ASTRONOMY

Perseid Meteors Flash Now

Any clear night just now will give good seeing for "shooting stars," the light flashes produced high in the atmosphere by flying "gravel banks."

By ANN EWING

➤ ANY CLEAR night now or for the next week or so will be good for seeing "shooting stars."

Billions of tiny particles of cosmic dust daily bombard the earth's atmosphere, and many of them flash into our view as brief streaks of light, or shooting stars, then disappear.

The number of these meteor trails visible —about one per minute—is greater during the Perseid shower in August than at any other time of the year. However, some random, or sporadic meteors can be seen any clear night.

Astronomers have found that, although the reason is not yet clear, about twice as many meteors can be seen during the last six months of the year as during the January-June period.

One of the best and most reliable of the shooting star shows is the Perseid shower, which reaches its height Aug. 12. An unusually large number of meteors can be seen, however, any time this week or next. The Perseid shower is so named because the meteors appear to originate in the constellation of Perseus.

Actually they are moving in parallel paths, one of the many separate swarms of flying "gravel banks" that swing around the sun in definite orbits. Due to perspective, they seem to radiate from the constellation, just as parallel railway tracks seem to run closer together in the distance.

Best Seen in Early Morning

The best time for viewing a meteor's brief flame is in the early morning hours, because at that time we are on the forward side of the earth. The earth thus sweeps through the meteors at a high speed. In the evening, we are on the back side of the earth, and see only the fast meteors, the ones that overtake the earth and enter its atmosphere at a comparatively low speed.

Sometimes the moon is so bright that its light makes it difficult to spot meteor showers. This year, however, the moon will be new on Aug. 9, and it sets early in the evening, so it will not interfere with the spectacular display of shooting stars.

A meteor gives no warning of its dash into our atmosphere—where it came from and what it is made of must be discovered in the very brief time it can be spied on, either visually or by radar. Therefore, amateurs, working according to pre-arranged programs, are of great help to professional astronomers, whose study of meteors is furnishing new information on the temperature and density of our atmospheric shell 35 to 60 miles out in space. In effect, these bullets from space furnish the government with high-velocity projectiles for atmospheric studies that do not cost a penny.

Even without a program, an amateur can, with luck, get a picture of a meteor. Place the camera in a fixed position and aim it low in the northeast at Perseus, just below Cassiopeia.

Use a fast, blue-sensitive film. With an f4 focal ratio, a two-hour exposure is needed; with f2.5, one hour; and with f1, ten minutes should be sufficient. Try off and on all night to get a photograph.

The stars, instead of appearing as bright dots, will show up as curved trails on the film. If you do snap a meteor, it will show up as a long straight line, probably cutting across the paths taken by the stars.

The Super-Schmidt cameras, operated by Harvard College Observatory near Los Cruces, N. Mex., are fast, wide-eyed cameras designed especially for meteor hunting. Yet when there is no special meteor shower, such as the Perseids, they catch only one flash every half hour. This, however, is still a great improvement over the average prior to operation of the Super-Schmidt; then it was only about one for every 100 hours of observing time.

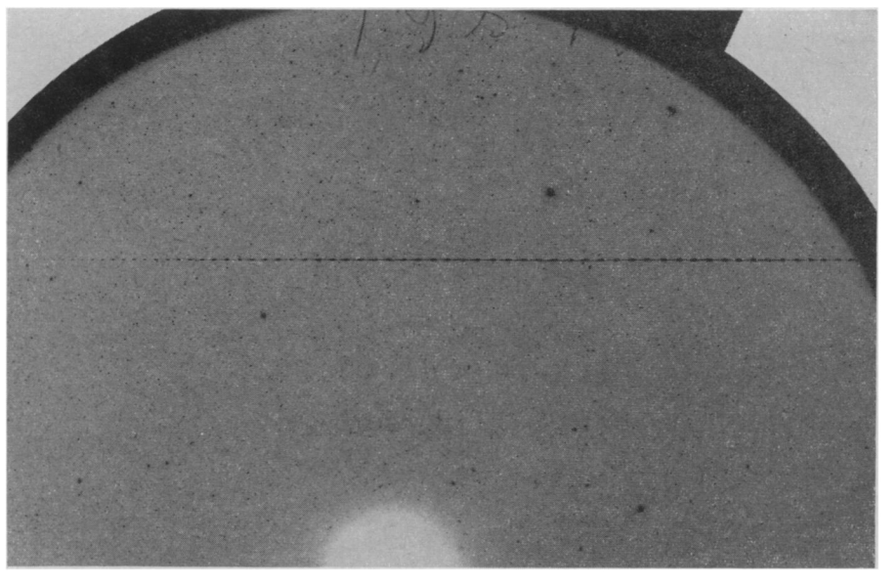
Studies with these new cameras confirm what the first systematic photographic survey of meteors, started over 20 years ago, and the more recent radar studies have shown—that most of the meteor showers belong to the solar system.

