which when it appeared in 1264 had a train 100° long, to the great terror of our forefathers. Of comets which have tails the shape is exceedingly various. Some have one tail, others two or three at different angles, and a few have been seen with more than three. Some have what we may call a succession of tails—one succeeding another with a vacant space between every two. But let me remark that the tails of all those comets which have heads,—appear only at certain distances from the head. In the comet of 1811 the nebulosity was 20,000 miles from the centre of the nucleus, which was in diameter 2,700 miles.

From all the information which can be gleaned upon the subject, almost all speculation has proceeded on the assumption, that the tails of comets consist of matter similar to the gases on our earth, and is a continued efflux from their bodies.

The matter of the tail of a comet is of such extreme tenuity that, according to Sir Isaac Newton, the whole tail of a comet might be comprised in the space of a cubic inch, and that, even then, its density would not exceed that of our atmosphere. The nuclei of many are so tenuous, that stars—even whole clusters, can be seen through them. I may state farther that the trains of these bodies are generally turned away from the sun, but this rule is by no means universal. The comet of 1825 had two tails—one directed towards the sun, and one from it. Much more might be said about the cometary system—but time will not admit. We direct your attention next to the stellar universe. In launching forth on an investigation of the surrounding glories of the higher worlds of suns and systems, a problem arises which demands solution, or will prove an insurmountable barrier to any high achievements. Man looks forth from his planet-home on the star-lit vault around him, and seeks to ascertain the mighty laws by which those orbs subsist, and the relations which they sustain to each other. In doing this he thinks on the immensity of spaces intervening. How, in imagination, is he to reach even the nearest of those suns? How is he to wing his flight from orb to orb? Where is the measuring-rod to fathom the infinite depth? The longest line with which nature has furnished us of actually measuring, is the circumference of our own globe. From this geometry teaches us how to find its diameter, and the diameter we employ as a scale with which to compare the distances of the sun and moon and the other bodies of the solar system. But large as is this means of measurement in our conceptions, it is an insensible point in comparison of the distances of the apparently fixed stars, and, therefore, other aid must be brought into requisition. The base of the earth's diameter being too small, they have attempted to discover a change in the position of the stars when viewed from the earth in two opposite points of its orbit, with a base of nearly 200 millions of miles; and if a parallactic angle of the smallest measure could be obtained—the distances of such stars might be computed. Sirius was one of the first tried with this immense base line of 200 millions of miles but with no success. But astronomers persevered, and at length, in our own time, responses came from several points almost at once. By Professor Henderson it was ascertained that the star of the constellation Centaur had a parallax of a full second,—establishing its distance in miles at about nineteen millions of millions. Afterwards, Professor Bessel, of Konigsberg, assigned a parallax of thirty-one hundreths of a second to the double star 61 Cygni, placing it at a distance of nearly 670,000 times the distance of the earth from the sun,—a distance which would require nine years and a quarter for a ray of light to traverse. By farther researches, this conclusion has been confirmed. Another star in the constellation Ursa Major, exhibits a parallax of ¾ of a second: and several others have had smaller parallaxes assigned them. By perseverance and careful computation, it is found that Sirius shows a parallactic displacement of a quarter of a second, which indicates a distance greater than that of 61 Cygni. Vega in Lyra is supposed to have a parallax of about the same amount. In the present state of our knowledge, it would appear that the brightest stars are not always the nearest to the solar system. It has been considered from recondite investigations, that the average distance of a star of the first magnitude from the earth is 986,000 radii of our annual orbit—a distance so immense that it would take light 15½ years to traverse; and from a star of the sixth magnitude 120 years. If then, the distances of the majority of stars visible to the naked eye are so enormously great, how are we to estimate our distance from those minute points of light discernible only by Rosse's telescope? The conclusion is forced upon us that we do not see them, as they appeared a few years ago, or even during the life-time of man, but with the rays which proceeded from them several thousand years ago. What an idea this consideration gives us of the immensity of the stellar-universe! So mighty are the distances thus opened up to our contemplation, and so insignificant is this world in the comparison, that were the globe, with all its myriads sunk into annihilation, it would be a thing unknown in the stellar heavens, or where known—known only as a little star that had ceased to twinkle. It is no easy task for even the astronomer to gain conceptions of the gigantic theme before him at all adequate to its vast proportions. What thoughts must burst upon the mind, when it, for the first time, attempts to grasp the great fact of the immensity of the universe! What feelings, too deep for utterance, and even for tears, overwhelm the soul, at the perception of the thought, that earth is but an atom in the awful expanse of creation, and we but dust upon it! The vast spaces, the enormous magnitudes, the surpassing effulgences, the dazzling splendours, the amazing diversity and complexity, and yet the unity and harmony of all, communicate delights and longings which are almost painful, and the entire man is fain, for very self-conservation to melt into a spiritual swoon of wonder. A chemist once stood with an astronomer upon his watch-tower: the eye of a telescope was bent upon a double star, a system of two suns of different coloured radiances, and we know not how many planets apiece, revolving round one another: the light by which the friends beheld these sun-stars had taken at least 30 years to come to the earth; it had been coming, and at the rate of 195,000 miles in a second, while they had been growing from childhood to manhood; and now their conversation was all about the celestial organism, of which it was a *single pulse*. "If I truly and presently believed all we have been saying," said the chemist, "I should *surely die* where I stand, and pass away to God by *evolution*." "Ah," said the master of the observatory, "we know these things, but we can hardly be said to believe them. Their vastnesses—their inscrutable mysteries, dazzle and bewilder the very eye of belief! From distance, let us now proceed to magnitude. On account of the immense distances of the stars, it is impossible to form any correct idea of their *actual* magnitudes, by direct computation. Hence their sizes can be determined only by their light and distances compared with that of the sun; and Dr. Wallaston has found by photometrical experiments, that the light of Sirius, the brightest of the fixed stars, is to that of the sun as one to about 20,000,000. Now the proportion of *light* received from any luminous body, being inversely as the square of its distance, it follows that the sun would require to be removed to 141,400 (the square root of the above number) times its actual distance, in order to make its light equal to that of Sirius. Dr. Wallaston, assuming the *smallest* limit of its parallax, which approaches more nearly to the truth, supposes the light of Sirius to be equal to fourteen suns!—If this be true, or even approximates to the truth, what an idea does it give us of the glory and majesty and omnific power of Him who brought it into existence, and clothed it with its glory, "by the breath of His mouth—who *commanded*, and it *stood fast*."

