not a comet!"

## About the Author:

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