most characteristic difference. Comets without tails are probably as numerous as those which boast that appendage. The true way of distinguishing a comet is to note its path in the heavens. That any perceptible motion exists at all, of course removes the body in question from the number of the fixed stars; it only remains to see if the stranger’s path is that of a planet.

The planetary orbits, without exception, are slightly eccentric or lengthened ellipses, which have but a small inclination to the plane of the ecliptic, the apparent path of the sun. The motion of a planet also is always direct. Now, the orbits of comets are, when ellipses, always of marked, sometimes of enormous eccentricity; they are occasionally parabolic, and frequently hyperbolas. Moreover, they exhibit every possible degree of inclination to the plane of the ecliptic; so that comets, unlike planets, may be seen in any part of the sky. We have said that the motion of the planets is always direct; that of comets, on the contrary, is either retrograde or direct,—as often one as the other.

Comets are visible during only a portion of their revolution. This happens partly because they recede to such vast distances from us, and partly because of the faintness of their light. The length of the period of visibility varies in different comets from a few days to seventeen months, which was the length of time the comet of 1811 was seen.

Another and striking difference between comets and planets is found in their physical and chemical constitution. The planets have a well-defined and stable form, while comets appear often to be mere nebulosities, or, as one of the old astronomers called them, "wandering clouds." In the centre of this cloud-like vapor, or nebula, which is called the coma, or hair, is generally a much more highly condensed portion of matter. This condensed matter is known as the nucleus. The coma and nucleus together form the head of the comet.

As the comet approaches that part of its orbit nearest the sun, the head generally undergoes a series of remarkable changes. The condensation at the centre becomes more marked; the brightness of the comet increases, and the coma seems to prolong itself into the faint, vaporous trace which forms the tail. The tail is almost always in a direction opposite to the sun, and sometimes attains to enormous dimensions. That of the comet of 1858 had a length, as calculated, of nearly 55,000,000 miles. Most frequently but one tail is formed, but comets with multiple tails are not uncommon; the year 1774 was made memorable by a great comet which showed six tails, spread, like a fan, across the sky. Most frequently the tail is straight, but it often exhibits a marked curvature.

That part of cometary astronomy which relates to the theories of comets' tails is by no means in a settled condition. The most commonly received theory is, that as the comet approaches the sun a part of the matter in the head is strongly attracted to that luminary; but that meeting with a powerful repulsive force, also emanating from the sun, this matter rises but a short distance before, under the influence of this repulsion, it is made to stream backward beyond the nucleus, like the smoke from a railroad train. This repulsive force is supposed to be electrical in character, and may arise from the heated condition of the sun's surface.

Many other theories have been proposed, but all are open to grave objection. Among these theories is a very beautiful one by Prof. Tyndall. He discovered that if a mixture of air and certain vapors filled a tube, the mixture would, under ordinary circumstances, show no change; but that if a beam of light were sent through a lens and into the tube, a decomposition of the matter inside took place, and the tube was filled with a luminous cloud. Now, according to the distinguished physicist, comets are composed of vapors which are readily decomposed by the sun's rays, and these rays shining through the vapors cause the luminous cloud, in this case the tail of the comet, to be manifested.