Jupiter helps Halley's Comet give us more spectacular meteor displays

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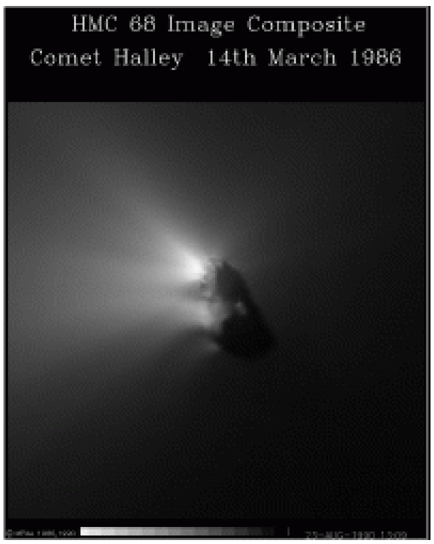

The nucleus of Halley's Comet, taken by the Halley Multicolour Camera on board ESA's Giotto spacecraft in 1986. Credit MPS Germany/H.U. Keller/ESA

(PhysOrg.com) -- The dramatic appearance of Halley's comet in the night sky has been observed and recorded by astronomers since 240 BC. Now a study shows that the orbital influences of Jupiter on the comet and the debris it leaves in its wake are responsible for periodic outbursts of activity in the Orionid meteor showers. The results will be presented by Aswin Sekhar at the National Astronomy Meeting in Manchester on Tuesday 27th March.

Halley's comet orbits the Sun every 75-76 years on average. As its nucleus approaches the Sun, it heats up and releases gas and dust that form the spectacular tail. This outgassing leaves a trail of debris around the orbit.

When the Earth crosses Halley's path, twice per orbit, dust particles (meteoroids) burn up in the Earth's atmosphere and we see meteor showers: the Orionids in October and the Eta Aquariids in May. Previous research has suggested that Orionid meteoroids have at times fallen into 'resonances' with Jupiter's orbit – a numerical relationship that influences orbital behaviour. Sekhar's new study suggests that Halley itself has been in resonances with Jupiter in the past, which in turn would increase the chances of populating resonant meteoroids in the stream. The particles ejected during those times experience a tendency to clump together due to periodic effects from Jupiter.

Image of 2007 Orionids, showing Orion constellation in the backdrop. Credit: S. Quirk

"This resonant behaviour of meteoroids means that Halley's debris is not uniformly distributed along its orbital path. When the Earth encounters one of these clumps, it experiences a much more spectacular meteor shower than usual," said Sekhar, of Armagh Observatory.

Sekhar has modelled Halley's orbital evolution over more than 12 000 years into the past and 15 000 years into the future. The model suggests that from 1404 BC to 690 BC, Halley was trapped in a 1:6 resonance with Jupiter (in which Halley completed one orbit for every six orbits of Jupiter around the Sun). Later, from 240 BC to 1700 AD, the comet's orbit had a 2:13 relationship with Jupiter's orbit. Debris deposited during these two periods can be directly attributed to heightened activity in the Orionid meteor showers in some years. Sekhar's work suggests that the unusual Orionid outburst observed in 1993 was due to 2:13 resonant meteoroids ejected from Halley around 240 BC. He predicts that the next similar display of meteors from this 2:13 resonance will be in 2070 AD.

"The real beauty of this area of science lies in the convergence of cometary physics and orbital dynamics. The close correlation between historical records from ancient civilisations and the predictions using modern science make it even more elegant," said Sekhar. He added, "There are enough unsolved problems pertaining to Halley and its meteor streams to keep us occupied till the next apparition of the comet in 2061!"

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