HAT is the latest in astronomy? Have astronomers recently made any startling discoveries? Is the question that an astronomer is often called upon to answer. While its general tenor is very flattering, inasmuch as it implies that the oldest of the sciences is as vigorous today as any of her younger sisters, the questioners forget that great discoveries are always the result of years of painstaking labor, that it requires the united work of many inconspicuous plodders to prepare the ground, so that the proper genius coming at the proper time, may complete the work, and thus seem to have done it himself.

Astronomers have indeed of late made a great discovery. It has come gradually. Very much preliminary work, much of it seemingly aimless except perhaps in its general purpose, had been carried on for years in the greatest observatories and by the most able men. But now the result may be announced with an assurance, which may not yet be called certainty, but which has promise of becoming so in the future. Before stating the discovery in its simplest way, let me make it more intelligible and more appreciated by preparing the ground in advance.

I must accordingly premise the knowledge of two, until now, totally dissimilar facts. The first is what is called the proper motion of the stars. When we speak of the stars, the older amongst us are apt to use the phrase "fixed stars." This adjective no longer appears in our modern text books, and the reason is that so many stars have been proved to be in motion, that is, in a motion of their own, on their own responsibility might say, that the proof of a star's being fixed or motionless
in space, would be as impossible by actual observation as it is false in theory.

The proper motions of the stars are generally divided into two classes, those athwart the sky and those in the line of sight. The first are shown by their lateral displacements in the heavens, by their apparently coming nearer to or receding from other stars. This is the only proper motion that a telescope can show. It is exactly like the blurring on a photograph of an object which moves during the time of its exposure. While we can readily measure its apparent motion by the length or width of its path in fractions of an inch on the photographic plate, we cannot know the real motion in space in feet and inches until we know the distance of the object.

As the determination of the distances of stars is probably the most delicate of all problems, the speed of the stars in miles per second is subject to much uncertainty. The ingenuity of astronomers has, however, discovered some way out of the difficulty, by treating the stars in classes instead of individually, and, by means of considerations which would take us too far adrift in the present article, finding with considerable reliability the distances and consequent proper motions in miles per second, of average stars of almost all magnitudes.

The second method finds a star’s proper motion in the line of sight, that is to say, directly towards or away from us in a straight line. This the telescope could not show except by an increase or decrease in the star’s brilliance, just as we may to some extent judge of the speed of an approaching or receding automobile at night by the rate at which its lights change in brightness. This is, however, absolutely impossible with the stars on account of their enormous distance from us. The spectroscope helps us out of the difficulty by showing us a slight lateral displacement of the star’s spectrum, just as if we were to cut a wall map in two and move one part a trifle out of place. This spectroscopic method has the enormous advantage that it gives us the velocity of the star in miles per second without our needing to know its distance from the earth. And besides, it
gives us the velocity of each star individually, with no assumption at all as to classes. While the first method gives us, to some extent the speed of a star in a direction parallel to the background of the sky, and the second gives it to us very accurately directly towards or away from us, neither of these two methods gives us the velocity in any other direction, that is, in what a non-professional might call a slanting direction. When both methods are applicable to the same star, as happens in some cases, we can, of course, compound the data and get the resultant direction and speed. In either method however, we observe a minimum, and we are sure that the star’s speed is at least as great as our measures indicate, and is most probably much greater.

We come now to the second fact that bears upon our subject, the classification of stars according to their spectra. A spectrum, as we all probably know, is the rainbow-colored band into which any light may be drawn by a triangular glass prism.

The sun’s white light is separated into all the colors, commonly denominated red, orange, yellow, green, blue, indigo and violet, with numerous black lines or interruptions, or at least dimnesses, in the series.

The stars give spectra very much like the sun, and this is a sure proof that they are self-luminous suns like our own, and that our sun is a star, like the unnumbered millions that dot our nightly skies. But while the general character of the spectra is the same for all the stars, they differ in particulars, that is, in their constituent colors, in the number and positions of their black lines. It has been possible, however, to divide all stellar spectra into a certain number of classes.

Experiments in the laboratory coupled with analysis have established a theory of evolution of the stars, according to which they condense from a diffuse nebula or cloud of cosmic dust, then become intensely brilliant and hot, white-hot as we may correctly say, when they are in their prime. Slowly the brilliancy and the heat lessen, the star becomes red-hot, and afterwards ceases to be visible at all. The period of the life history
of any particular star is shown by the character of its spectrum, especially by the number and position of its black lines and their sharpness or diffuseness. It goes without saying that untold millions of years are needed to complete the cycle of evolution. The painstaking, and apparently aimless, labor of astronomers has measured the proper motions of stars and tabulated them along with the class of their spectra. Professor W. W. Campbell, director of the Lick Observatory, deserves the credit of having been one of the first, if not the first absolutely, to suspect, then to detect, and finally to prove that there is a sure connection between the velocity of a star and the class of its spectrum. That is to say, and this is the great discovery, that if the theory of stellar evolution is true, as is generally admitted, then a star’s speed increases with its age. At the beginning of its career, when the matter that is to condense into a star, is nothing but a diffuse cloud of cosmic dust, it seems to have no motion at all, to be independent, as it were, of the force of gravitation. Slowly it gathers speed with age, and finally attains its maximum when it has, as we might say, ceased to be, ceased at least as a star in the ordinary sense, that is, as a sun, a self-luminous body.

Astronomers themselves are still so amazed by the greatness of this recent discovery, that they have not yet been able to recover their breath, and to tell us what must have been a star’s ancestry and what becomes of it when it is a dead sun. Difficulties there are already, of course, as there must be to every theory, but this one fits in so nicely with many other discovered facts, and is so universally accepted by the ablest leaders in the science, that astronomers are all on tiptoe to see what it will lead to.