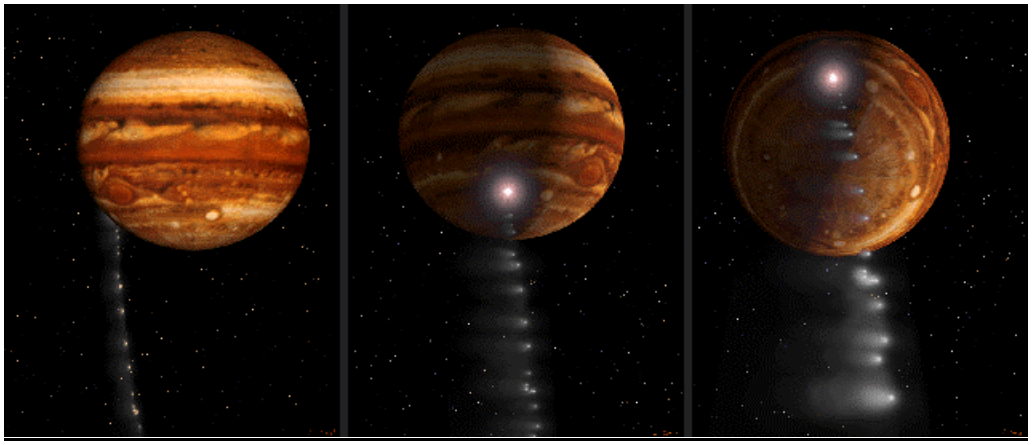
The Great Comet Crash of 1994

Information regarding the impact of comet Shoemaker-Levy 9 with the planet Jupiter



Graphic of comet Shoemaker Levy 9 impacting with Jupiter from three different angles.
Left: From Earth Center: From Voyager II Right From Jupiter's south pole
Image created by David A. Seal, Jet Propulsion Laboratory, California Institute of Technology, NASA
Image Courtesy of CompuServe.

Written by
Gary A. Donahue
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JUPITER

Jupiter is the 5th planet from the Sun orbiting at an average distance of 483 million miles from the sun. It is by far the largest planet in the solar system containing approximately 71% of the total planetary mass. More than two and a half times as much as all other planets combined! Jupiter is considered a gas giant because it is primarily comprised of gases and liquid gases such as hydrogen, helium, and ammonia. One of the possible reasons that Jupiter is a gas covered world is that the smaller planets did not have enough gravity during their creation to hold the lighter gases. In other words, when the earth was forming, it possibly had a large atmosphere like Jupiter, but since the earth's gravity was not enough to hold these light gases, they simply floated away into space. A Helium balloon on Jupiter would not rise like we expect it to on Earth!

Jupiter's atmosphere contains easily visible bands that cross the planets mammoth girth. These cloud belts are called belts and/or zones and are used by astronomers to identify regions on the planet.

One of Jupiter's most famous attributes is the Giant Red Spot. This spot is easily visible in even a modest telescope, and makes for quite a memorable experience the first time it is seen. This Red Spot, is actually a large storm which is three times the size of the Earth! This storm has been raging for hundreds of years and will undoubtedly rage for hundreds more.

Here is some basic information regarding Jupiter:

Mass:	1.9x10(27) kg Earth=5.98x10(24) kg)
Diameter at Equator:	142,800 km (Earth = 12,756 km)
Diameter of Red Spot:	40,000 km at its largest
Distance from Sun (Mean):	5.20 AU (1 AU = 93,000,000 mi.)
Escape Velocity:	60 km/sec (Earth = 11.2 km/sec)
Ave Temperature:	133K, -220F (Surface Temp)
Time one Rotation (1 Day):	.41 Days (9h 50m @ equator)
Time one Orbit (1 Year):	11.9 Earth years

Note: One Astronomical Unit (AU) is the distance of the Earth from the Sun (Approx. 93,000,000 mi.)

COMETS IN GENERAL

Most people have never seen a comet. Comets like Haley's Comet are famous and people have heard a lot about them, however during Haley's last visit, the media hype greatly outweighed the actual event (As in most cases with the media). This is not to say that they are not common. They are in fact quite common. The problem with viewing them is that they are usually quite small, quite dim, and further more, the average person just doesn't know they are there to see!

Comets are usually called dirty snowballs by astronomers when they describe them. A more accurate description would be a dirty iceberg. Comets are basically just huge chunks of ice with dust and dirt embedded in them. The huge chunks of ice hurtle through space until some large body captures it into its orbit. This is the case with most of the comets we see. They have been captured by the sun and therefore orbit around it.

Most comets are roughly the size of a large city, and as such are usually not more than a few miles in diameter. Picture a huge chunk of ice, the size of Manhattan slamming into your home town from above. That is what will be happening to Jupiter multiple times in rapid succession!

Comets are comprised of three main parts. The nucleus, which we just described, the head, and the tail. The head and the tail are really the same thing, and you can think of the tail being an extension of the head that flows out behind it like long beautiful hair. Lets see how this beautiful tail comes about, and why it is only seen when the comet gets near the sun.

Without going into great detail about the Sun's makeup, suffice to say that the sun emits a steady stream of what we call *ions.* Ions are simply particles that have a positive or negative charge. That is to say they have an extra electron or proton. This constant stream of charged particles radiating from the sun in all directions is called *the solar wind.* (The soar wind is what causes aurora borealis also known as the northern lights). The solar wind, when it leaves the Sun, is heated to 2 million degrees Kelvin, and travels at a speed of 600-1000 kps. By the time the solar wind reaches earth it has cooled to a mere 200,000 degrees Kelvin, but the gas is so thin, that is delivers no heat to us. The solar wind is only measurable out to about the orbit of Saturn.

