

What sort of size and or weight distribution do meteorites have? (I appreciate the difficulties of accurate numbers at the smaller end of the distribution)

Meteorites vary between objects around about 1 cm in size up to about couple of metres. The largest single meteorite is Hoba, a meteorite found in Namibia, and weighs approximately 60 tonnes. Meteorites, however, often split into pieces during flight through the atmosphere and fall as a shower of individual stones. The Chelyabinsk meteorite that fell in 2013 fell as several thousand individual stones. If we take the mass of a meteorite before it enters the atmosphere then there is no real upper limit. Objects larger than 30-200 m tend to impact the ground at cosmic velocity, since they are not slowed significantly by the atmosphere, and generate impact craters. Some fragments of these impactors can be preserved as meteorites, although most of the mass is vaporised on impact. Around 30 tonnes of the Canyon Diablo meteorite, for example, surround the 1.2 km Barringer Crater in Arizona and this object probably weighed 20,000 tonnes.

Does the earth get hit with meteorites uniformly during the year or is there a lot of variation from one time to another?

Meteorites fall pretty uniformly over the course of a year. Cosmic dust is much more irregular since large amounts of dust enter the atmosphere during meteor showers when the Earth crosses the dusty trails of comets. These trails, and the meteor showers they produce, occur at about the same date each year. Comet debris is very fragile and most enter the atmosphere at too high velocity for meteorites or dust to survive atmospheric entry to reach the ground.

I appreciate that there is no air resistance in space, but what forces cause asteroids and meteorites to move so fast? Is it mainly gravity? What sort of variation in velocities do you get with asteroids and meteors?

Gravity is the most important force controlling the motion of larger objects such as asteroids and meteorites. The actual velocity of a meteorite at the top of the atmosphere is mostly generated by the Earth's gravity and most exceed 11 km/s, Earth escape velocity. Objects on more elongate orbits encounter the Earth at higher velocities. Comets, which can have very elongate orbits and can orbit the Sun in the opposite sense to the planets, can have very high velocities of up to 70 km/s. Some comets and comet dust can move so fast that it escapes our Solar System entirely. The highest velocities of >70 km/s for interstellar dust particles that originate outside our Solar System. These are accelerated by falling in towards the Sun.

How many “near misses” does the earth get from really big fast moving objects every 10 years or so? Given that the earth is hurtling through space at about 20 km/second orbiting the sun, is there much chance of the earth being directly hit with something really big in the next 30 years or so?

Several thousand meteorites fall every year and most go unnoticed. Very occasionally an event such as the Chelyabinsk meteorite occurs that penetrates the atmosphere low enough to cause damage on the ground. Larger objects are not slowed by the atmosphere and impact the ground to make impact craters. These crater forming events occur every few thousand years and there are several that were probably witnessed by humans in antiquity. The events that are of the most concern are the impact of objects larger than about 1 km since these have global effects and one of these occurs roughly every million years. Impacts are, however, like buses, their timetable is not regular. A concerted effort has been made by astronomers worldwide to track all asteroids larger than 1 km

and has succeeded in finding virtually all Earth-crossing objects. There are none that pose an immediate hazard.