



A WELL-OBSERVED BRIGHT PERSEID METEOR

ON AUGUST 11-12 two years ago, the night of the Perseid meteor shower maximum, I observed from an elevation of 3,600 feet near Luray, Virginia. During the evening viewing conditions were excellent, although fewer than 10 Perseids per hour were seen. At 11:45 p.m. Eastern daylight time, I made the observations of a bright fireball reported here, and 45 minutes later the sky became completely overcast.

Two 35-mm. cameras had been loaded with Tri-X film and pointed toward Cassiopeia. For direct photography I used a Retina with an $f/3.5$ lens, while an $f/2$ Leica was equipped with a Bausch and Lomb replica transmission grating. It had 300 grooves per millimeter and was blazed to concentrate the light into the first-order spectrum.

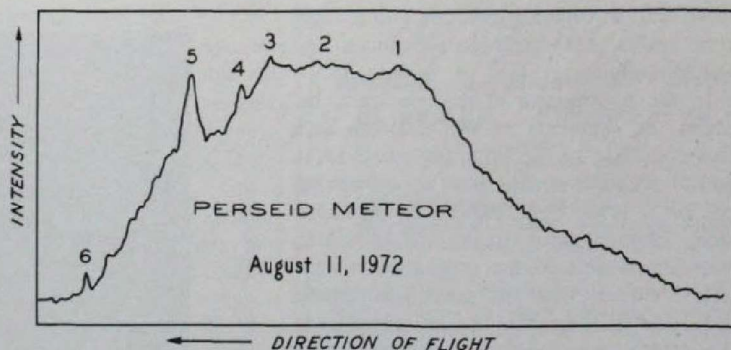
The Perseid was captured by both cameras. Visually, I estimated its brilliance to be greater than magnitude -2 . Photometry of the 9°-long trail seen at left above indicates that the meteor attained a maximum brightness of -6.5 (uncertainty 0.5 magnitude), by comparison with the trailed images of stars and an assumed velocity of 60 kilometers per second, which is typical for Perseids. It is well known that eye estimates of very bright objects tend to be conservative, due to the lack of suitable comparison objects. Also, though I had noticed the terminal burst, the photograph later revealed at least five other distinct brightenings.

Visually, a train persisted for at least 20 seconds. The spectrograph shutter was closed immediately after the passage of the meteor, but the direct-view camera probably recorded the train as well as the meteor.

The spectrum seen at the top of page 128 was recorded near the edge of the camera's field, the path of the meteor on the film mak-

ing the favorable angle of 80° with the grating's direction of dispersion.

The strongest feature is the unresolved yellow sodium (Na) doublet at 5890 and 5896 angstroms wavelength, followed by the unresolved green magnesium (Mg) triplet at 5170. The violet H and K lines of singly ionized calcium (Ca II) are well resolved in



Above: Using a microdensitometer, the author scanned along the meteor trail shown at left. A gradual rise in intensity, flat peak, and rapid fading are evident, as well as a terminal burst (6), which is common among Perseid meteors.

Left: This Perseid meteor was observed by Walter A. Feibelman visually, photographically, and spectrographically. Prints of two densities but at the same scale are reproduced, the darker inset showing better the bursts (numbered) in the brighter part of the trail. The brightest star is Epsilon Cassiopeiae, magnitude 3.4, and the meteor crosses 43 Cassiopeiae, 5.5. North is at bottom left.

both spectral orders, and many of the brightenings are especially conspicuous. Two broad features that fill the orange-red region, from about 5900 angstroms to 6400, are probably due to the first positive bands of nitrogen in the upper atmosphere.

