

In order to see how much man's conceptions of the universe have been enlarged by these discoveries, compare the opinions which prevailed before the introduction of the Copernican system with what is now certain knowledge, founded upon physico-mathematics, respecting the extent of the universe. Then this earth was thought to be the centre and the principal body of the creation, immoveably fixed, with the heavenly bodies, generally thought to be of diminutive size, revolving around it every twenty-four hours. The earth, too, except in the opinion of a few sagacious philosophers, was not imagined to be that vast globe which we now understand it to be, but a flat surface, perhaps a few hundred or thousand miles in extent, bounded by a circle, and resting on an imaginary foundation. The heavenly bodies were looked upon as little more than shining points, or at most a few yards, or by the most daring fancies a few miles, in extent. What a change have the telescope, the quadrant, and the transit instrument, aided by profound mathematics, and the talismanic power of the Newtonian theory of gravitation, produced! Every school-boy now knows that this globe, enormous though it be compared with what the eye can take in from the loftiest eminence, is but a mere speck in creation, and, with the exception of the moon, appearing from other worlds only as one of the smallest stars in their heavens; so small that its extinction would not be noticed. To the ignorant mind, distances and magnitudes exceeding a hundred miles are conceived of only with great difficulty. But the astronomer, when he conceives of magnitudes, must make a thousand miles his shortest unit, and a million of miles when he conceives of distances in the solar system. And when he attempts to go beyond the sun and the planets, the shortest division on his measuring line must be the diameter of the earth's orbit; and even then he will be borne onward so far, not on the wings of imagination, but of mathematics, that this enormous distance has vanished to a point. Even then he has only reached the nearest fixed star, and, of course, has only just entered upon the outer limit of creation. He must prepare himself for a still loftier flight. He must give up the diameter of the earth's orbit as the unit of his measurements, because too short, and take as his standard the passage of light, at the rate of two hundred thousand miles per second. With that