CHANGES IN THE STELLAR HEAVENS.

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IF we look up at the starry heavens on a clear, moonless night, all seems still, lifeless, and devoid of energy and motion. All of us are—or at least should be—familiar with the apparent diurnal motion of the star sphere, caused by the actual rotation of the earth on its axis, and with the slower annual motion, due to the earth's revolution round the sun, which brings different constellations into view at different seasons of the year. These motions, due to the great and universal law of gravitation, discovered and so ably expounded by the famous Sir Isaac Newton, are of course wonderful and orderly in their regularity, and bear silent testimony to the amazing power, majesty, and goodness of a great and glorious Creator. There are, however, other motions and changes, even still more wonderful, going on in the depths of space, which, though unperceived by the ordinary observer, have been revealed to the eye and contemplation of the astronomer by the accurate instruments and methods of research which modern science has placed at his disposal. Some accounts of these marvelous discoveries may prove of interest to the reader. The "fixed stars" are so called because they apparently hold a fixed position with reference to each other on the concave surface of the celestial vault, and do not, as far as the unaided eye can judge, change their relative positions as the planets do. Many stars have, however, what is technically called a "proper motion," which, though of course very minute, and only to be detected by the aid of refined and accurate instruments, yet accumulate in the course of ages, and sensibly alter their position in the sky. The largest "proper motion" hitherto detected (about seven seconds of arc per annum) is that of a small star in the constellation Ursa Major, known to astronomers as No. 1830 of Groombridge's catalogue. It has been calculated that this star is rushing through space with the amazing and almost inconceivable velocity of 200 miles per second!—a velocity which would carry it from the earth to the sun in about $5\frac{1}{2}$ days and to the moon in 20 minutes! The well known double star 61 Cygni has a proper motion of about five seconds of arc per annum, both components moving through space together. This is, as far as yet known, the nearest star to the earth in the northern hemisphere. Its parallax, as determined by Sir R. S. Ball, is 0.4676 of a second of arc, and by Prof. Pritchard (by photography) 0.43 of a second. Taking the mean of these values, its distance from the earth would be about 460,000 times the earth's mean distance from the sun, and its actual velocity about 33 miles per second. This is, of course, the motion at right angles to the line of sight, but as it may also have a motion in the line of sight, either to or from the eye, its real velocity is probably greater than this. The remarkable triple star 40 Eridani has a proper motion of four seconds annually. The components are a fourth magnitude star accompanied by a distant double companion which is a binary (or revolving double star), and accompanies the bright star in its flight through space. There are two other faint and distant companions which do not partake in the motion of the ternary star. In the year 1864 the bright star was situated to the east of a line joining these faint companions, but owing to its large proper motion it is now to the west of them. In the case of the triple star Struve 1516, one of the companions, which was to the west of the primary star in 1831, is, owing to the proper motion of the bright star, now to the east of it. Prof. Asaph Hall has found a parallax for 40 Eridani of 0.223 of a second. This, combined with the observed proper motion, indicates an actual velocity of about 54 miles per second. The star Mu Cassiopeie has also a large proper motion. This star, about 4,000 years ago, must have been close to Alpha Cassiopeie, and might have been so seen by the ancient astronomers. The proper motion of the bright star Arcturus is so considerable that in the course of about 30,000 years it will be near the equator, and about 10° to the north of the bright star Spica, from which it is at present separated by over 30° . These motions are of course those which take place across the face of the sky. There are, however, motions in the line of sight—both toward and from the eye—which have of late years been revealed to us by the spectroscopic, that wonderful instrument of modern scientific research, by the aid of which several new metals have been discovered, and which has been found so useful in chemical analysis, and even in the manufacture of steel by the Bessemer process. Some years since, Dr. Huggins, the eminent spectroscopist, found that the bright star Sirius, "the monarch of the skies," was receding from the earth at the rate of about 20 miles a second. Later observations at Greenwich Observatory showed that this motion was gradually diminishing, and within the last few years it has been found that the motion of recession has been actually changed into a motion of approach, showing that this giant sun is probably traveling in a mighty orbit round some as yet unknown center of gravity.

From a consideration of stellar proper motions, it has been concluded that the sun—and therefore the whole solar system—is moving through space. Recent investigations make the velocity of translation about 19 miles per second (30 kilometers). The Greenwich observations place the "apex of the solar motion" (as the point toward which the sun is moving is called) between Rho and Sigma Cygni, while Dr. Huggins' results fix a point near Beta Cephei. Both these points are near the Milky Way.

There are other startling changes which have occasionally taken place among the stars, and which must be looked upon almost in the light of catastrophes. At rare intervals in the history of astronomy "temporary" or "new" stars have suddenly blazed out in the heavens which were previously either unknown to astronomers, or else were invisible, except in the telescope. Some of these were of great brilliancy. In A. D. 173 a bright star is recorded in the Chinese annals as having appeared between Alpha and Beta Centauri (two bright stars in the southern hemisphere). It remained visible for seven or eight months, and is described as resembling "a large bamboo mat" (!)—a not very lucid description. It is worthy of remark that there exists at the present time, close to the spot indicated, an interesting variable star, which may possibly be identical with the bright star of the

second century. Perhaps the most remarkable of these wonderful objects was that observed by the famous Tycho Brahe in 1572, in Cassiopeia, and called the "Pilgrim." It was so brilliant that it rivaled the planet Venus at its brightest, and was visible at noon-day. It remained visible for over a year and then disappeared.

