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OPTICAL ELECTRONICS FOR METEOR OBSERVATIONS

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For several years, the Turkmen Academy of Sciences Institute of Physics and Technology has been carrying out spectral observations of meteors using an optical electronics facility. Interest has centered on faint meteors and their trails in the period of intensive meteor showers.

Over 800 meteors were registered during the observation period with spectrograms obtained for 170 of these. A total of 86 meteors were photographed from two sites and for 25 of these spectrograms of the meteors as well as their trails were obtained. The brightness of the photographed meteors ranged from (-3^m) to ($+9^m$). All meteors have undergone routine processing in order to determine atmospheric characteristics.

Sporadic meteors have great ranges of appearance as well as disappearance heights. This is explained by a great variety of entry velocities into the Earth's atmosphere and also by different composition and structure of meteor particles.

In the period from 1977 to 1981, 25 meteors of the Perseids were photographed from two sites and for 13 of them spectrograms were obtained. The brightest meteor had a visual stellar magnitude of -2^m and the faintest one $+6^m$. For the majority of meteors, the visual stellar magnitude was in the range ($+3^m$) to (5^m).

The radiant area of the Perseids in Fig. 1 is given on the basis of our observation results. Scatter in the early visual radiants (symbol = 0) is significant. It cannot be ruled out that some of them have nothing to do with the Perseids. When making allowances for diurnal motion of this distribution, the cross-section of the radiant area is about 4° diameter.

Fig. 2a shows the meteor mean velocity distribution for the Peseids. For most of the meteors, the velocities vary for 58 to 61 kms indicating an insignificant scatter of particle velocities within this stream.

The distribution of meteor beginning heights for our Perseids is shown in Fig. 2b. In comparison with ordinary photographic meteors, the heights in our case are somewhat high. This can be explained by the greater sensitivity of our equipment which allows better detection of the least visible upper part of a meteor trail. Most of the meteors in our sample had heights within the interval of 198-117 kim. This confirms the previously indicated dispersion of particle velocities for this stream. The beginning heights of brighter members of this stream were observed as high as 120 km apparently due to excitation of the oxygen green line. This is clearly seen from a spectrogram of a meteor of the Perseids presented in Fig. 3. Since the mass of particles causing bright meteors is greater, they possess sufficient kinetic energy to cause the oxygen green line to glow at higher altitudes. Fainter meteors of the stream glow at lower

