Space scientists find way to monitor elusive collisions in space

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(Phys.org) —Many collisions occur between asteroids and other objects in our solar system, but scientists are not always able to detect or track these impacts from Earth. The "rogue debris" created by such collisions can sometimes catch us by surprise.

UCLA space scientists have now devised a way to monitor these types of collisions in interplanetary space by using a new method to determine the mass of magnetic clouds that result from the impacts. Their findings, published online this month in the journal *Meteoritics and Planetary Science*, are the result of nearly 30 years of observations of collisions and could help scientists better understand where to look first to find new meteroid debris that could become dangerous.

"The passage by the Earth earlier this year of the small asteroid 2012 DA14 and the explosion the same week of an even smaller asteroid in the atmosphere above central Russia remind us that while space is mostly empty, the objects that are orbiting the sun do occasionally collide with other orbiting bodies, and the energy released in such collisions can be catastrophic to the bodies involved," said Christopher T. Russell, a professor in UCLA's Department of Earth and Space Sciences and a co-author of the research.

"We have found a way by which we can monitor such collisions in space by identifying the magnetic signature produced in these collisions," he said. "While the colliding objects may be only tens to hundreds of feet across, the resulting magnetic signature can be hundreds of thousands of

miles in width and be carried outward from the sun by the solar wind for millions of miles."

Hairong Lai, a graduate student in Russell's laboratory, devised the method for finding the mass of collision-produced magnetic clouds, which contain fine, electrically charged dust.

"We have used multiple spacecraft encounters with these magnetized clouds to determine their dimensions," said Lai, the lead author of the research. "Then we calculate the magnetic force applied to the dust, which balances the sun's gravitational force, allowing us to weigh the fine component of the debris created by the collision. These dust clouds weigh from about 10,000 to 1 million tons—very similar in mass to the asteroids the Earth recently encountered over Russia and over Australia."

The technique of monitoring the debris cloud of collisions magnetically was applied to material that co-orbits with the asteroid known as 2201 Oljato. This asteroid was first associated with collisions near Venus in the early 1980s; Oljato made successive passes by Venus in 1980, 1983 and 1986, when NASA's Pioneer Venus spacecraft was in orbit around the planet.

In 2006, the European Space Agency's Venus Express mission entered orbit and resumed monitoring the collisions. Now, some 30 years later, the collision rates have dropped dramatically in the sector in which impacts with material in Oljato's orbit could be detected, but the rates are unchanged elsewhere.

"The collisions have destroyed both the impactors and their targets in this longitude sector, demonstrating that meteor streams can be quite dynamic," said Hairong, who presented research last week at the third Planetary Defense Conference of the International Academy of Astronautics, in Flagstaff, Ariz. "They can be created by collisions and

also destroyed by collisions."

Asteroids whose positions are known by scientists are all potential producers of smaller meteroids that can change orbits more rapidly, making it difficult to keep track of them, Russell said. This new method, he said, makes such tracking much easier.

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