Halley's comet object of UCSD study

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An authority on comets at the University of California, San Diego, says he may have an explanation for the puzzling fluctuations in brightness which have been observed in Halley's Comet as it streaks toward its rendezvous with the sun.

Asoka Mendis, a research physicist at UCSD's Center for Astrophysics and Space Sciences, believes that the unexpected phenomenon may be due to high speed solar wind streams which are electrically charging the comet's surface.

Mendis, graduate student Karen Flammer and UCSD research physicist B. V. Jackson will publish a paper on their findings in a fall issue of "Earth, Moon and Planets," an international journal of planetary studies.

The solar wind, said Mendis, is a stream of electrically charged, or ionized, particles which escapes from the sun and extends billions of miles into space.

A comet is believed to be nothing more than a "dirty snowball," a hunk of frozen gases, mainly water, and dust. Only when the comet approaches the sun does the ice evaporate and create the coma, the gaseous cloud that envelopes the comet's compact nucleus.

However, the fluctuating brightness of the celebrated Halley's Comet was observed while it was still frozen solid, before the gas began to vaporize. To Mendis, it was clear that something was disturbing the comet's dust-covered surface.

Since comets have no protective atmosphere at great distances from the sun, Mendis and his colleagues deduced that "ionized material flowing from the sun has direct access to the surface of the comet and electrically charges it." The mutual repulsion between the ionized surface and the ionized dust results in the electrically charged dust storms that can affect the comet's brightness.

Flammer, together with Mendis and Jackson, went on to show why the fluctuations in brightness were sporadic.

It was known that solar wind is not uniform, but gusty, like any other wind. They discovered it takes several days for solar wind blowing at a normal speed of approximately 250 miles per second to charge the comet's surface, while high-speed wind streams, which blow at a rate of about 400 miles per second, charge the nucleus very rapidly--within a few hours.

"That was very nice, because the enhancements in brightness also last only a few hours," Mendis said.

Only one key question remained to be answered. Does the sun actually emit its high-speed wind streams at the critical times, enabling them to reach the comet during its bright periods?

High-speed wind streams are emitted from regions of the sun known as coronal holes. Using coronal maps of the sun, Flammer and Jackson figured backwards, calculating where and when the stream would have had to originate in order to reach the comet during a specified time period.

"We found what we were looking for," Flammer said. "At the time the brightnesses occurred (on the comet), there were coronal holes back on the sun in exactly the position that would account for these periods of brightness."

"I find this very exciting," Mendis said. "We can really see the effects of these solar wind streams."

Mendis will be in a unique position to test his theory during the comet's passage. He will serve as co-investigator on the Soviet and European unmanned space probes to the comet, and thus will have the chance to acquire his data first-hand.

He plans to be in Moscow on March 9, when a Soviet spacecraft will intercept the comet 6,000 miles from its nucleus. Four days later, he plans to be in Darmstadt, Germany, to watch on monitors as a European craft flies within a mere 300 miles of the comet.

"The spacecraft will be close enough (for us) to actually see the nucleus of the comet," Mendis said. He hopes to gather data that will reveal more about the shape and content of the nucleus.

What makes a comet worth all the attention?

"Comet's are primordial. They give us clues to the origins of the solar system," Mendis said. "Planets can't tell us much because they've changed since they were formed. Comets are pristine. They have not been tampered with."

Comets can actually be used as probes in the deep reaches of space. "For example," Flammer said, "they're an indicator of what's going on in the solar wind."

Also, the study of comets has helped to demonstrate what Mendis calls "the crucial role played by electromagnetic forces in explaining cosmic phenomena.

"There has not been enough recognition of this by the astronomical community," he said.

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