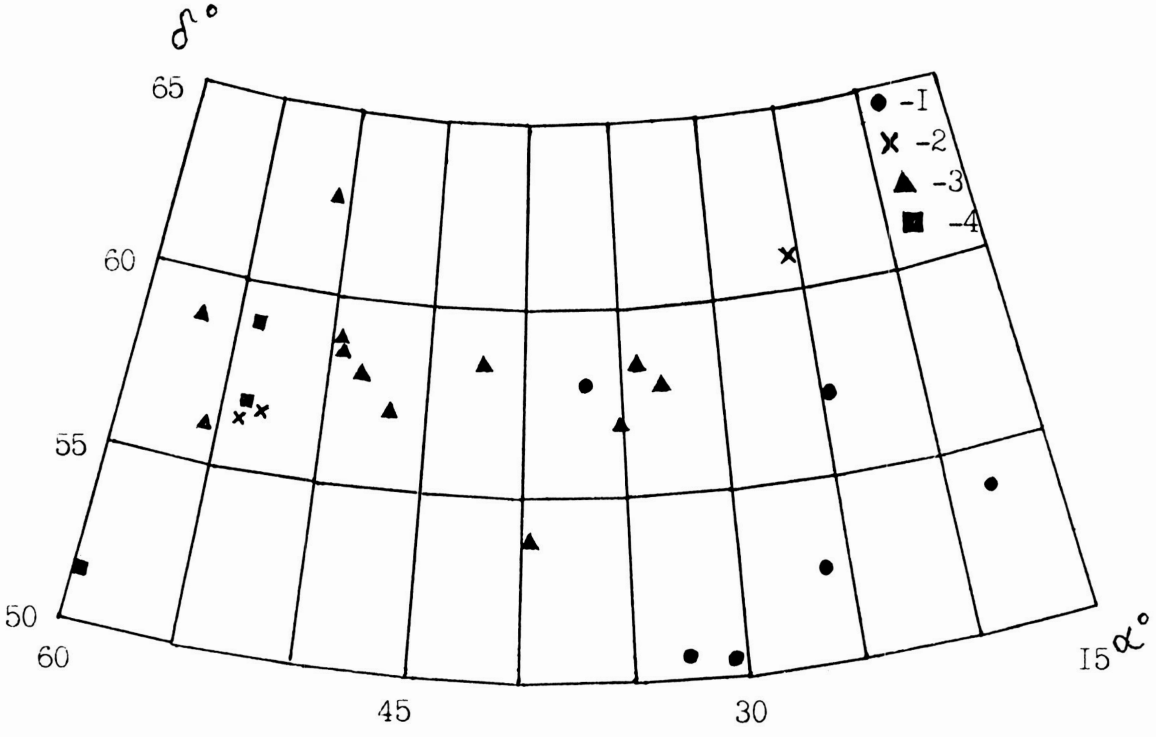
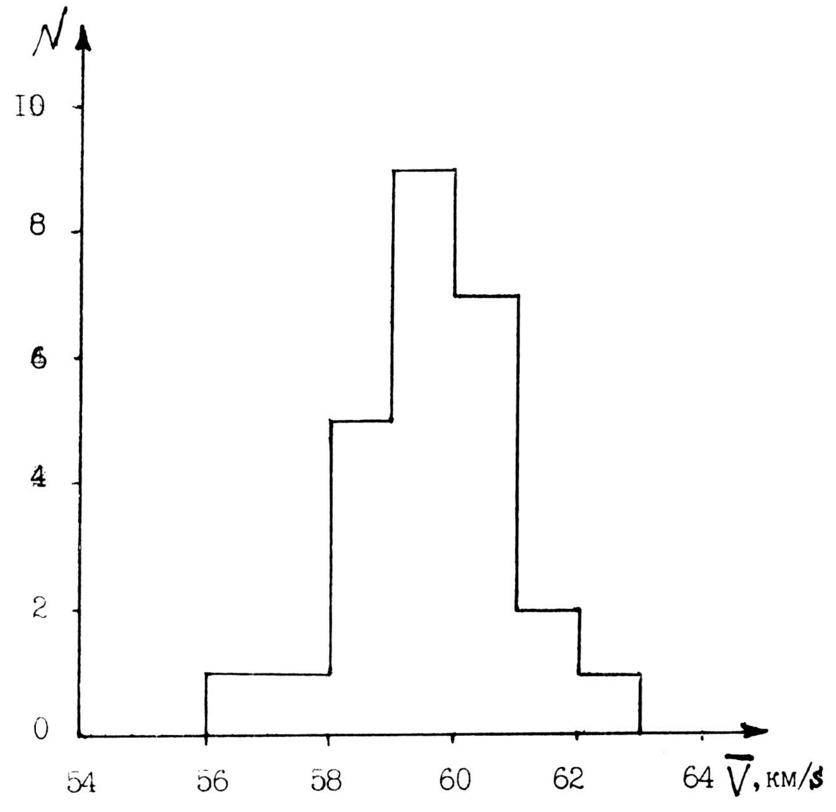


Fig. 1 Radiant area of Perseids. I - radiants obtained before August 9; 2 - August 10 and 11; 3 - August 12, 13, 14; 4 - after August 14.

a)



b)

