Falling Meteors Might Wipe Out Cities

Astronomy

By James Stokley

Flashes of light in summer skies. "A shooting star", we say. A meteor, dead fragment of a star, has burned itself out in our atmosphere.

But someday there may be the roar of a million express trains. A massive chunk of sky dust may project itself out of space and land in the middle of a great city. Thousands would perish, the effects of aerial bombs will fade into insignificance. More terriffic than war would be the effect of a single large meteorite that smashed into civilization.

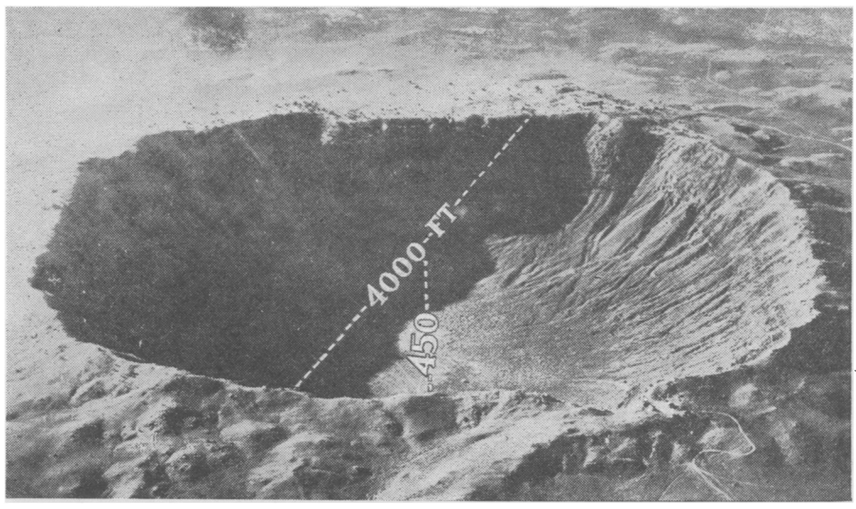
Such possibilities lie in the minds of enthusiastic amateur astronomers, who have taken as their pleasure the increase of knowledge about meteors. Without telescopes, with bare eyes and keen senses, they chart the meteoric flashes of the night.

More interesting to them than possible world disaster is the hint that meteors contain of the existence of other solar systems, other groups of planets surrounding the stars of the sky.

And how do they come to such conclusions?

A few months ago there was discovered in South Africa a huge meteorite. So far, its size can only be estimated, as it is still almost entirely buried in the earth. However, Dr. W. J. Luyten, stationed at the Harvard College Observatory's South African branch, has estimated it at fifty to seventy tons.

In the American Museum of Natural History, in New York City, is the famous Ahnighito meteorite, which weighs thirty-six and a half tons, until the discovery in South Africa the largest known in the world.

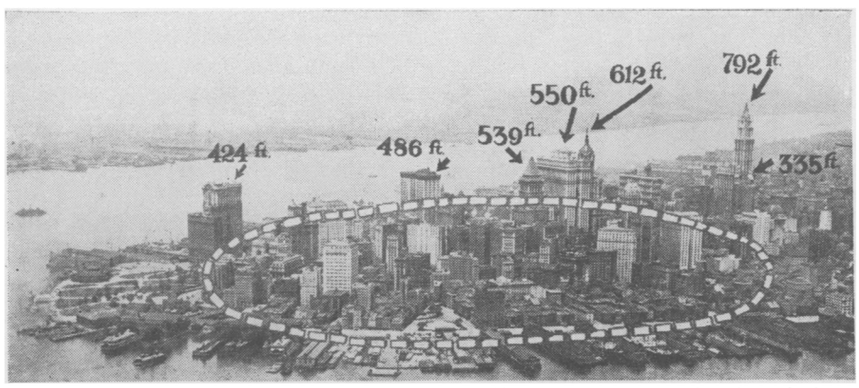


THE GREAT METEOR CRATER IN ARIZONA, hollowed out of the desert about 2000 years ago when a compact cluster of meteors, the head of a small comet, hit the earth. It is seen here from an airplane

But even these huge celestial projectiles are doubtless small compared with two other famous falls. On June 30, 1908, at seven o'clock in the morning, in the Yenisei Province of Siberia, a swarm of meteorites—really the nucleus of a small comet—was observed to fall. Though a sparsely settled region, hundreds of people saw it, still more heard the thunderous roar that accompanied its passage through space. A seismograph at Irkutsk, used for recording earthquakes, revealed the vibrations caused when the meteors hit ground.

