astronomy

Chicken Little Was Right: The Sky *Is* Falling

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On a clear, dark night away from the city lights you might be lucky enough to glimpse a grain of sand colliding with the Earth at 15 miles per second. To our primitive ancestors, these "shooting stars" must have been the most interesting objects in the night sky -- brief flashes of light to break the monotony of the fixed stars.

Of more practical concern to the ancients, however, was the passing of the seasons. The science of astronomy became a respected means of timing the planting of crops and hunting migrating herds. The elite practitioners of this science probably dismissed shooting stars as unimportant and this attitude persisted until just a few decades ago.

From time to time, the peace and tranquillity was broken by violent events -- collisions with large chunks of rocks from space. Most of these collisions were destructive. Some may have pushed the human species close to extinction, but sometimes they brought a blessing, such as mysterious metals that could be pounded into weapons and tools.

Violent cosmic collisions are inevitable events on a time scale of thousands of years, but not during a human lifetime. Without firsthand accounts of impacts there was no reason to suspect that a hazard existed. This changed in the 1960s. Robotic spacecraft sent back pictures of thousands of impact craters on most of the airless moons of our solar system, as well as on the planets Mercury, Venus and Mars, where craters are not obscured by plant growth or oceans. Hundreds of impact craters have since been discovered on the surface of the Earth. The scientific study of asteroids and comets became respectable.

Our neighbors in space

The Earth and the other planets orbit the sun in near-circular paths and stay well away from one another in their respective "running lanes." Many asteroids and comets also orbit the sun in near circular orbits well away from the Earth. However, some of these objects are occasionally sent into elongated orbits and they venture into our region of the solar system. If their running lanes cross Earth's they become a threat.

Comet Halley circles the sun every 76 years and spends most of its time out beyond the orbit of Saturn. But every year the Earth crosses Halley's running lane and collides with tiny bits of the comet. The results are the Eta Aquarid and Orionid meteor showers. If Halley's orbit stays the same then eventually, perhaps after hundreds of millions of years, the Earth and Comet Halley will collide at more than 100,000 mph. A "dirty snowball" ten miles across can make quite a mess at this speed -- just ask the dinosaurs.

Comets, however, are not the greatest hazard to the Earth. We share our running lane around the sun with millions of asteroids. Most of these chunks of rock are less than 50 yards across and, if they collide with the Earth, will burn up in the upper atmosphere.

Asteroids between 50 and 200 yards across will typically explode several miles up in an "airburst" -- much like a hydrogen bomb. One such event devastated 800 square miles of Siberian forest in 1908. Larger asteroids will reach the Earth's surface and, if they hit land, will form an impact crater. Asteroids and comets with orbits that come close to the Earth are known as Near Earth Objects. (Rather a dull name!)

The asteroid Ida is about 32 miles long. Above, Comet Halley.
IMAGES: NSSDC/NASA

The odds of an impact

Based on estimates of the number of objects out there, astronomers expect an asteroid 1 kilometer (1,100 yards) in diameter to collide with the Earth about once every 100,000 years, on average. Such an impact is thought to be at the threshold of global catastrophe. 100 million people could die, mainly from starvation due to global crop failures. It is also likely that the fragile global economy would collapse. Impacts by small asteroids occur more frequently but do much less damage. An asteroid 50 yards in diameter could easily devastate a city. With asteroids more than 200 yards in diameter there is an additional risk to coastal cities from tsunami (tidal waves) caused by ocean impacts.

Looking out for NEOs

The chances of an impact by a large asteroid or comet are very small, but the consequences for our civilization are very grave. After watching the movies "Deep Impact" or "Armageddon" you might have come away thinking that dozens of telescopes and hundreds of scientists are busy searching for "a big one with our name on it." But only a handful of professional searches are underway, and none of these cover the skies in the Southern Hemisphere.

As it now stands, if a large asteroid is on a collision course with the Earth then the odds are 7 to 1 against that astronomers will detect it beforehand. In 1992 the "Spaceguard Survey" was proposed as an international search for large asteroids. The worldwide, ten-year budget was less than Americans spent watching the "Armageddon," but Spaceguard is not yet underway. We seem to be facing the dilemma of the ancient skywatchers -- those in power dismiss the issue as unimportant.

Saving the future

If an object is discovered to be on a collision course, it is preferable that we have several decades warning (provided that the full Spaceguard Survey gets underway soon). Given enough advance notice, we have the capability to send spacecraft to rendezvous with an asteroid or comet and nudge it into a safe orbit. Current technology is certainly closer to the task than that available to NASA when President Kennedy announced the moon landing goal in 1961.

On this theme of historic events another U.S. politician, Congressman George Brown Jr, who died recently, had this to say at the opening of a 1993 Congressional hearing into the asteroid threat: "If some day in the

future we discover well in advance that an asteroid that is big enough to cause a mass extinction is going to hit the Earth, and then we alter the course of that asteroid so that it does not hit us, it will be one of the most important accomplishments in all of human history."

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