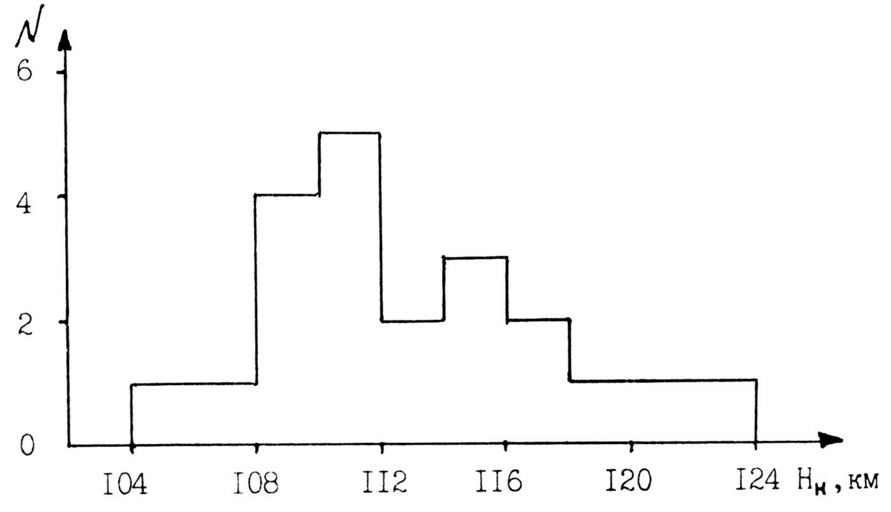
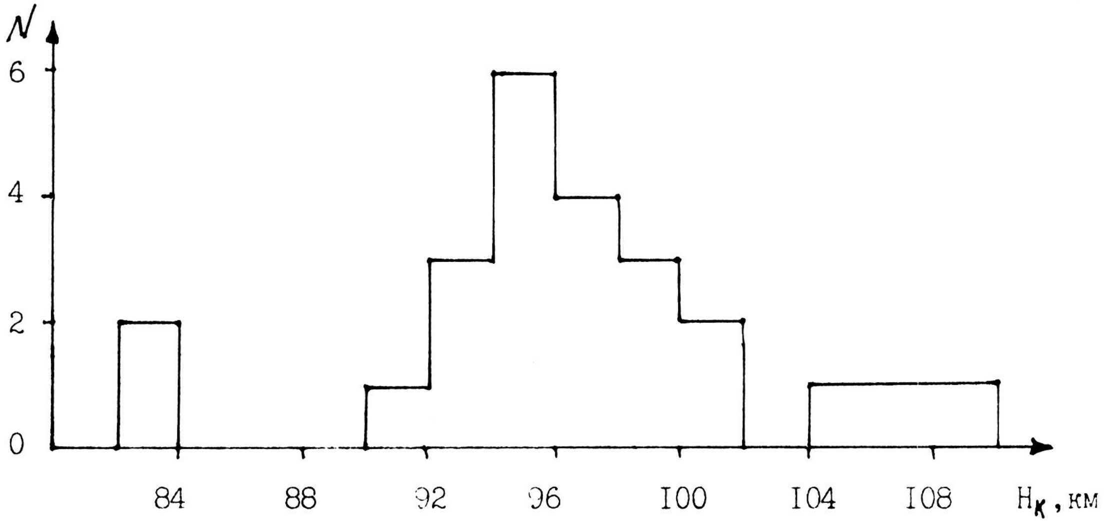


Fig. 2 Distributions of Perseid parameters. a) mean meteor velocity; b) meteor height; c) meteor disappearance height; d) pathlength.

c)



d)

