Protecting Earth from asteroid impact with a tethered diversion

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Our planet exists within the vicinity of thousands of Near-Earth Objects (NEOs), some of which—potentially hazardous asteroids (PHAs)—carry the risk of impacting Earth and causing major damage to infrastructure and loss of life. Methods to mitigate such a collision are highly desirable. A new paper published in *EPJ Special Topics*, authored by Flaviane Venditti, Planetary Radar Department, Arecibo Observatory, University

of Central Florida, suggests the use of a tether assisted system to prevent PHA impact.

The method suggested by Venditti and her colleagues involves using the tether—previously suggested for other uses, such as space/lunar elevators and tethered satellite systems—to connect the threatening PHA to another, smaller, asteroid, thus changing the center of mass of the two and hopefully raising the PHA to a safer orbit.

Each potential PHA impact mitigation method carries with it its own set of benefits and risks. A considerable risk associated with 'high-impact' mitigation techniques, such as the detonation of explosives at the surface of the PHA, is fragmentation. This makes methods which gradually alter the orbit of a PHA, and thus prevent the break up of such an object, look like a less risky prospect. The tether system carries with it little risk of causing fragmentation and smaller pieces of the PHA falling to earth, something which could itself cause widespread damage.

Using the asteroid Bennu as a test subject, the team used computer simulations to calculate the dynamics of such a tether system for a variety of different initial conditions, concluding that it would be feasible for use as a planetary defense system. The team also suggest that the system could be of use in both the study and potential mining of NEOs and other asteroids.

One of the likely drawbacks of such a method is the fact that it could require a longer lead time than many high impact methods which quickly deliver kinetic energy to a PHA to knock it out of orbit. Thus, the continued cataloging of such objects is needed if such a method is ever to be viable.

More information: Flaviane C. F. Venditti et al, Dynamics of tethered asteroid systems to support planetary defense, *The European Physical*

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