

# COMETWATCH

Year of the Comet 2013

ARTICLE 6

## Keeping An Eye On COMET ISON

BY TAMMY PLOTNER

Tammy is a professional astronomy author, President Emeritus of Warren Rupp Observatory and retired Astronomical League Executive Secretary. She was the first woman astronomer to achieve Comet Hunter's Gold Status.

Early morning observers have been getting some first looks at Comet ISON. To date, it has breezed past Mars and is continuing towards the center of our solar system. It won't be long until November 28, when ISON makes its blazing pass just 730,000 miles above the Sun's surface. Will it stay intact and put on a show for the eager crowd on Earth? Now that the comet is a bit closer, astronomers have been able to study it with much greater accuracy and improve their predictions.

"We measured the rotational pole of the nucleus. The pole indicates that only one side of the comet is being heated by the Sun on its way in until approximately one week before it reaches its closest point to the Sun," said Planetary Science Institute research scientist Jian-Yang Li, who led a team that imaged the comet. "Since the surface on the dark side of the comet should still retain a large fraction of very volatile materials, the sudden exposure to the strong sunlight when it gets closer to the Sun than Mercury could trigger huge outbursts of material."

As we have learned before, comets don't put on much of a show until they reach a certain point in the solar system known as the "frost line"—the point in space at which water-ice (the dominant component of comets) begins to sublimate. Now that this point has been met, researchers are able to study the comet spectroscopically and give us even more information on how ISON might be constructed.

"We measured the color of the coma, and found that the outer part of the coma is slightly redder than the inner part," Li said. "This color change is unusual in comets, and seems to imply that the inner part contains some water ice grains, which sublimate as they move away from the nucleus." Discovered outside Jupiter's orbit just a little over a year ago, ISON displayed a lot of activity for a comet so distant from the Sun, leading researchers to believe this "Sungrazer" may put on a brilliant display as it becomes intensely heated. During its solar pass, it will release ice, silicates, metals, and a copious amount of dust. This facet of the comet's behavior will become a perfect observing laboratory for comet experts.

"As a first-time visitor to the inner solar system, Comet ISON provides astronomers with a rare opportunity to study a fresh comet preserved since the formation of the solar system," said Li. "The expected high brightness of the comet as it nears the Sun allows for many important measurements that are impossible for most other fresh comets."

However, there are divided opinions on whether or not Comet ISON will survive its trip around the Sun—or even brighten as expected. According to a few comet experts, the light curve displayed by ISON is similar to other comets that disintegrated, showing signs of unusual responses which are difficult to explain. "Comet ISON has presented a peculiar behavior," said astronomer Ignacio Ferrin, FCom researcher. "The light curve of the comet exhibited a slowdown event characterized by a constant brightness with no indication of a brightness increase tendency."



Comet ISON Image Credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA)

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This unconventional photometric signature leads the professor to assume that ISON is on the road to disintegration, but other camps disagree. In a numerical-simulation study performed by scientists at the Lowell Observatory and Southwest Research Institute (SwRI), the close pass to our Sun is unlikely to spell the end of the comet. According to their press release, "The comet's positioning makes it more favorable for observation from Earth after it passes the Sun rather than before, so most intensive observational campaigns are scheduled after perihelion. If the comet were not expected to survive, those efforts would have to shift to pre-perihelion studies."

Will Comet ISON survive the incredibly hot solar brush and the huge gravitational pull to which it will be subjected? The truth is we don't know a whole lot about ISON's exact size, density and composition: the very things that could determine its fate. Researchers involved in the study, funded by NASA's Lunar Science Institute, have done comparisons with previous Sun-grazing comet behavior and still remain enthusiastic about ISON's possibilities. Astronomers are reasonably convinced the comet is large enough to escape disintegration, and newer findings put a positive "spin" on the comet's fate. What makes them so confident? In this case, it's the movement of the comet itself. A comet spinning towards the Sun on approach would be subject to increased tidal forces, thus increasing its potential to disintegrate despite its density. Fortunately for ISON, it appears to have a retrograde spin, or no spin at all, which helps to cancel out some of the tidal forces closest to the Sun. Thanks to current constraints on ISON's nucleus properties, researchers have found that unless some violent jetting activity occurs causing rotational spin-up, the comet will likely survive its solar confrontation.

"A major part of our work was to test if the encounter with the Sun would provide enough of a spin increase to pull material off

the surface of the comet," said Dr. Kevin Walsh, a research scientist in SwRI's Planetary Science Directorate at Boulder, Colorado. "When the comet passes near the Sun, it feels the tidal forces pulling on it, and it also gets a slight spin increase due to this rapid flyby. This spin increase is in the prograde direction, so if the comet is already spinning prograde, then it's just that much closer to spinning fast enough to lose mass."

Dr. Matthew Knight, research scientist at Lowell Observatory in Flagstaff, Arizona, added, "Whether or not disruption occurs, the largest remnant must be big enough to survive subsequent mass loss due to evaporation for ISON to remain a viable comet well after perihelion."

So what does this mean to the backyard observer? It means that right now, while the Moon is absent from the morning sky, is a good time to start our observations of Comet ISON! It is a roughly 10th magnitude object and well within the capabilities of a 6" or larger telescope from a reasonably dark sky location. Where is it? You'll find the comet roaming around in the constellation of Leo. By October 26, Comet ISON will be located within three degrees (RA 10 45 33.6 Dec +09 45 40) of the "Leo Trio" (M95, M95 & M105), presenting an excellent opportunity for astrophotographers to image.

Need more? Let's skip ahead to early November when skies are favorable again. By November 7, Comet ISON passes less than a degree away from Beta Virginis (RA 11 47 04.8 - Dec +01 46 57) and well within the reach of small optics. On November 18, it will pass within a half a degree of Spica (RA 13 24 59.4 - Dec -10 48 47) and be located just slightly under five degrees south/southwest of planets Mercury and Saturn. Finally, ISON will become naked-eye object by November 23. Will it survive? We don't know for sure, but we'll all be keeping our eyes on ISON!

**COMET TALES**  
The most memorable comets of the 20th century.

- 1910 Halley's
- 1965 Ikeya-Seki
- 1976 West
- 1997 Hale-Bopp
- 1957 Arend-Roland
- 1970 Bennett
- 1996 Hyakutake

→ What comets tell us:

1. The distance scale of the solar system.
2. Comets and asteroids are interrelated.
3. Near-Earth object dangers exist.