I was able to determine the wavelengths of 24 lines in the first-order spectrum and 18 in the second; using a small Gaertner measuring machine. These elements have been identified: neutral and singly ionized cal-



OPTICS FOR ASTRONOMY

ASTRONOMICAL MIRRORS • CASSEGRAIN OPTICS
ELLIPTICAL DIAGONALS • OPTICAL GLASS • SUPPLIES

ASTRONOMICAL MIRRORS

Recognized as the finest, yet still at the lowest cost. Meet the most demanding specifications. Made from fine annealed Pyrex blanks with 1:6 thickness ratio. Aluminized and silicon monoxide coated, $\pm 1/25$ wave parabolic. Satisfaction guaranteed. **Postpaid U.S.A.**

6" f/10	\$29.95	8" f/7	\$69.95	12 1/2" f/8	\$187.50
6" f/8	\$39.95	10" f/5.6 ..	\$105.50	14 1/4" f/7	\$345.50

RICH-FIELD MIRRORS

These $\pm 1/8$ wave parabolic mirrors provide breathtaking wide-angle views of the heavens. Unsurpassed for viewing the Milky Way, clusters, and nebulae. Guaranteed. **Postpaid U.S.A.**

6" f/4	\$57.00	8" f/4	\$98.00	10" f/4	\$156.00	12 1/2" f/4	\$275.00
-------------	---------	-------------	---------	--------------	----------	------------------	----------

CASSEGRAIN OPTICS

Perforated Dall-Kirkham type. These $\pm 1/16$ wave sets make compact telescopes with relatively long focal lengths. Ideal for lunar and planetary observation. **Postpaid U.S.A.**

6" f/15 ..	\$98.50	8" f/20 ..	\$139.50	10" f/16 ..	\$249.50	12 1/2" f/15 ..	\$350.00
------------	---------	------------	----------	-------------	----------	-----------------	----------

LARGE ASTRONOMICAL MIRRORS

Made of fine annealed Pyrex from blanks 2 1/2" thick, these mirrors are diamond edged and have flat ground backs for precision mounting, $\pm 1/16$ wave parabolic. Free of astigmatism, aluminized and silicon monoxide overcoated. **f.o.b. N. Hollywood. Add \$15 for crating.**

16" f/5 to f/6	\$795.00	18" f/5 to f/6	\$1,195.00	20" f/5	\$1,695.00
---------------------	----------	---------------------	------------	--------------	------------

ELLIPTICAL DIAGONALS

These coated flats are ready to mount and use. Low-priced and available in a wide selection $\pm 1/25$ wave guaranteed. Choose minor axis given below. **Postpaid U.S.A.**

1.30"	\$8.00	1.83"	\$13.50	2.60"	\$19.50
1.52"	\$11.50	2.14"	\$16.50	3.10"	\$29.95

