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ASTEROID NEAR MISSES

Ken Tapping, 18th April, 2017

On 19 April an asteroid will pass close by. At its closest it will be less than five times the distance of the Moon. The asteroid, named 2014 JO25, is about 600 metres across. It will scoot across our northern sky in a few hours, moving at 33.5 km/s. It will be closest to us at 08:24 EDT, 05:24 PDT. However, to see it you'll need a telescope.

If it were made of basalt, like the Moon, it would have a mass of some 300 million tonnes. This is the biggest object in about 13 years to pass this close. A rough estimate suggests on average we could be hit by something that size every million years or so. Such an event would certainly be a disaster, but it would not be likely to endanger our existence. Smaller objects pass within that distance every week and on average one of them could hit us every 80 years.

The Moon is peppered with craters due to impacts. The Earth has been hit at least as often, but weathering and the continuous recycling of the Earth's surface due to subduction and the emergence of new land surface have erased most of them. However, there are still conspicuous craters on the Earth's surface. These cosmic collisions are not unusual; they are just part of the ongoing process of planet building.

The Earth itself was formed through impacts, as dust and progressively larger lumps of material smashed together some 4.6 billion years ago. Some of that material contained ice, which brought us the water to make our oceans. Fortunately most of that primordial "building material" has been used, but there are still pieces of it orbiting the Sun. A piece of this material some 12km across smashed down in the Sudbury area in Ontario about 1.8 billion years ago. The geological disturbance brought a wealth of minerals closer to the surface and concentrated them.

One of the most well-known and dramatic impacts occurred about 64 million years ago. After 180 million years of stability, environmental change and habitat loss was putting many species, such as the dinosaurs and ammonites into a steady decline. Then a 10km diameter asteroid hit the Earth, leading to such a rapid environmental change that 75% of species became extinct, including the dinosaurs and ammonites. In 1908 something entered the atmosphere and exploded over Tunguska, Siberia. Over 2000 square kilometres were flattened, and glasses rattled on shelves in Paris, France. A tiny difference in arrival time could have put that impact in Europe.

Today, our species dominates the Earth. Feeding ourselves and providing for our other needs involves heavily exploiting our planet's resources. That means we are becoming increasingly vulnerable to any sort of environmental disaster. Can we do anything to reduce the impact risk? This involves two problems: detecting impact threats and then somehow mitigating them.

Small, dark objects on a dark background are hard to see. We usually detect them just in time to watch them sail past. Current radar methods are no better. In principle we can use our observations to assess the possibilities of future collisions. This is rendered difficult by all our data being obtained over a tiny part of the orbit, and the perturbation of that orbit by little tugs by the other planets. This means that unless we can give threatening asteroids a really big "shove", changing the orbit by more than the uncertainties in our calculations, we might turn a miss into a hit. Unfortunately, as yet we don't know how to give objects with masses of millions of tonnes a big shove. Blowing them up, as in the movies, would just turn one threat into many. However, the detection and mitigation of cosmic impact threats are getting a lot of attention.

Mars lies low in the Southwest after sunset. Jupiter rises soon after dark and Saturn in the early hours. The Moon will reach Last Quarter on the 19th.

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