# Hit by objects from space

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# HIT BY OBJECTS FROM SPACE

**Ken Tapping, 25th July, 2017**

As you read this, the Earth is moving deeper and deeper into a stream of dust and grit that is orbiting the Sun at tens of thousands of kilometres an hour. When these particles collide with our atmosphere at this high speed, they burn up, leaving short-lived glowing streaks. These are often called "shooting stars", although they obviously are not stars. "Meteors" is a more correct term. We will reach the centre of the stream on 12 August. Every evening until then the number of meteors we see per hour will increase. After the 12th the meteors' hourly rate will gradually decrease, until we leave the stream on the 24th. This stream of dust and grit is called the "Perseids" because the meteors arrive from the direction of the constellation of Perseus. Typically the Earth picks up about 100 tonnes of meteor material a day, evidence of the continuing process of "planet building". Most of it is dust and grit. However, the things hitting us can be larger- much larger.

On the morning of 30 June, 1908, something crashed into the Earth's atmosphere over Siberia, moving at between 10 and 20 times the speed of sound. The frictional heating and aerodynamic stresses finally made the object explode. Two thousand square kilometres of forest were flattened, and glasses rattled on shelves in Paris. The energy released was equivalent to exploding a 10-20 megaton nuclear bomb. That is, the same as putting between 10 and 20 million tonnes of TNT in a pile and then setting it off. Luckily that area in Siberia was largely uninhabited. A very small difference in arrival time could have placed the explosion over Paris, causing an unimaginable disaster. A small difference in the other direction could have made Western Canada the target. At the time there was little that anyone could have done to prevent or even predict the event. Unfortunately, even with today's enormously improved astronomical technology, there is still little we can do to detect these tiny, faint, dark objects as they move against a black sky. Even today, with instruments committed to searching for threatening objects, we usually only see them as they fly past us. We failed to see the 20-metre object that ploughed into the Earth's atmosphere at about 70,000 km/h over Chelyabinsk, Russia on 15 February, 2015. It exploded about 30km above the ground, releasing the energy equivalent of roughly half a megaton of TNT. The shock wave caused extensive damage on the ground, together with a number of injuries: fortunately no deaths.

Something big hit the Earth about 65 million years ago, and the Canadian Shield shows the remains of impacts occurring over the last one or two billion years. Plate tectonics and the weather have erased most of the other craters. However, we can see the result of billions of years of impacts by getting out the telescope and looking at the Moon. With no plate tectonics or weather, craters last until new craters obliterate them. It is best to observe when the Moon is not Full. Then we can examine the boundary between the lit and unlit parts of the Moon, where surface features cast long shadows and are easier to see.

Perseids might be tiny but can still do a lot of damage to a spacecraft, satellite or astronaut. A 2mm Perseid particle has the same kinetic energy as a baseball moving at 500 kilometres an hour. However, thanks to our atmosphere burning them up, we can safely observe the Perseids from our backyards, or here at DRAO. Every year we hold a "Perseid Star Party". We'll be doing it this year too, on Saturday, 12 August, with the usual programme of meteor watching, observing other astronomical objects and a series of talks. Try to find the time to get outside to spot a few Perseids.

Jupiter is low in the southwest after sunset, and Saturn low in the south, in the constellation of Ophiuchus, the unofficial sign of the zodiac. Venus, shining brilliantly, rises before dawn. The Moon will reach First Quarter on 30 July.

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