an investigation to ascertain the amount of force necessary to burst a planet and separate its fragments. "The possibility of determining by calculation, even approximately, the epoch of such a cosmical event as the destruction of a planet," Humboldt considers "more than doubtful, from the complication produced by the already large number of the 'fragments' known, the peculiar retrogression of the apsides and motion of the nodes." This has not, however, deterred ingenious men from investigations respecting this "destroyed planet." Mr. Daniel Kirkwood, of Delaware College, United States, has even ventured to restore from the fragments which remain the primitive planet, in the same manner as others have attempted to restore the animals of the primitive earth. He finds for it a diameter greater than Mars (of more than 4320 geographical miles), and gives it the slowest rotation of all the principal planets and a length of day of 57 hours and a half. Another American, Professor Alexander, concludes, from the mean of two results separately obtained, that the equatorial diameter of the supposed parent planet was about 50,000 miles, while its polar diameter was scarcely greater than the thickness of the bright rings of Saturn.

As illustrative of the mode in which this supposed original planet may have been broken up, Mr. Nasmyth, in a paper read before the British Association in 1853, referred to the case of the well known toy called "Prince Rupert's drop," viz.: "A drop of glass which has been let fall while in a semi-fluid state into water, by which the surface of the glass drop is caused to cool and consolidate so rapidly that the subsequent consolidation and contraction of the interior mass induces such a high degree of tension between it and the exterior crust, that the slightest vibration is sufficient to overcome the cohesion of the external crust, and by so letting free the state of tension to cause the glass drop to fly into thousands of fragments." Applying this to the case of the parent planet of the asteroids, he says: "it may have consisted of such materials as that by the rapid passing of its surface from the original molten condition to that of solidification, while the yet fluid or semi-fluid went on contracting by the comparatively gradual escape of its heat into space through the solid crust, a state of tension may thereby have been induced, such as that in the 'Rupert's drop,' and that the crust may have at last given way with such violence as to cause the fragments to part company, and to pass off, whirling into orbits, slightly varying from each other, according to corresponding variations in the condition of each at the instant of rupture."

With the progress of discovery, opinions change. The great inclination of the orbit of Pallas had long presented a difficulty to those who supported the hypothesis of Olbers. The numerous additions made yearly to the sum of the small planets, have confirmed some astronomers in the opinion that the planetoids were formed in the same manner, and according to the same laws, as the other heavenly bodies—that no alteration, in fact, had occurred in the primitive system of the universe. While examining, during last winter, the opinions of astronomers in regard to the small cosmical bodies denominated meteors or falling stars, I had a strong impression that the asteroids would be found to be similar to these in origin and character, as well as destiny. I was afterwards confirmed in this opinion by a paper written by Le Verrier, and published in *Silliman's Journal* for July, 1854, in which he overturns the views of Olbers regarding the perturbation of the orbits of the planets, caused by their mutual attraction; and after a thorough investigation of the secular variations of the elements of the orbits, establishes, amongst others, the following propositions:—"1. The eccentricities of the orbits of the known asteroids can suffer only very small changes as the effect of perturbation. These eccentricities, which are now quite large, have then always been and will always remain large. 2. The same is true of the inclination of their orbits. So that the amount of eccentricity and inclination answers to the primitive conditions of the formation of the group."

Amongst the latest hypotheses on the subject of the asteroids, I may state the opinion of the author of that remarkable book, "The Plurality of Worlds," who, it is pretty well known, is Professor Whewell.* "The near coincidence," says he, "of the orbits of the small bodies between Mars and Jupiter, has suggested to astronomers the conjecture that they have resulted from the explosion of a larger body, and from its fracture into fragments. Perhaps the general phenomena of the universe suggest, rather, the notion of a collapse of portions of sidereal matter, than of a sudden disruption and dispersion of any portion of it; and these small bodies may be the results of some imperfectly effected concentration of the elements of our system, which, if it had gone on more completely and regularly, might have produced another planet like Mars or Venus. Perhaps they are only the larger masses among a great number of smaller ones, resulting from such a process; and it is very conceivable that the meteoric stones are other results of the like process—*bits of planets* which have failed in the making, and lost their way, till arrested by the resistance of the Earth's atmosphere. Their great eccentricity, great deviation from the zodiacal path, and their great number all fall in with the supposition that there are in the solar system a vast multitude of such *abnormal planetoidal lumps.*"

In a paper on "New Theories of the Universe," prepared for presentation to the British Association at the meeting last year, and with a copy of which I have been favored, the author, James Bedford, Ph.D., of New Brighton, advances some startling doctrines, amongst which is the following regarding these bodies:—"The asteroids," he believes, "were projected in one mass from the sun, as were all the other primary planets; but, like a snowball thrown into the air when not sufficiently compacted, the mass separated where they are found; hence they all move in the same direction as the other planets, which could not be accounted for, if, as some terrifyingly suppose, they were originally a world that burst asunder. Verily, a planet once sufficiently condensed, cooled down from its igneous state to become a habitable globe, will *never* burst."

The following are the most remarkable peculiarities of this group of planets:—

1. They are exceedingly small, the largest being at the utmost only 145 geographical miles in diameter. Le Verrier concludes that the sum total of the matter constituting those situated between the mean distances of 2° 20′ and 3° 16′ cannot exceed about *one-fourth of the mass of the Earth.*

2. They occupy a distinct zone in which they circulate, and thus clearly indicate the existence of some peculiar family relationship.

3. The inclinations of their orbits range from zero up to 35°; and the eccentricities from near zero up to more than one

* Since the above was written, it has been found that Mr. J. S. Smith, of Balliol College, Oxford, not Dr. Whewell, is the author of the "Plurality of Worlds."