Over an area of a couple of miles in diameter the ground was pitted with hundreds of holes like shell craters. The size of the individual meteors is problematical, as the place where they landed is swampy, and it was not until twenty years later that a Russian scientific expedition made a thorough examination of the spot. It is planned to dig for the meteors during the coming year. On account of the softness of the ground in summer, digging must be done in the winter, when it is frozen hard, so it will not be an easy undertaking. But probably it will be found that many of the individual bodies are far larger than any known at present.

The effect of this cometary collision was not confined to the immediate bombardment that produced the shell holes. As the swarm entered the earth's atmosphere, it piled up a huge mass of air in front of it. So fast was it moving that the air had no time to sweep aside, and was highly compressed and heated. When the meteorites hit the ground, the air then rushed to all sides. Barographs at Irkutsk and Kirensk recorded this air wave as it reached these cities. For miles on every side it swept through the forests, levelling trees before it, and actually scorched them as with a blow torch. A herd of domesticated reindeer nearby was annihilated. A small shack containing some tools and cooking utensils was destroyed, and many of the metal objects melted. Over a still larger area, perhaps forty miles in diameter, trees that were not felled showed signs of the forest fire. The trees that were knocked over all (*Turn to next page*)



WHAT WOULD HAPPEN TO NEW YORK if hit by a meteor the size of the one causing the meteor crater in Arizona may be imagined from this view. The ellipse covers the same area as the actual crater shown in the upper photograph

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pointed away from the center of the fall. Fortunately, no human beings were in the affected area, as far as we know.

But even the Siberian meteorites are probably smaller than the famous one that caused the meteor crater in Arizona. Nobody knows when this fell —perhaps it was thousands of years ago, but it has left evidence of its fall in the form of a great crater, four-fifths of a mile across the top and about four hundred and fifty feet deep below the surrounding plains. Piled up around the outside is a rim of quartz and rock fragments so that it has an inside height of about five hundred and seventy feet. A company has been formed, and is now at work trying to locate the mass of iron of the meteor itself. It may prove that this was a swarm of meteors, but it was much more compact than the 1908 one in Siberia.

Thus, on a number of occasions, huge masses of stone or iron have landed on the earth from outer space.

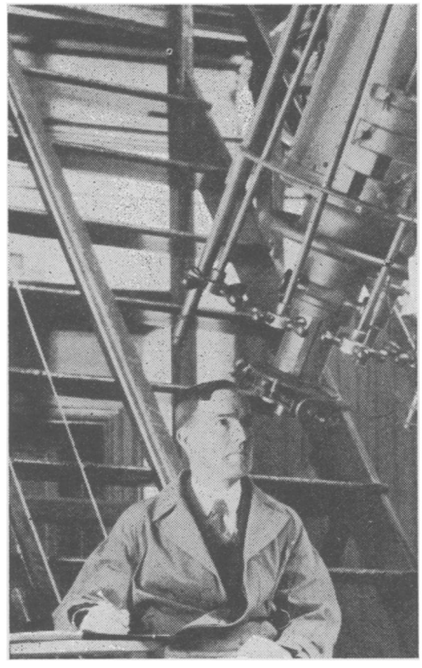
What would have happened if one of them, instead of landing in an inaccessible region of South Africa, the heart of Siberia, or the deserts of Arizona, had happened to hit a populous city?

Suppose that in 1908 the meteor had reached the earth five hours later. Then the earth would have turned enough so that the heavenly projectile would have hit northern Sweden or Norway, with terrible loss of life. Had it been some ten hours later, and a little farther south, it might easily have hit New York and caused a catastrophe, the like of which the earth has never known.

Weather we can predict, and eventually may control; even earthquakes may in time be predicted, but the great meteorite is one potential danger that is ever with us, no matter how rare it may be. A great meteorite may fall on your house while you are reading this; on the other hand, one may never fall anywhere near your location for millions of years.

