Scientist says nuclear weapons may be best bet for saving Earth from asteroids

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Illustration of an asteroid impact. Credit: NASA.

(PhysOrg.com) -- If scientists detect an asteroid headed directly for Earth - one that was large enough to pose a serious threat to life on our planet - would it be wise to bring out nuclear weapons to prevent an impact? Over the past several years, scientists have expressed conflicting opinions on the use of nuclear weapons as a defense against asteroids. Part of the problem is that it's very difficult to know what asteroids are made of, and how they will respond to different types of nuclear explosives. But at the semiannual meeting of the American Astronomical Society held last month, physicist David Dearborn of the Lawrence Livermore National Laboratory argued that nuclear weapons could be the best strategy for avoiding an asteroid impact - especially for large asteroids and little warning time.

According to Dearborn, the sheer power of a nuclear explosion may make it the most practical and cost-effective option for deflecting or fragmenting asteroids, compared with alternatives such as chemical fuel or laser beams. For one thing, a nuclear explosive would be cheaper to launch into space due to its large amount of energy per unit mass. In contrast, a non-nuclear blast might require several launches for an equivalent amount of power.

Also, the nuclear option could be implemented in a short amount of time; a detonation just 15 days before impact could fragment or divert the course of a 270-meter asteroid (the size of Apophis, which has a 1 in 250,000 chance of striking Earth in 2036) to avoid a collision. On the other hand, a laser such as one at the National Ignition Facility at Lawrence Livermore would take 6,000 years to sufficiently divert the course of the same size asteroid.

As far as the radiation released from a nuclear explosion in space, Dearborn said that you wouldn't even be able to measure the difference on Earth. The explosion would occur millions of miles out in space, where there is already an intense radiation environment.

Dearborn has developed models and run simulations to determine the effects of a nuclear detonation occurring both near and on the surface of an asteroid. His simulations show that the best strategy depends on both the size of the asteroid as well as how much time we have before impact. If a collision with a smaller asteroid is a few decades away, detonating a nuclear explosive near the asteroid could nudge it off course while still keeping it intact. But if a collision with a large asteroid is just weeks away, a direct detonation on the asteroid would be required, although some smaller fragments could still strike Earth.

While the size of the asteroid and its distance from Earth can be estimated quite well, the biggest unknown variable in any defense

strategy is the asteroid composition. Asteroids are a diverse class of objects, and some materials fragment more easily than others. Dearborn advised that, if we had 30 years to avoid a collision, the best thing to do would be to launch a characterization mission to the asteroid. Even if Dearborn and other scientists would like to test a nuclear explosive in space, test ban treaties as well as political and public opposition make a test unlikely.

Fortunately, scientists aren't expecting an asteroid impact any time soon. NASA has identified and categorized about 90% of near-Earth objects that are large enough (more than 10 km [6.2 miles] in size) to cause mass extinction on Earth, and none of these pose a significant risk of collision in the near future - even Apophis is considered to have very low risk. Smaller objects, on the other hand, are more difficult to track down. The smallest known asteroid, 1991 BA, measures 6 meters (20 feet) across.

"In a few more years, we'll be able to say that there's nothing out there to cause a global catastrophe," said David Morrison, director of the NASA Lunar Science Institute and senior scientist for Astrobiology at NASA's Ames Research Center. "But, there'll be a million that will be big enough to wipe out an entire city. It'll take a long time, if ever, to find them and figure out their orbits. The bottom line is, we could be hit by one of those small ones at any time, with no warning at all. Right now, I can say almost nothing about the probability of one of those small objects hitting us, because we simply haven't found all of them."

More information: via: Space.com and Scientific American

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