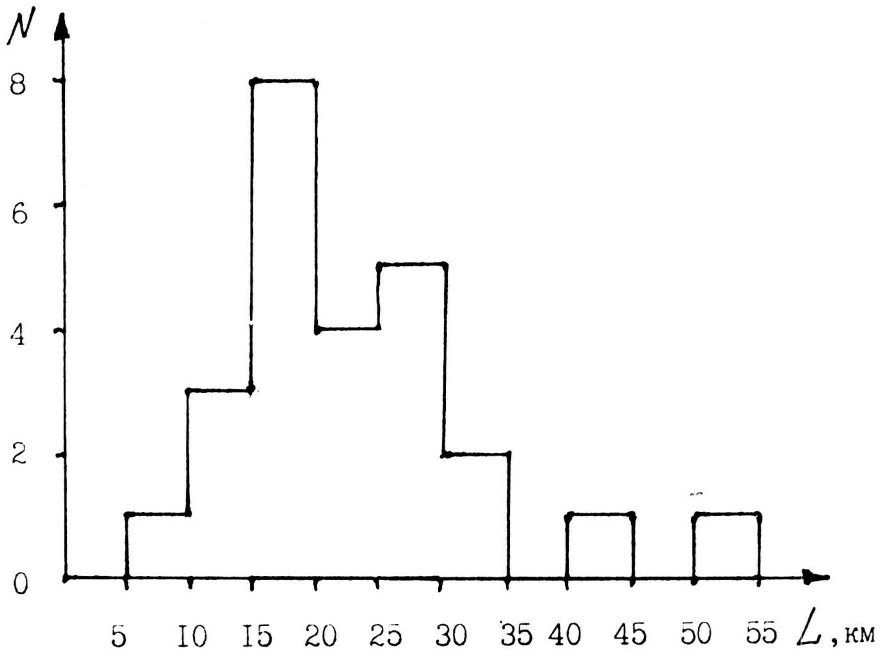


Fig. 2 Continued.

heights where concentration of oxygen atoms in the Earth's atmosphere is greater.

Fig. 2c gives the height distribution of meteor disappearance for our Perseids. The majority of our meteors had a height of disappearance in the interval from 92 to 100 km. This shows that particle mass dispersion of this stream is relatively small. Two bright meteors -2^m and -1^m of this sample disappeared with bursts at the height of 82-84 km.

Fig. 2d shows the path length distribution in the atmosphere for the Perseids. This shows the absence of small particles (i.e., preponderance of short trails) in the stream and confirms the previously indicated small dispersion of particle masses and indicates that most of the particles in our sample of the Perseids produce meteors in the $(+3^m)$ to $(+5^m)$ range.

The meteor spectra recorded by the optical electronics cameras usually differ from photographic spectra of bright meteors with intense lines and molecular bands of atmospheric components seen, especially in the red part.

The main emissions in the meteor spectra of the Perseids are the magnesium triplet, the oxygen green line, the sodium doublet and the oxygen red line (Fig. 3). The monochromatic curves of brightness are qualitatively similar and appear in the part of the trail, where there is little overlapping of the oxygen green line radiation. In composition, faint meteors of the Perseids do not appear to differ from bright ones.

Comparison of our results on faint meteors obtained by optical electronic devices and those obtained using other techniques shows that the former is more informative, especially when studying composition and interaction of meteor particles with the Earth's atmosphere.

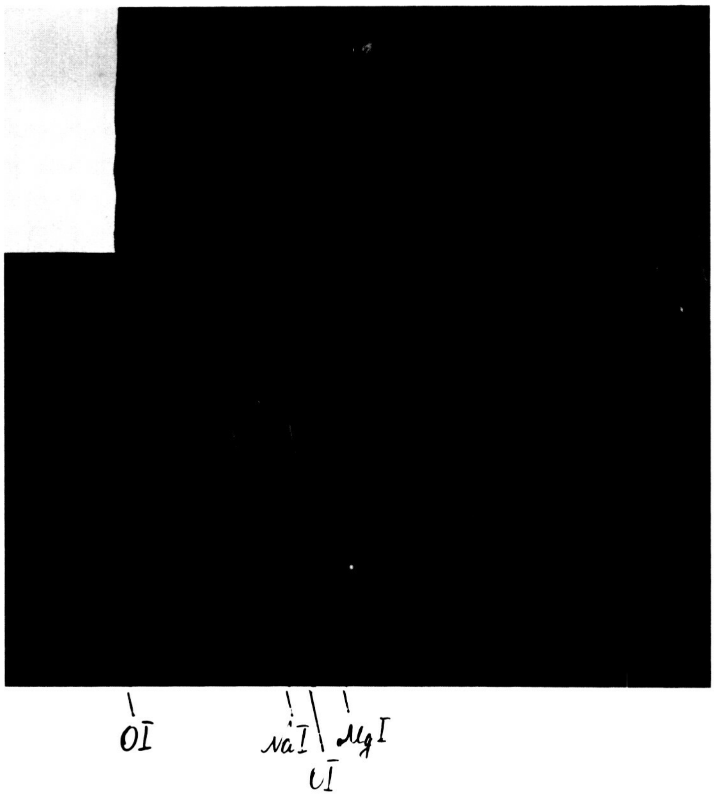


Fig. 3 Spectrogram of a +3m Perseid meteor obtained on August 16, 1979 by optical electronics camera. Bright emmissions on the spectrogram from left to right: oxygen red line, sodium doublet, oxygen green line and magnesium triplet.