When a comet gets near then sun, the solar wind affects the comet by basically boiling it. What's interesting about this however is that the comet is in the near vacuum of space, where it does not go from solid to liquid to gas. What happens instead, is the comet converts directly from a solid to a gas, eliminating one step. This process is called sublimation, and the comet is said to sublime.

When this gas emitted from the comet escapes the comet, it includes much of the impurities that were in it. Remember the term dirty iceberg? Well this is were the dirt comes in. As the solar wind sublimes the comet, the ionized gas from the sun blows the water vapor and dust away from the comet in a direction opposite from the sun. To help picture this imagine a woman with long hair standing in the wind. No matter which way she faces, her hair streams out away from the source of the wind. Similarly, the tail of a comet always points away from the sun, even when the comet retreats from the sun.

Another interesting point regarding comets is meteor showers. When the dirt from the comet is released, only the very light dust is carried away by the solar wind. The heavier particles remain behind in space and form a trail of debris. When the Earth travels through this trail of debris, the particles fall into our atmosphere, where the friction burns them up in a blast of fire. We see these small particle deaths as beautiful meteors! Since there is usually a cloud of particles behind a comet, these clouds cause a meteor shower.

Where do comets come from? We know what a comet is, now lets look at where they may come from. These chunks of ice may be left over material from the creation of the solar system. Dutch astronomer Jan Oort studied the distribution and orbits of comets and discovered that they spend about 90% of their time in the outer reaches of the solar system, about 50,000 AU from the sun. This is far beyond even Pluto (Approx. 39 AU). Oort surmised that there may be billions of comets floating out in this region of space surrounding our Solar System. We call this the Oort Cloud. As these bodies of ice float slowly through space, a outer planet may come close enough to effect their motion. The resulting change in the ice chunks movement causes it to plummet towards the Sun where it will start to sublime and grow it’s beautiful tail.

COMET SHOEMAKER-LEVY 9

When an astronomer discovers a new comet, the tradition is that the comet gets named after the discoverer. Thus the comet Shoemaker-Levy 9 was discovered by the team of Gene and Carolyn Shoemaker, and David H Levy. The number 9 in the name denotes that this is the ninth comet this team has discovered.

This comet is unusual in that it was captured by Jupiter more than a century ago. This was proven by the discovery team in March 1993 when they found the object for the first time. The comet got close enough to Jupiter to cause it to crumble in the planets gravitational field, breaking up into 21 major and thousands of minor pieces. Astronomers call this comet the string of pearls, as that's what it looks like through a high power telescope like the Hubble.

When the comet got close enough to Jupiter to break it up, that was only the first insult. Now the comet is back for more, only Jupiter won't be so forgiving this time. Jupiter will now grab the comet fragments and not let them go, causing them to crash into the planets atmosphere possibly releasing the equivalent energy of 10,000,000,000,000 (Ten trillion) tons of TNT. No one knows this for certain, however, as this is an unprecedented observing event. The exact sizes of the comet fragments is not even know. All we can do is watch, wait, and see.

Some of the theories of what may happen include new storms causing more red spot type disturbances in the Jovian (Jupiter's) atmosphere, Explosions so bright as to light up the moons of Jupiter, and some even say a disruption of the Jovian atmosphere so severe, that we may se visible waves in the surface.

The major drawback to this exciting event, is that the impacts will all occur on Jupiter's dark side. The good news is that Jupiter rotates completely in less than ten hours. This helps us out because the direction of rotation is towards us from the impact site, affording us a view of any disturbances mere minutes after the impact and lasting for many hours.

VIEWING THE CRASH

To view "The Great Comet Crash" you need some sort of telescope or binoculars. Jupiter is the second brightest object in the sky next to Venus, and excluding the Sun and the Moon. Look up to the South and find the brightest "star" in that region. For the week of July 17, Jupiter is just about due south in the sky, and heads to the west as it sets. The later in the night you look, the closer Jupiter will be to the horizon. On July 16th, Jupiter will be a mere 3 Degrees from the quarter moon, so just look for the bright "star" near the moon!

Jupiter appears as a small disk rather than a point of light in even modest binoculars! Though a larger telescope you can start to make out cloud bands and even the great red spot. If you are lucky enough to be able to afford a really big scope, a 6" or bigger refractor is the way to go here. A refractor telescope has much higher contrast than a similar reflector, and will give a much sharper view of the planets. With any scope or binoculars, you will easily see up to four bright objects near the planet. These are Jupiter's biggest moons, Io, Europa, Callisto, and Ganymede.

Keep in mind when looking for the comet crash that you may in fact not see anything. We just don't know what to expect. But what a thrill if there is something to see and you were there to see it! This is the lure and excitement of astronomy.

Here are the projected impact times for the comet fragment impacts:

Fragment	Impact Time
A	July 16, 3:55 p.m. EDT
B	**July 16, 11:07 p.m. EDT**
C	*July 17, 2:59 a.m. EDT*
D	*July 17, 7:18 a.m. EDT*
E	July 17, 11:30 a.m. EDT
F	**July 17, 8:40 p.m. EDT**
G	July 18, 3:52 a.m. EDT
H	July 18, 3:47 p.m. EDT
K	July 19, 6:39 a.m. EDT
L	July 19, 6:40 p.m. EDT
N	July 20, 6:21 a.m. EDT
P	July 20, 11:27 a.m. EDT
Q	July 20, 3:52 p.m. EDT
R	July 21, 1:59 a.m. EDT
S	July 21, 11:46 a.m. EDT
T	*July 21, 2:16 p.m. EDT*
U	**July 21, 8:25 p.m. EDT**
V	*July 22, 12:06 a.m. EDT*
W	July 22, 4:34 a.m. EDT

Note: *Italics*: Non-Independent orbits (Times may be inaccurate)
Bold: Best Pieces to be viewed.

Sources and References

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