their being luminous bodies which present themselves independently of the earth's rotation, and penetrate into our atmosphere *from without*—from space. The observations of Olmsted proved that in the case of the November falls in 1833, 1834, and 1837, the stars proceeded from the star γ Leonis, but in the August fall in 1839, Algol in Perseus, or a point between Perseus and Taurus, was the centre of divergence. According to the accurate observations of Heis, at Aix la Chapelle, as quoted in Vol. I. of the *Cosmos*, "The falling-stars of the *November period* present the peculiarity that their paths are more dispersed than those of the *August period*. In each of the two periods there were simultaneously several points of departure, by no means always proceeding *from the same constellation*, as there was too great a tendency to assume since the year 1833." After investigating the paths of 407 stars, he found that 171 came from Perseus, 83 from Leo, 35 from Cassiopeia, 40 from the Dragon's Head, but full 78 from undetermined points. Schmidt, of Bonn, in a letter to Humboldt (July, 1851), says: "If I deduct from the abundant falls of shooting-stars in November 1833 and 1834, as well as from subsequent ones, that kind in which the point in Leo sent out whole swarms of meteors, I am at present inclined to consider the *Perseus point* as that point of divergence which presents not only in August, but throughout the *whole year*, the most meteors. This point is situated in Right Ascension 50·3°, and Declension 51·5° (holding good for 1844–6.") He adds, "If the directions of the meteor-paths are considered in their full complication and periodical recurrence, it is found that there are certain *points of divergence* which are always represented, others which appear only sporadically and changeably."

THEORIES REGARDING THE ORIGIN OF METEORITES AND FALLING-STARS.

Passing over the opinions of those who attributed *meteorites* to the effect of lightning in tearing up the earth and converting it into a compact mass, of Aristotle, who considered them masses of stone carried by a hurricane from one locality to another, and of those who have supplied that mysterious region, the North Pole, with an enormous volcano, hurling its eruptions to the distance of many hundred miles, the hypotheses regarding their origin may be reduced to three: 1st. that which makes them of atmospheric origin; 2nd. that which gives to them a lunar or planetary origin; and lastly, that which is now generally received as the true one, viz., that they are of cosmical origin.

The hypotheses respecting the atmospheric origin of these bodies are now generally exploded; and yet a great deal can be said in their favour. The ablest and most satisfactory paper upon this subject that I have been able to procure, is one written by F. G. Fischer, Esq., in the Berlin *Memoirs*. It is too long, and discusses too many points, to admit of the compression suitable to a paper like this. He lays down his positions something to this effect: Owing to the many gases and exhalations which are continually evolving at the surface of the earth, many matters exist in the atmosphere which escape chemical investigation, either from the want of tests to denote their presence, from their extreme rarity, or from their accumulating only in the higher regions of the atmosphere, where no experiments can be made. Owing to their extreme lightness, these exhalations ascend with the rapidity of lightning immediately on being disengaged, commingling only when they reach a stratum of air of equal rarity. What becomes of these vapours and gases, which, in the lapse of ages, must be greatly augmented? "Perhaps," says Mr. Fischer, "falling-stars, fire-balls, northern lights, and meteoric stones are the means by which Nature either transforms them into her own essence or returns them directly to the earth." In the reduction of these gases to solids, he has recourse to the agency of electricity, but the *modus operandi* he attempts not to explain. Kepler held somewhat similar views, and describes fire-balls and shooting-stars as "meteors arising from the exhalations of the earth, and blending with the higher ether." Sir William Hamilton, while giving an account of the great eruption of Vesuvius, in August, 1799, ascribes such phenomena to local electrical agency, developed by volcanic ejections. "This kind of electrical fire," says he, "seems to be harmless, and never to reach the ground." (On the improbability that meteoric masses are formed from metal-dissolving gases, which, according to Fusimeri and others, may exist in the highest strata of our atmosphere, and, previously diffused through an almost boundless space, may suddenly assume a solid condition, and on the penetration and misceability of gases, Humboldt treats largely in his *Relation Historique*, vol. i., p. 525.)

ORIGIN IN LUNAR VOLCANOES.

Another opinion is, that aerolites derive their origin from volcanoes in the moon. Chladni states that an Italian, Paolo Terzago, was the first to surmise (1664) that these bodies were of selenic origin. In 1795 Olbers commenced an investigation into the amount of the initial tangential force that would be requisite to bring to the earth masses projected from the moon; and the mathematical possibility of a sufficient force existing, together with the then prevalent opinion of there being active volcanoes in the moon, led to the belief in some minds of the physical probability of such an origin. La Place, Biot, Brandes, and Poisson all gave considerable attention to this *ballistic* problem, as Humboldt designates it. Olbers, Brandes, and Chladni thought "that the velocity of 16 to 32 miles, with which fire-balls and shooting-stars entered our atmosphere," furnished a refutation to the view of their selenic origin. Setting aside the resistance of the air, an initial velocity of 8292 feet in a second would be required, according to Olbers; to La Place, 7862; to Biot, 8282; and to Poisson, 7595. Olbers has shown "that, with an initial velocity of 8000 feet in a second, meteoric stones would arrive at the surface of the earth with a velocity of only 35,000 feet. But the measured velocity of meteoric stones averages five times that amount, or upward of 114,000 feet to a second, and, consequently, the original velocity of projection from the moon must be almost 110,000 feet, or fourteen times greater than La Place asserted." —(*Cosmos*, vol. i., p. 121.)

La Place, in one portion of his great book, cautiously observes that aerolites, "in all probability, come from the depths of space," but elsewhere inclines to the hypothesis of their lunar origin—assuming, however, that the stones projected from the moon "become satellites of our earth, describing around it more or less eccentric orbits, and thus not reaching its atmosphere until several, or even many revolutions have been accomplished." The distinguished chemist Berzelius has examined this hypothesis at great length, and adopts it on grounds which he finds in the chemical constitution and mineralogical character of these bodies. His arguments, which are copied in the Edinburgh new *Philosophical Journal*, are exceedingly ingenious, but still they are built on hypothetical conjectures which can be met and answered. Von Ende Beuzenberg and others coincide in his general views. The great velocity of these bodies, however, as well as the direction of their orbits, which is often opposite to that of the earth, are now regarded as conclusive arguments against this hypothesis. In connection with this, I may just name the opinion of Olbers and those who consider these meteoric bodies the *debris* or fragments of a large planet which had burst, and of which the *asteroids* are the remaining portions. The smaller fragments continue to circulate about the sun in orbits of great eccentricity, and when they