fuel selenological disputes for months to come.

Mountains rising from the flat floor of the crater—probably the group on the left in the Lick photo—are 1,000 feet high with slopes up to 30 degrees.

A ledge NASA identifies as bedrock is visible in the central part of the mountain chain on the floor of the crater. The 3,000-foot mountain on the left horizon is the Gay-Lussac Promontory in the Carpathian Mountains.

Cliffs on the rim of the crater are 1,000 feet high and undergoing continual downslope movement of material.

From the horizon to the base of the cover photograph is a distance of about 150 miles. The distance from east to west across the part of Copernicus shown is about 17 miles.

### Close-up

The close-up picture at left shows the floor of Copernicus in detail. The triangular shaped flat area in the foreground on the left margin is a fault trough filled with geologically young volcanic rock.

From the horizon to Fauth at the base of this photo is about 180 miles.

Copernicus, 60 miles across and two miles deep, dominates the upper left quadrant of the moon seen from earth.

The rim of the crater is surrounded by angular blocks, up to 150 feet across. The Lunar plain appears to roll from Fauth to Copernicus, pitted with what may be either small impact craters or "dimple" craters, puffed from within. The absence of debris around them seems to support the latter interpretation.

There is apparently little doubt that Copernicus was formed by the impact of a gigantic meteor. The angular blocks of rubble around the rim were probably thrown out of the crater by the impact.

Dr. O'Keefe, a fierce defender of a "still-living" moon, believes he sees evidence of it in the cover photograph.

The fact that the hummocks are smooth and free of impact pits indicates to him that they are like the convex, dome-like structures on earth, pushed up by eruptions of viscous matter. "The regions beyond are pitted," he notes, "but the slopes of the peaks are not."

He postulates the origin of the peaks as oozing eruption of volcanic material through fissures in Copernicus' floor. Since there are no erosive forces on the moon, each erupted "plug" stays in place over its fissure; subsequent eruptions must then find new weak points. Hence, the array of pit-free peaks in close proximity to each other.

(See Lunar Photography, p. 503).

ASTRONOMY

# To Catch a Falling Star

You don't have to be an astronomer to photograph a meteor shower. But you do have to be something of an insomniac.

The year's second best regular display of shooting stars—the Geminids —is due Dec. 13. And while it won't rival last month's Leonid shower, photographers awake at about 2 o'clock on the moonless morning may get a shot at a star-streaked sky.

The following tips, drawn up by the American Museum of Natural History, may give an amateur photographer some good results.

You need a camera that can be set for an unlimited time exposure. A special cable release and a "bulb" setting might work. The camera should also be "fast," having a lens opening, or aperture, of f/6.3, or f/4.5 or even more. If you have any doubts as to the suitability of your camera, consult your camera dealer.

You also need sensitive film—the fastest film you can get for your camera. Finally, you need a sturdy tripod or other very stable support on which to place the camera during an extended time exposure.

Point the camera straight up with the focus set for infinity, and the lens opened to its widest. Taking care not to jiggle the camera, note the time on your watch, then open the shutter and leave it open. Then monitor visually the region the camera sees, counting the meteors you think passed through its field of vision. After you have counted a few, say five, close the shutter and again note the time.

Record these times, not just the length of the exposure, because the actual opening and closing times give your picture scientific value. Move the film to the next frame and repeat the above procedure.

To photograph meteors, find a place free from light that might fall on the camera lens. Stay away from nearby city lights that brighten the sky and be sure to pick a night when moonlight will not be too bright.

To prevent a jiggling of the camera from affecting your picture, hold a card over the lens until you are sure the camera has recovered from the shock of your opening the shutter. Similarly, cover the lens before closing the shutter. In both cases, record the time the card is put in place.

How long the film can be exposed depends on how much light there is in the sky. Local lights or a bright moon will fog the film after several minutes. A dark night will let you expose for perhaps an hour or two. The only advice that can be given is to experiment a night or two before the shower to find the practical limits, remembering that the moon may not be the same on two successive nights.

David McLean

Leonid shower with the Big Dipper.

The stars will be shown even in short exposures, if they are not too faint or the exposures too short. A wide-angle lens, if it is fast enough, will be useful. Try to aim the camera in such a way that the shower radiant is in one part of the frame. The picture will then be much more interesting because the streaks radiate from a point. Do not aim directly at the radiant unless you use a very wide-angle lens, or you will miss most of the meteors.

| SHOWER | DATE | RATE |
|---|---|---|
| Geminids | Dec. 13 | 50 |
| Ursids | Dec. 23 | 15 |
| Quadrantids | Jan. 3 | 40 |
| *Lyrids | Apr. 22 | 15 |
| $\eta$Aquarids | May 5 | 20 |
| $\delta$Aquarids | July 29 | 20 |
| Perseids | Aug. 12 | 50 |
| *Orionids | Oct. 21 | 25 |
| Taurids | Nov. 5 | 15 |
| *Leonids | Nov. 17 | 25 |
| *Geminids | Dec. 13 | 50 |
| Ursids | Dec. 23 | 15 |

*Full moon may hamper viewing.