A small star close to its recorded position has been observed in recent years, and as it is thought to be slightly variable in its light, it may possibly be identical with the long lost star of Tycho Brahe. Another new star of almost equal brilliancy was observed in October, 1604, in Ophiuchus, a few degrees southeast of the star Eta Ophiuchi. The planets Mars, Jupiter, and Saturn were close together in this vicinity, and one evening Mostlin, a pupil of Kepler's, remarked that a new and very brilliant star had joined the group. When first seen it was white, and exceeded in brightness Mars and Jupiter, and was even thought to rival Venus in splendor! It gradually diminished, however, and in six months was not equal in luster to Saturn; in March, 1606, it had entirely disappeared. In 1670 a star of the third magnitude was observed by Anthelm near Beta Cygni. It remained visible for about two years, and increased and diminished several times before it finally disappeared. Flamsteed's star, No. 11 of Vulpecula, has been supposed to be identical with Anthelm's star, but Baily could not find that such a star exists. A small star has, however, been observed at Greenwich within one minute of arc of the place assigned to the temporary star by Picard's observations.

Variability has been suspected in this faint star, and according to Hind it has a hazy, ill-defined appearance about it, which may perhaps suggest that it may be a small planetary nebula, similar to Schmidt's new star of 1876 in Cygnus. A small new star was observed by Hind in Ophiuchus on April 28, 1848. When first noticed it was about the fifth magnitude. It afterward rose to about fourth magnitude, but very soon faded away, and, although still visible in the telescope, has become very faint in recent years. A new star of seventh magnitude was found by Pogson on May 28, 1860, in the well known star cluster known as 80 Messier in Scorpio. The light of the star when first seen obscured the light of the nebula. On June 10 the star had nearly disappeared, and the nebula was again seen shining with great brilliancy.

A very interesting temporary star—known as the "Blaze Star"—suddenly appeared in Corona Borealis in May, 1866. It was first seen by the late Mr. Birmingham, of Tuam, Ireland, on the night of May 12, when it was of the second magnitude and equal in brightness to Alphecca, the brightest star in the well-known "Coronet." It must have made its appearance very suddenly, for Dr. Schmidt, the director of the Athens observatory, stated that he was observing this region of the heavens a few hours previously, and noticed nothing unusual. It rapidly diminished in brightness, and on May 24 of the same year was reduced to nearly the ninth magnitude. It was soon discovered that the star had been previously observed, and its place registered by the great German astronomer, Argelander, as of magnitude $9\frac{1}{2}$, so that it is possibly a variable star of irregular period and fitful variability. When near its maximum brilliancy, its light was examined by Dr. Huggins with the spectroscopic, which showed the bright lines of incandescent hydrogen gas in addition to the ordinary stellar spectrum. This implies that the great increase in its light was due to a sudden outburst of hydrogen in the star's atmosphere. Some observers remarked that when viewed with the naked eye it decidedly twinkled more than other stars in the neighborhood, which rendered a correct estimate of its relative brightness somewhat difficult. During the years 1866 to 1876, Schmidt detected variations of light which seemed to show a period of about 94 days, and these observations were confirmed by Schonfeld.

On the evening of November 24, 1876, the late Dr. Schmidt, of Athens, discovered a new star of the third magnitude, near Rho Cygni, in a spot where he was certain that no bright star was visible four nights previously. When first seen, it was somewhat brighter than Eta Pegasi. It did not, however, remain long at this degree of brightness, but rapidly decreased, and on November 30 had faded to fifth magnitude. It afterward diminished very regularly, and in September, 1885, was estimated only fifteenth magnitude with the $15\frac{1}{2}$ inch refractor of Mr. Wigglesworth's observatory. The star was examined with the spectroscopic a few days after its discovery, and showed bright lines similar to the "Blaze Star" in the Northern Crown. One of these bright lines was believed to be identical with Kirchhoff's No. 1474, which has been observed in the spectrum of the solar corona during total eclipses of the sun. This star would seem to be quite new, as there is no star in any of the catalogues in its position. In September, 1877, it was examined with the spectroscopic at Lord Crawford's observatory, and its light was found to be almost entirely monochromatic (of only one color), showing that the star "had changed into a planetary nebula of small angular diameter" (!)

