The Biela comet meteor-stream.

The showers of meteors from this stream (see *Science*, vi. 489 and 496) were observed not only very extensively on the night of Nov. 27, but also at some places on nights preceding and following this; and a complete collection of all the observations should be made in order to study the distribution of matter in the stream. We should be glad to receive from everywhere reports of observations of these showers; and they should give, as fully as may be, the following data: 1°. The time the observations commenced, whether in twilight or darkness, and whether the shower seemed to be beginning or already in full operation. 2°. The clearness of the sky, and freedom from interference of trees, street-lamps, etc. 3°. If a continuous count was kept, the rate at which it proceeded (as illustrated on p. 490 of last week's *Science*), the number of observers, and how stationed. 4°. If no count was kept, then the time of any marked variations in the density of the shower. 5°. The time the observations ended, and whether the shower appeared to be over; and, if so, whether any further watch was kept for a renewal of it, and how long. 6°. The appearance of the meteors, especially the color of the brighter ones and of their trains, if any; also if any appeared to describe *curved* paths. 7°. If the observer was reclining so as to watch all round the radiant equally well, or, if there was an observer for each quadrant, then some approximate indication, if possible, of the relative density in each quadrant; and, if this varied decidedly, then the times of the variation.

Probably few can give much information on the last point, but it would be valuable in discussion of local differences in the showers. There are some indications of this at stations not many hundred miles apart, which, if they are real, indicate a considerable *bunchiness* in the meteor-stream within very moderate distances. These will always be interesting showers to observe, not only for their connection with the lost comet, but also because they come into our atmosphere with low velocities, nearly on the *following* side of the earth, and hence are conveniently observed in the evening and with the radiant near the zenith, — very rare characteristics of well-marked showers.

Some features of the meteor-orbit may be of interest. Assuming the elements which Santini computed (*Astr. nachr.*, L. 124) for the unobserved return of the comet in 1859 as the latest computation of its probable motion, they show that the orbit is an elongated ellipse inclined about 12° to the earth's orbit, with a perihelion distance of .87 (the earth's mean distance being unity) and an aphelion distance of 6.21 (Jupiter's mean distance is 5.20), and that the aphelion is only .92 from the plane of the ecliptic; thus making it highly probable that Jupiter pulled the comet into the solar system originally, and showing that it can still perturb its motion considerably. The most interesting feature (the one which makes the meteor-showers possible) is that, according to Santini's elements for 1859, the radius-vector of the comet at its descending node equals .992, while that of the earth at this point is .986, — an approach within .006, or about 550,000 miles. This small distance, however, is liable to have been changed by several times its whole amount by perturbations since then.

At this node the velocity in the comet-orbit is 24.3 miles per second, while the earth's is 18.7; and as the motion of the comet is direct, the inclination only 12°, and the angle between the radius-vector and the normal of the comet-orbit only 18°, the meteors enter the earth's atmosphere from the apparent direction of the radiant in Andromeda, with a velocity of only 9.8 miles per second, thus causing their sluggish motion, which perhaps would be even more marked were it not likely, that, on account of their slow speed, they are consumed at a somewhat lower level than the swift showers, and hence appear relatively too fast from greater proximity.

Of course, there can be no shower unless there are meteorites scattered along that part of the orbit where the earth reaches the node about Nov. 27. Santini's elements make the passage through the node about thirty days before that through perihelion, and give the following series of times for the successive crossings of the node, the period being 6.67 years. The next column gives the elapsed intervals from these times till the nearest earth-crossing about Nov. 27.

Date of comet's node-passage.	Distance of comet beyond node Nov. 27.
1859.31 (April 23)	−5 months.
1865.98 (Dec. 24)	−1 "
1872.65 (Aug. 25)	+3 "
1879.32 (April 27)	−5 "
1885.99 (Dec. 27)	−1 "
1892.66 (Aug. 29)	+3 "
1899.33 (May 1)	−5 "

The only recently observed showers certainly attached to this stream, so far as known to the writer, are those of 1872, when the comet was already three months past the crossing, and the one just happened, when, according to the same elements, the comet should not have crossed till a month afterwards. There appears to have been no well-marked shower observed in 1865, when, with imperturbed elements, the circumstances should have been almost the same as this year; and the difference is, no doubt, due to the increased diffusion of the stream and the perturbations since 1859. The phenomena of 1892, as compared with those of 1872, will furnish some evidence on this point; but, as the perturbations of this stream are pretty large, the above times may very likely be wrong by some months at the end of the century.

This is by far the most interesting meteor-stream we have to deal with as yet, and the study of its special perturbations would seem to be well worth making. After the passage of the double comet in 1852, the *Academie des sciences de St. Petersbourg* offered a prize (*Astr. nachr.*, XXXVIII. 95) for a full discussion of the whole theory of the comet from its discovery in 1826 to its expected re-appearance in 1859; but no one seems to have undertaken the work at that time. Perhaps its discussion at this day, extended to its perturbations as a diffusing meteor-stream, would be worthy of a prize.

H. M. PAUL.

Washington, Dec. 5.

The Biela meteors.

On the evening of Friday, Nov. 27, at 6.15, I observed a meteoric shower of considerable proportion. In taking a casual glance at the heavens after tea, my attention was at once attracted by several meteors, which followed in such rapid succession that I was able to count twenty in less than five minutes. They appeared all over the heavens, and, among the great number observed during less than half an hour, the radiant point of but one was other than in the con-