

published. When I wanted to fix up a plan with him, he thought we ought to wait till his observations on the dynamics of the universe could also be included; "for," he said, "if these are not correct, the rest is not worth reprinting either." These words we hear from the mouth of a man of whom it has been so repeatedly—and rightly—testified that he saw his scientific wishes fulfilled more than anyone else! Could it be otherwise? Whoso has seen the ideal—and few have seen it as purely as Kapteyn—feels himself little before the Truth he desires to master.

THE METEORIC PROCESSION OF FEBRUARY 9, 1913.

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PART I.

This remarkable phenomenon was in no sense a meteoric shower. It was a different kind of event altogether, and while undoubtedly much less spectacular than a great shower, such as that of Nov. 1833, was in some respects more interesting and instructive. It consisted of a procession of fire balls and meteors all moving very slowly, in practically the same path across the sky, from horizon to horizon. It was first seen near Mortlach, 65 miles west of Regina, Saskatchewan, lat. $50^{\circ}5' N.$, long. $106^{\circ} W.$ It traversed successively Manitoba, Minnesota, Michigan, Ontario, New York, Pennsylvania, and New Jersey a few miles to the south of New York City. It then went out to sea, and appeared next in Bermuda, was seen from the steamship *Bellusia*, lat. $17^{\circ}35' N.$, long. $51^{\circ}11' W.$, and last from the steamer *Newlands*, lat. $3^{\circ}20' S.$, long. $32^{\circ}30' W.$ The distance between the first and last stations is 5659 miles. Computation indicates that the meteors traversed several thousand miles more, while still within the limits of the earth's atmosphere, thus forming prior to their final destruction a series of minute temporary terrestrial satellites.

There appear, when first and last seen, to have been some 40 to 60 fire balls, arranged at first in 4 or 5 separate groups. Several of these had long tails. In part of the route they were accompanied by innumerable finer particles that were swept off of them in their rush through our atmosphere. The interval during which the larger fire balls were visible under favorable circumstances seems to have been from 30 to 40 seconds, and the duration of the display about 5 minutes. In Canada their color was usually described as yellow or reddish, but not white. Generally they were compared to bright stars, sometimes to Venus, but in Bermuda the two leaders looked like large arc lights, slightly violet in color and of diameter equal to the moon. Their true angular diameter was of course much less than this. An incandescent steel globule 0.2 inches in diameter, at a distance of one half mile was

found by Professor I. L. Smith in 1857 to appear of the moon's diameter (*Jour. R. A. S. Canada*, 1914, 8, 109). This would correspond to a diameter of 24 feet. It therefore appeared 1400 times its true size. If the meteors were at a distance of 70 miles from Bermuda, this would indicate that the diameter of the two leaders was about 28 inches.

A very full description of them, with a computation of their path, and estimates of their height, speed, and size is given by Professor Chant in the *Journ. R. A. S. Canada* 1913, 7, 145 (See also 404, 438; 8, 108, 112; 9, 287, and 10, 294). The last two papers are by Mr. Denning, and are particularly valuable as giving the data of the two observations made at sea. These were not available when Professor Chant made his calculations, and they not only permit us to correct them, but they serve to give us much more definite information regarding the height, speed, and size of the meteors, regarding which his paper left us in considerable doubt.

The path of the meteors across the United States was about as long as it was in Canada, and they must have been visible over an area of rather more than a quarter of a million square miles, including all the large cities and observatories of the important states of Michigan, New York, Pennsylvania, New Jersey, Delaware, Maryland, the District of Columbia, and southern New England. In fact if the skies were clear they might have been seen by over 30,000,000 people. It is regrettable that it did not occur to any one in this area that this very unusual phenomenon was worth investigating. A collection of observations might at that time have been made, culled from newspapers and by private correspondence, similar to that secured by Professor Chant. His collection is most valuable and unique, and it is proper to say that all that we know about the meteors is really due to him, since it was his work which called Mr. Denning's attention to the matter. My own first knowledge of the phenomenon was due to reading his papers. The total number of reports on which our knowledge is based is 141. Of these 135 came from Canada, 1 from southern Michigan, 1 from a lady in New Jersey, 2 from Bermuda, and 2 at sea. It is gratifying to find that America is not left out entirely in the investigation.

It is certainly unfortunate for our scientific reputation however that the most important and interesting meteoric event of the past ninety years, visible in the early evening, and to more advantage in our country than in any other, should be described by us in only two very brief reports. From these two the most important information that we gather is that the sky was clear in those two regions.

In Professor Chant's first paper he gives the height of the meteor stream in Ontario as 26 miles. In a later paper he modifies this statement to 34 miles. Mr. Denning believes it from the data to have been 38, and Mr. Davidson from other considerations, 45 miles. The last value seems to me irreconcilable with the observed facts, but if, follow-