

motion was parallel to the surface of the earth, and found that in describing half their journey, 1200 miles, with this velocity, they would rise 17 miles. If the velocity gradually fell from 5.15 to 4.93 miles a second, the latter being attained when half the journey was completed, the rise would be half of this, that is, 8.5 miles. In traversing the second half of their path, I assumed that the velocity was gradually decreasing from 4.93 miles a second, the result being a slow drop towards the earth's surface of about 8 miles, this descent continuing until they were dissipated by the atmosphere or struck the sea farther on in their flight.

The next question to decide was that of the height above the surface of the earth. Using the most reliable results of atmospheric resistance to the flight of projectiles, I found that a body of diameter 100 feet and of density about 6, would be required to start at a height of 34 miles, rising to about 43 miles towards the middle part of its flight, and then sinking as the velocity decreased from 4.93 miles a second. With bodies 10 feet in diameter, the figures are 45 miles and 54 miles; those intermediate in size would demand heights lying between 34 miles and 45 miles at the beginning. A flight much below 34 miles, even for the largest body, would be stopped, by the resistance of the air before it could move 2400 miles, unless the velocity were considerably above 5 miles a second, and in that case it would rise very much from the earth's surface. An explanation of the ability of the various bodies to move so far may be found in the fact that they were at various heights, a fact attested by some of the observers; the smaller bodies which described the whole distance of 2400 miles or more were probably higher than the larger ones. Those which were not may have been amongst those described as "snuffed out". As atmospheric resistance increases relatively with a decrease in the diameter, it seems necessary to place the smaller ones which traversed the whole distance higher than those which were greater. Since a great number entered our atmosphere, there is every probability that some of these would be included amongst the fortunate ones which were of the requisite dimensions for their height to perform the long path.

I find it difficult to accept the upper limit of the estimate of their velocity given in the JOURNAL for May-June, 10 miles a second. The height given in one part, 26 miles, is not, I think, so near the truth as that given in another part, Table III, about 34 miles. Even this may be too low, and I am disposed to believe that they were much higher than this. Professor Chant has reduced the elevations by about one half, for reasons of which an explanation is given; without such reductions the height would be somewhere near 70 miles. It agrees more easily with the effects of atmospheric resistance to take an average height somewhere between 34 and 70 miles, probably near 45 miles.

It will be noted that Colonel Winter insists that the appearance of the display, at Bermuda was quite different from that when over Ontario. This was suggested to me on receiving Colonel Winters sketch, which was reproduced along with his report. In Ontario the bodies were arranged in distinct groups, while at Bermuda there were two brilliant ones leading a large number of bodies distributed fairly regularly in a long train behind. Many of the larger bodies may have broken up into smaller ones. From several places in Ontario observations of explosions and descriptions were reported.

The new evidence regarding the height of the meteors is interesting and important. To determine the height we must know, of course, the elevation above the horizon and the distance, from the observer, of the trace on the earth. Now the latter I think is the best determined feature of the phenomenon. Its location in central Ontario is in error hardly more than or three miles, and I think it hardly more than ten miles out of its true position at Pense in Saskatchewan. A combination of these maximum errors would not make a change in the location of the easterly end of the observed path of more than 15 miles, that is the trace was not less than 116 miles from Bermuda. Of course, this assumes that the bodies were travelling over a great circle on the surface of the earth. Colonel Winter's new determination of the altitude is about 30 $\frac{1}{2}$ °, which, when cor-