Passing the asterism of stars, which may not be very interesting to my audience, I proceed to notice some other thing in the stellar universe more attractive and, perhaps, easier remembered.

On examining the stars with telescopes of considerable power, many of them are found to be composed of two or more stars placed contiguously to each other, or of which the distance subtends a very minute angle. And we have many instances of two stars whose angle of position so varies as to indicate a motion of revolution about a common centre, and in this case the two stars form—what astronomers call a *binary system*—performing to each other the office of planet and sun—yet both suns. Motions have been so rapid, with some of these as to become measurable within short periods of time; and at certain epochs the feebler star has been observed to disappear—either on passing behind or before its primary; or by approaching so near it, that its light has been absorbed by that of the other. The number of double stars yet discovered is estimated at about 6000.

How wonderful are the revelations which astronomy unfolds, may be gathered from the fact that, when we thus speak of double star systems, and allude to it as one of ordinary interest, we are in truth, recording the astounding fact, that *suns revolve round suns, and vast systems of suns, around others as vast:* that vast as are the planetary systems, in all their proportions, yet that these are but as a tiny speck in the great universe of God, in which all suns and all systems sustain relations to one another so simple, and yet so gigantic, that they may be expressed in a sentence, but which our mightiest arithmetic and most comprehensive imaginings cannot fully explain. It is a wonderful thought, that a globe as large as those in our own solar system should revolve around the central orb at the rate of many thousand miles an hour; but how overpowering is the conception of a sun encircled with a retinue of vast planets, satellites and comets, each in rapid motion, sweeping through the universe at a speed with which those of our planetary