In August, 1885, a star of about seventh magnitude made its appearance close to the nucleus of the Great Nebula in Andromeda—a well known object visible to the naked eye, and which has been well called "the Queen of the Nebulae." The new star was independently discovered by several observers toward the end of August, but seems to have been first certainly seen by Mr. T. W. Ward, of Belfast, on August 19, at 11 P. M. At Greenwich Observatory the spectrum of the new star was found "of precisely the same character as that of the nebula, i. e., it was perfectly continuous, no lines, either bright or dark, being visible, and the red end was wanting." Dr. Huggins, however, on September 9, thought he could see from three to five bright lines in its spectrum. The star gradually faded away, and on February 7, 1886, was estimated only sixteenth magnitude in the 26 inch refractor of the naval observatory at Washington. From a series of measures by Prof. Asaph Hall he found "no certain indications of any parallax," so that evidently the star and the nebula, in which it probably lies, are situated at an immense distance from the earth. Prof. Seeliger has investigated the decrease in light of the star on the hypothesis that it was a cooling body, which had been suddenly raised to an intense heat by the shock of a collision, and finds a fair agreement between theory and observation. Answers point out the similarity between this outburst and the new star of 1860 in the

cluster 80 Messier, and thinks it very probable that both phenomena were due to physical changes in the nebulae in which they occurred.

With reference to the colors of the stars, some of the red stars have been suspected to vary in color. The bright star Sirius is supposed—from the description of it by ancient astronomers—to have been originally red, but this seems very doubtful. The Persian astronomer Al Sufi, in his "Description of the Heavens," written in the tenth century, describes the well known variable star Algol distinctly as a red star. It is now white, and this is perhaps the best attested instance on record of change of color in a bright star.—*Naturalists' Monthly*.

THE COMMON DANDELION.

By FREDERICK LEROY SARGENT.

IN the various names which the dandelion has received, we see expressed, for the most part, either a reference to the tooth-like recurved lobes of the leaves, Fig. 1, or an allusion to the medicinal properties of the plant. Thus, our English name is a modified form of

FIG. 1.

the French *dent de lion*, meaning lion's tooth, and in German we have the same idea expressed in *Löwenzahn*. Fifty years ago this plant appeared in the botanies as *Leontodon taraxacum*, the generic name being derived from the Greek *leon*, lion, and *odons*, tooth, and the specific from the Greek *taraxos*, to stir up, in reference to the effect of a dose. In later works we find the genus *Leontodon*, including the "fall dandelion" (*L. autumnale*), but not the true dandelion, which now appears in a genus by itself under the name *Taraxacum Dens-leonis*. Here the specific name is merely "lion's tooth" again, in Latin.

Finally, in the latest works our plant is given as *Taraxacum officinale*, since this has been found to be the name which, according to the rules of botanical nomenclature, takes precedence of all others. An allusion to the teeth is thus no longer retained, the only reference remaining being to the plant's official use.

To the majority of people the mention of the dandelion calls to mind not so much its medicinal properties as its use for food. Although its cultivation, either as a spring potherb or as a salad with blanched leaves, is comparatively modern, the wild plant seems to have been long valued as a vegetable. There is reason to believe that the Romans made use of it as a pot herb, and Chinese writers of the fourteenth century mention its being eaten in their country, although there is no evidence of cultivation at that time.

There are but few of our flowering plants that grow so widespread over the world. It occurs in North America from the Atlantic to the Pacific coast, in Europe, in Asia, and in the Arctic regions. This extensive range may in part be accounted for by the fact that our plant belongs to the large and aggressive family of the *Compositae*, and is thus related to such invaders as daisies, burdocks, and thistles. Still, the dandelion has more to recommend it than mere family connection; for, despite its lowly aspect, it is no poor relation, but, as we shall hope to show in the present article, it has many virtues of its own which entitle it to respect.

Prominent among these is its adaptability to the different conditions under which it grows. It seems to make the best of everything. If by chance a seed falls upon poor, thin soil, the young plant sends forth, as rapidly as possible, a rosette of leaves pressed close to the earth. And thus, on the principle that "possession is nine points of the law," it secures for its roots the use of a certain amount of territory quite safe from the encroachments of other plants. In rich ground the case is quite different, for here there is so much nutriment in a small quantity of earth, that the struggle for soil is not such a life and death matter as in the less favored localities. Consequently we find a large number of plants crowded together as close as they can stand; and it is obvious that if, under these circumstances, the dandelion should develop a flat rosette of leaves, the grass and other plants growing around would soon overshadow it, and it would have small chance for life.

Our plant, therefore, extends its leaves upward, and does its best to elongate them so as to keep pace with the growth of its rivals. But as these are for the most part grasses and plants which grow by elongation of the stem, the race for sunshine is rather in favor of these other plants, for the reason that a given amount of material put into a stem makes a stiffer organ than when put into a leaf. Still, even with these odds against it, the dandelion seems well able to hold its own, for it probably derives more or less advantage from the recurved lobes, or teeth, which give the plant its name. These are admirably fitted to act in much the same manner as a ratchet; and when the neighboring grasses are blown against the dandelion, a blade may slide along the margin of the leaf toward the base; but, as it springs back from its own elasticity, it cannot slide in the opposite direction, for a tooth will catch it, and thus force it to help support the leaf, and hold it up to the sunshine. We need not stop to consider how the dandelion behaves in soil which is neither very rich nor very poor, for enough has been said to show that it has not much to fear from any rivals it may meet under ordinary circumstances.

It is not only against the aggressions of neighboring plants, however, that our dandelion needs to be pre-