So the scientist does not worry about what damage a meteorite might do. Instead, he devotes his time to studying them, finding what they are made of, and learning their significance in the scheme of the universe.

At the University of Pennsylvania is one of the meteor authorities of the world. A man in his forties, and looking even younger, with a southern drawl that reminds one of the fact that he is a native Virginian, Prof.



PROF. CHARLES P. OLIVIER, Director of the Flower Observatory of the University of Pennsylvania, and president of the American Meteor Society

Charles P. Olivier, is the author of the standard work in English on the subject of meteors. Recently he spoke before the Franklin Institute in his adopted city, and told of his latest conclusions on his favorite subject. Perhaps the most striking of these is that the meteors which continually bombard the earth are messengers to earth from other stellar systems carrying the assurance that our sun, and its attendant planets, are not alone among such systems in the heavens.

When a meteor hits the earth's atmosphere it is moving so rapidly that the friction with the earth's atmosphere causes it to be heated and to glow. The effect is the familiar shooting star. Sometimes it is so bright that it is called a fire-ball, but a fire-ball is simply a very bright shooting star. In the vast majority of cases, a shooting star, or fire-ball, is completely burned by the atmospheric friction. The iron, or other elements in it is converted to oxides and dissipated into the air. Occasionally one is so large that it reaches the surface of the earth and is called a meteorite.

Coming as unexpectedly as they do, exact determination of the way a meteor is moving is seldom possible. But under Prof. Olivier's direction there has been formed a very active group of amateur scientists, known as the American Meteor Society. Its members watch particularly for shooting stars, and report them to him. From a large number of such observations of the paths they take it is possible to calculate just the way they are moving and their speed. Such work as this has shown that most of the meteors are moving in the curve known as a hyperbola.

If you cut a slice out of a cone, you get one of three kinds of curves, all of which are grouped together under the general name of "conic sections". If the cut is perpendicular to the axis it is a circle, which is, to the mathematician, a special form of an ellipse. If the cut is parallel to the opposite side the curve is a parabola, while if it is away from the opposite side and away from the apex the result is a hyperbola.

All of the heavenly bodies that belong to or enter the solar system move in one of these three curves. The planets themselves move in ellipses, so do most of the known comets. A few comets move in parabolas, but it turns out that most of the meteors are moving in hyperbolas. This latter fact is more than a curious bit of information, for only bodies originating in our own solar system can move in ellipses. Motion in a hyperbola proves that the body entered the solar system from outer space, and so we have evidence that the meteors are really visitors from some other part of the universe. When they are, they enter the atmosphere with a speed of at least 26 miles a second. But not all meteors are such visitors. Many of them, especially those of the great showers, such as the ones that occur in November and August, do move in elliptical paths. This shows that they are natives of the solar system and have been born in a way similar to the birth of the earth itself.

Probably this birth occurred when a passing star approached close to the primeval sun. By its gravitational attraction, the passing star pulled out large masses of material from which were formed the eight planets, the thousand or so little planets, or asteroids, and many of the comets and meteors.

Aside from their motion, the strange meteors, and those of our own family, are the same. And this brings us to the conclusion, as Prof. Olivier expressed it, "That planets also, not unlike our own, (*Turn to next page*)

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circulate about other stars, as well as these meteorites, which alone, with an occasional comet, can escape from their original home and bring this message to us."

So here is evidence, for the first time in astronomical history, that our solar system is not alone in creation. In a few months the star Capella will appear in the constellation of Auriga, the charioteer, in the northeastern sky. This is a yellow star, the spectroscope shows it to be similar in composition to the sun. Perhaps surrounding Capella is a retinue of planets. Presumably on one of these planets conditions would be similar to what they are on the planets of our own system.

It is conceivable that these planets might also be inhabited, but the astronomer who now has the first meager evidence that there are other solar systems hesitates to express an opinion.

The study of meteors has an interesting history, beginning with veneration, passing through a stage of skeptical disbelief and finally reaching the present scientific attitude towards them.

The earliest records are of meteors falling in China in the years 687 and 644 B. C. During the following six centuries these annals record 14 others. Various classical writers mention them and that they were supposed to be sacred.