The speeds at which the meteors flash into our atmsophere are the clues to their origin, and these speeds can be accurately plotted when the meteor's photographic path is regularly broken by a whirling shutter.

Speed Can Be Calculated

The periodic breaks made many times a second in photographs of a meteor's trail reveal the slowing down of the meteor due to the resistance of the upper air, from which its speed before hitting our atmosphere can be calculated.

None of the speeds for the shower-connected meteors are fast enough to indicate that they came from beyond our own solar system. In fact, many astronomers today believe that probably all meteors, both shower-connected and sporadic, originate in the solar system.



SPEED-REVEALING TRAIL—The deceleration of a meteor due to resistance of the upper air is revealed by the periodic breaks made in a meteor trail by a rotating shutter on the camera. This meteor trail, flashing from left to right, was photographed with the Baker Super-Schmidt by Samuel Whidden at Soledad, N. Mex., for the Harvard Meteor Project, directed by Dr. Fred L. Whipple for the Office of Naval Research and the Air Force. The shutter breaks are 60 times a second.

All known meteor showers are related to comets. Tuttle's comet, last seen in 1862, is the parent of the millions of particles of cosmic dust that the earth meets in August. They broke from the comet some 40,000 years ago, Drs. Fred L. Whipple and Salah El-Din Hamid of Harvard College Observatory have computed.

Most astronomers believe that at first meteor particles are close to or part of the parent comet. The cosmic dust then gradually strays behind or ahead of the comet, but keeps pretty close to the same path. Over a long period of time the particles become evenly distributed around the orbit, as is the case with the Perseids.

Thousand Year-Old Showers

Past records show that the Leonid shower has been seen in October or November for over 1,000 years, and the Lyrids have been spotted in April for over 2,500 years. The associated comets, 1866-I and 1861-II, were not, however, observed until the nineteenth century.

Especially bright meteors, those emitting sufficient light to cast shadows, are called fireballs. The few meteors that enter our atmosphere and penetrate to the ground are known as meteorites. Meteorites that have been spotted and picked up immediately after falling have not yet been identified with a meteor shower, and probably are from sporadic meteors.

As the tiny meteor particle rushes into the earth's atmosphere, it collides with air molecules. The impact is very violent because of the particle's great speed, and the atoms on the surface of the pin-head-sized particle are vaporized and spread out. These atoms, in turn, collide violently with other air molecules, mostly not in the direct path of the meteor itself.

These collisions break off electrons from the air molecules and the meteor atoms. They also make the meteor atoms luminous. Thus the meteor creates around itself a luminous cloud of its own atoms. It is this cloud we see as the shooting star. The meteor's atomic cloud is continually blown away and is being constantly renewed, until the original material is entirely used up, or, if the entering material is sufficient, until it falls to the ground as a meteorite.

Radar Spots Meteor's Trail

As the meteor with its atomic cloud moves on, it leaves behind a long trail of ions and electrons. The trail, originally less than an inch in diameter, may be rapidly disturbed by the high winds of the upper atmosphere, much like the trails left by jets are blown about lower in the atmosphere.

These ionization trails, though not visible, can be spotted by radar beams, since for a brief time they reflect radio waves back to their source just as a plane or ship does, providing the radio waves meet the trail at right angles.