SEND FOR FREE LIST

COULTER OPTICAL COMPANY

8217 Lankershim Blvd.

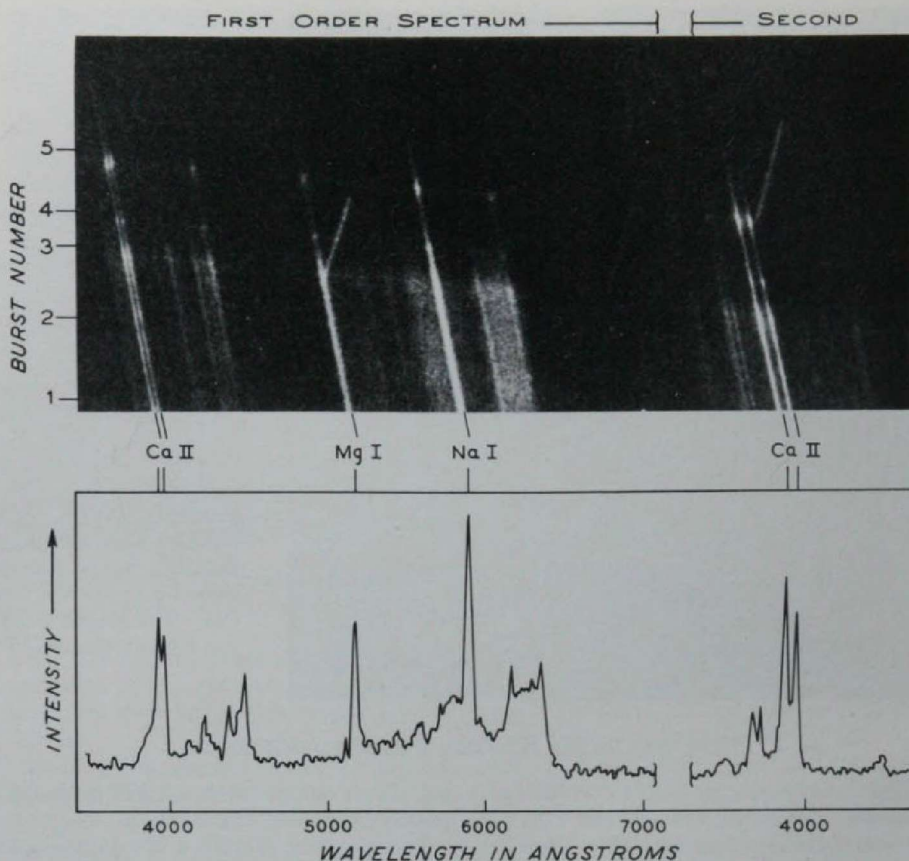
North Hollywood, Calif. 91605

Phone (213) 767-8538

cium, neutral iron, magnesium, and manganese, neutral and singly ionized silicon, and neutral sodium.

In the photograph of the spectrum, between the segments of the emission lines corresponding to the brightest bursts (3, 4, and 5) are faint streaks that slope from upper left to lower right, parallel to the dispersion. Though these streaks are only intermittently visible in the reproduction here, measurements with the microdensitometer indicate that they cross the entire spectrum. The streaks may be due to continuum radiation or to many unresolved emission lines.

W. A. FEIBELMAN
NASA-Goddard Space Flight Center
Greenbelt, Md. 20771



Several emission lines are identified by the author in the spectrum and microdensitometer tracing through the brightest burst (3). The original dispersion was about 640 angstroms per millimeter in the first order.

**Drives
Circles**

Slow motions
for both axes.

8" Mount (shown) \$109.50

Complete mounts — 6" and 8"
individual castings and parts

Write for free catalog.
Phone 213-896-3016

Pacific Instruments
P. O. Box 1876, Pacoima, Calif. 91331



6" SOLAR-SKREEN (in a cell)

SOLAR-SKREEN™

THE SPACE-AGE FILTER THAT MAKES
DIRECT SOLAR OBSERVATION ABSOLUTELY SAFE —
PROVEN BY THOUSANDS OF SATISFIED USERS

SOLAR-SKREEN's mirror-like vacuum-deposited aluminum surfaces stop 99.999% of the sun's heat before it enters the telescope. This filter permits superior views of sunspots and solar granulation.

SEND FOR OUR FREE CATALOG SHEETS.

SOLAR-SKREEN FILTERS ONLY: 3" or less — \$8; 3½" QUESTAR, 4" or 4¼" — \$10; 5" CELESTRON or 6" — \$14; 8" — \$18; 10" — \$20; 12½" — \$24. Other sizes.

SOLAR-SKREEN FILTER and CELL ASSEMBLY (MOUNTS IN SECONDS, NO MACHINE WORK NEEDED): 3" UNITRON — \$21; 3½" QUESTAR — \$26; 4¼" (4⅞" I.D. tube) — \$27; 4" UNITRON or 5" CELESTRON — \$33; 6" (6⅞" I.D. tube) — \$39; 8" CELESTRON or DYNAMAX — \$44.

YOUR NAME MONOGRAMMED FREE ON ANY CELL ASSEMBLY

SHIPPED POSTPAID
IN U.S.A.

ROGER W. TUTHILL

11 Tanglewood Lane, Box 1086 F, Mountainside, N.J. 07092