In more recent years they fell in other parts of the world and also were regarded as holy objects. However, the oldest known meteorite whose fall is actually recorded, dates from 1492, so that year has something else to be famous for. Also, in ancient or medieval times, there were at least several dozen descriptions of meteor showers when the entire sky seemed to be covered with shooting stars, like ribs of a gigantic umbrella.

"At present," said Prof. Olivier, "one thousand meteorites are represented in various museums."

The meteorites are of two kinds. One consists largely of nickel and iron like the Ahnighito. As in the case of Peary's discovery of this one, many of these were found long after they fell and were identified by their composition. The other meteorites consist of stone. As they look like common rocks, and soon disintegrate in our damp atmosphere, they can only be identified when they are actually seen to drop from the sky.

"Our very term 'meteorology' proves that for a long time they were considered to be merely atmospheric phenomena, like the aurora, lightning, etc.," said Prof. Olivier. "As for meteorites, scientists during the eighteenth century ridiculed the fact that a stone could fall from the sky, and branded as ignorant dupes or deliberate liars every one who reported such occurrences.

"Their argument was simplicity itself: Stones could not fall from the sky, therefore they did not. Who could ask for more? But, despite the dictum of the greatest scientists (and this included every branch of natural science as well as astronomers) stones kept on falling. In 1803 Biot was finally delegated by the French Academy to investigate the fall of l'Aigle in France, and his report carried conviction to the most opinionated of his colleagues. From that day on, meteorites took their place as respectable, if minor, members of the solar system."

It was on November 13, 1833, that one of the greatest of meteor showers appeared. At this time all the meteors seemed to radiate from a point in the constellation of Leo, the lion. Every year, in November, meteors appear that seem to emerge from the same point, known as the radiant. The meteors of this group, because of this, are known as the Leonids.

It was the 1833 shower, said Prof. Olivier, that forced the attention of the scientific world to the fact that meteors constituted a neglected field of astronomy waiting for investigation. One result was the finding that previous showers had occurred at approximately thirty-three-year intervals, and so it was predicted that another large shower would happen on November 13 or 14, 1866. The shower occurred as predicted.

About 1899, it was expected again, and while nothing as brilliant as in 1833 or 1866 appeared, there were unusually large numbers of meteors, even for November, in 1900 and 1901. Perhaps 1933 will bring another unusually great return of them.

Several of these showers were shown to be connected with comets. The Perseid meteors, which seem to radiate from a point in the constellation of Perseus, every August, were shown to follow the same orbit as Tuttle's Comet. The November Leonid meteors were shown to follow exactly the same path as Tempel's Comet. In November, 1872, another shower appeared which came from the direction of the orbit of Biela's comet. These came again in 1885, in 1892, and as a small one in 1899. Since then they have not been seen with the exception of a single observation last year made through a telescope by an amateur at Swarthmore, Pa.

This shows some connection between meteors and comets. According to Prof. Olivier, the nucleus of a comet is not a solid mass but a multitude of small solid pieces of varying size. On each visit to the sun, a comet loses part of its material. it is probably from the pieces constituting the nucleus that comets form meteors. The small compact mass of meteors that dug out the meteor crater in Arizona must have really been the nucleus of a small comet. Just when this happened we cannot tell, although Prof. Olivier believes it to have been certainly within the last five thousand years, and probably within the last two thousand.

Probably the Siberian meteorite of 1908 was also connected with a comet. It was in the following year that the Pons-Winnecke Comet came close to the sun. In 1916 a number of meteors were seen in May and June, which Prof. Olivier identified as following the same orbit as this comet and so proving that it was already disintegrating.

So perhaps comets are being formed in distant solar systems. Perhaps along with them the tiny planets and the meteorites are also being created. And perhaps occasionally one of these meteorites and, once in a while, a comet, parts company from its system and travels across the gap to our own part of the universe. To us they signify their origin.

"Just as the brickbats, pieces of stone, scraps of metal and wood chips that lie around a newly completed house would give us some idea of how the building was erected, so meteors and meteorites can give us similar information as to the evolution of the solar system," said Prof. Olivier "and by the same token they give us information as to the other solar systems."

Science News-Letter, July 20, 1929

To avoid disputes as to authorship of their paintings, artists in France are having their pictures registered, and filing data sufficient to establish identity of the pictures.