Chinese propose method for deflecting asteroid Apophis

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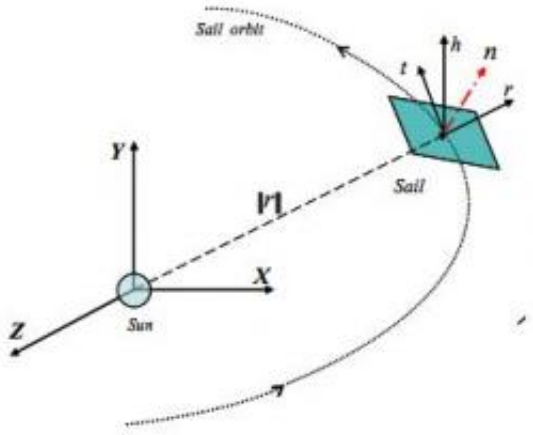

Orientation of the sail cone and clock angles. Image: arXiv:1108.3183v1 [astro-ph.IM]

(PhysOrg.com) -- Chinese scientist Shengping Gong and associates at Tsinghua University in Beijin have proposed an alternative method of deflecting the asteroid Apophis to ensure that it does not strike the earth. They believe that rather than just blowing it up ala the European Space Agency's Don Quijote project, a better approach would be to use a solar sail, as described in their paper on the preprint server *arXiv*, to slowly nudge the asteroid off its trajectory just enough to keep it from bothering us here on Earth.

Apophis is approximately 880 feet in diameter and weighs an estimated

46 million tons. If it were to strike the earth, it would most certainly cause damage for thousands of miles around the epicenter, but wouldn't spell doom for the planet as a whole.

First discovered in 2004 by Roy Tucker, David Tholen and Fabrizio Bernardi at the Kitt Peak National Observatory, Apophis was after initial study, thought to have a possibility of hitting the earth; then after further study, it appeared that an impact was unlikely. Then later it was noted that when Apophis makes a close approach in 2029, there is a possibility that it could pass through what is known as a "keyhole" (a small gravitational zone near enough a planet to alter the course of an object) near our planet that could cause the next pass, in 2036, to hit us. Because of the dizzying number of variables involved in such a scenario, however, there appears to be differing views as to the probability of that actually happening. There also seems to be some disagreement as to the origin of its name; some suggest that Apophis comes from the ancient Egyptian deity, enemy of the uncreator Ra, Apep. Others suggest it's simply a nod to the character Apophis on the television show Stargate SG-1.

In either case, Gong et al, propose using a space vehicle propelled by a solar sail that would move in a retrograde (opposite) orbit relative to Apophis fast enough so that when the collision occurred (like two cars running head on into each other on a freeway) the vessel would strike the asteroid moving at a relative speed of some 55 miles per second, enough they say, to push the offending asteroid off its current path.

The problem is, as the Chinese group readily admit, is in being precise enough in aiming the vessel. With all the variables at play (including the years it would have to travel) it would seem an almost impossible task. Nonetheless, the team seems undaunted, suggesting that such a vehicle could be built and launched in the time frame available.

More information: Utilization of H-reversal Trajectory of Solar Sail for Asteroid Deflection, Shengping Gong, Junfeng Li, Xiangyuan Zeng, arXiv:1108.3183v1 [astro-ph.IM] arxiv.org/abs/1108.3183

Abstract

Near Earth Asteroids have a possibility of impacting with the Earth and always have a thread on the Earth. This paper proposes a way of changing the trajectory of the asteroid to avoid the impaction. Solar sail evolving in a H-reversal trajectory is utilized for asteroid deflection. Firstly, the dynamics of solar sail and the characteristics of the H-reversal trajectory are analyzed. Then, the attitude of the solar sail is optimized to guide the sail to impact with the object asteroid along a H-reversal trajectory. The impact velocity depends on two important parameters: the minimum solar distance along the trajectory and lightness number. A larger lightness number and a smaller solar distance lead to a higher impact velocity. Finally, the deflection capability of a solar sail impacting with the asteroid along the H-reversal is discussed. The results show that a 10 kg solar sail with a lead-time of one year can move Apophis out of a 600-m keyhole area in 2029 to eliminate the possibility of its resonant return in 2036.

Via ArXiv blog