Radio waves spot these trails regardless of weather, and regardless of whether it is day or night. The narrow radio beams are much more sensitive than the eye and they can detect meteors much fainter than the eye can see. They have thus opened up a whole new field of meteor study, and led to the discovery of some daytime-only meteor showers that had previously gone undetected.

The spectroscope can spread out the meteor's light into a band that reveals what kinds of atoms or molecules are emitting its light. Since the meteor's passage is both brief and unexpected, these spectrograms are hard to get.

Dr. P. M. Millman of Ottawa, however, has succeeded in catching them. These spectrograms show that meteoric light is emitted by metallic atoms, especially atoms of iron, calcium, magnesium, manganese, chromium, aluminum, nickel and sodium.

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AERONAUTICS

First Delta-Wing Trainer Makes Its Initial Flight

See Front Cover

➤ THE WORLD'S first delta-wing trainer has made its initial flight, the British government has revealed. The plane is a dual control version of the delta-wing research craft, and is designed to familiarize pilots with this type of aircraft.

It is expected that the Avro 707C trainer, shown on the cover of this week's SCIENCE NEWS LETTER, will make its first appearance at the Society of British Aircraft Constructors' display later this year. The trainer is powered by a Rolls Royce "Derwent" turbojet engine.

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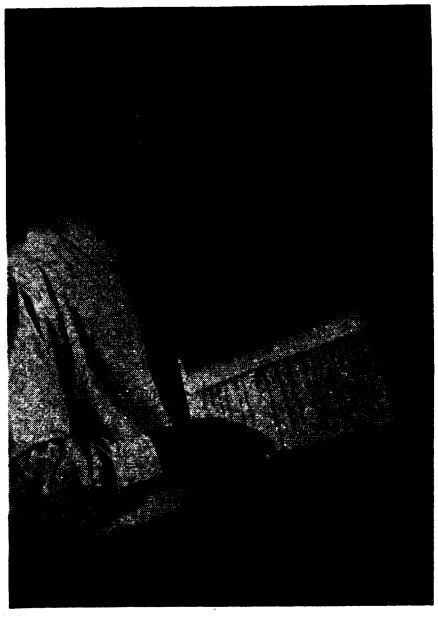
MATHEMATICS

Suggest Einstein Solution

➤ THE BASIS of the universe, including both matter and gravitation, is electromagnetism, Prof. Vaclav Hlavaty of Indiana University believes.

He has found mathematical proof that, if Einstein's new unified field theory is valid, an electromagnetic field is required for a universe which contains matter, and hence, gravitation.

Einstein's unified field theory attempts to explain the workings of the universe in one set of laws. He proposed certain formulas to link all known physical phenomena, but did not attempt to solve his equations.



PROF. VACLAV HLAVATY— Shown on the blackboard is a portion of the equations used by Prof. Hlavaty to obtain solutions to formulas of Einstein's unified field theory.

Prof. Hlavaty believes that it will now be possible to devise experiments to test the validity of Einstein's field theory. His solution, he says, reveals the route by which the conflict on what law or laws govern the universe can be resolved.

Because of its great success in predicting atomic behavior, most physicists today favor the quantum theory. This pictures the universe as made of discrete bundles, or quanta, of energy, the size of each such packet being proportional to the frequency of the radiation. Energy can thus vary only in multiples of this elementary quantum.

Because these quanta are so tiny, they can be dealt with only on the basis of large groups at one time. Such use of the statistics of chance in dealing with nature prompted Einstein's remark, "I cannot believe that God plays dice with the cosmos!"

The unified field theory pictures the universe as continuous and well-ordered, with equations of a single theory giving a complete description of gravitational, electrical and nuclear forces.

Prof. Hlavaty's solution of Einstein's theory shows that gravity is just another facet of electromagnetism; that it is electromagnetism that gives rise to matter and thus to gravity. He makes use of spinors, a mathematical tool also used in quantum mechanics, in arriving at his solution. Therefore, Prof. Hlavaty believes, the spinor theory will be the first arch of a possible bridge between the unified field and quantum concepts.

Prof. Hlavaty, a refugee from Communist Czechoslovakia, is an expert in the field of multi-dimensional geometry. He is a member of the Indiana University's Graduate Institute of Applied Mathematics.

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