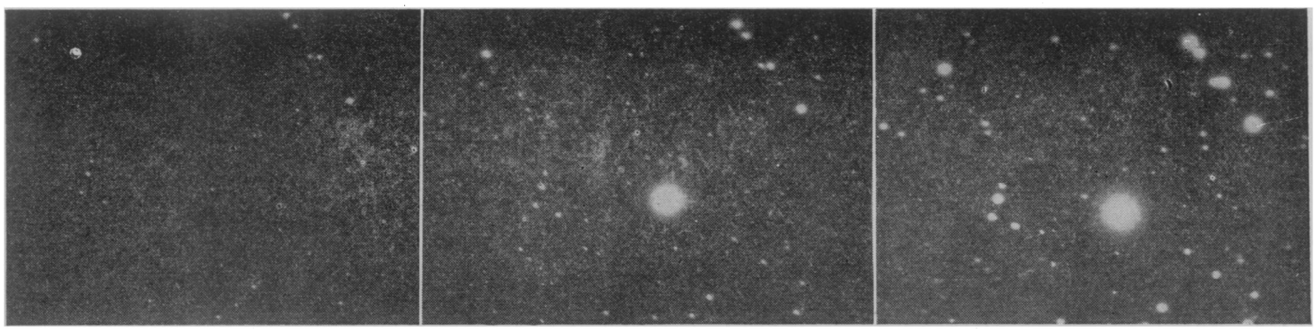
Exploding Star Astronomical Mystery

Astronomy



AN ILLUSTRATED HISTORY of nova Pictoris, from photographs made at the southern station of the Harvard College Observatory. Left: April 1, 1902; middle: Nov. 6, 1926, more than a year after the outburst; right: Dec. 19, 1927, showing a faint nebulous ring, which is now triple. In the first picture the star is faint and barely visible, but can be located with reference to nearby stars

By James Stokley

One night, several years ago, a telegraph operator happened to work late.

Messages must go over telegraphic lines day and night, so such an event is not uncommon. But this wasn't an ordinary telegraphic operator, and because he happened to work late this particular night there was brought to the attention of the scientific world one of the most remarkable of astronomical phenomena —a new star. The astronomer prefers to speak in Latin, so he calls it a "nova."

A nova is not really a *new* star. It is a star that has continued to shine for an indefinitely long period as an ordinary star, with nothing particularly striking about it to distinguish it from any of its myriads of neighbors. Then, suddenly, for some reason or other, it may become brighter than the brightest star in the sky. It may even become bright enough to be seen in the daytime.

This is what the telegrapher, whose name is Watson, and who lives in South Africa, observed in the early morning hours of that eventful night in 1925. As he returned from his night trick to his home, he looked at the sky, for astronomy was, and still is, his hobby. Low in the southeast was the constellation of Pictor, the painter. This is a group that never rises above the horizon for residents of northern contries. Even to people who live in places south of the equator it is never very conspicuous, for the brightest star in it, ordinarily, is of the third magnitude.

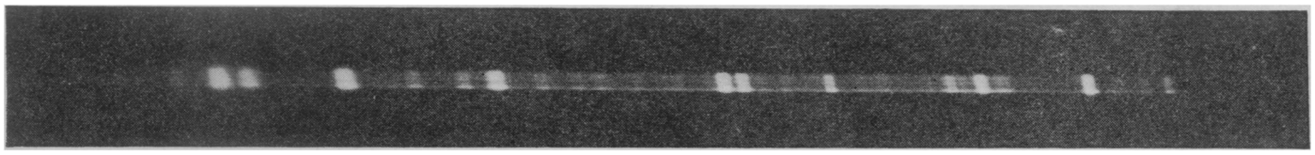
Watson looked at the constellation of Pictor in astonishment. For there was in it a bright star that he had never seen before, and about the same brightness as alpha Pictoris, the member of this group that is ordinarily the brightest.

As anyone should do who discovers something unusual in the sky, he immediately notified the nearest observatory, and from there the news was cabled to astronomers throughout the world. Astronomers in the southern hemisphere trained their telescopes on the strange apparition, and watched it, photographed it, and analyzed its light with their spectroscopes. Astronomers in the northern hemisphere, unable to see it, discussed it, and anxiously awaited further reports from the South, for it was the brightest nova that had appeared in many a year.

It soon became apparent that the discovery of this nova had some unique features. In the first place, a new star is not usually discovered until it has just about reached its greatest brightness. Many novæ have only been noticed after that, when their light had started to diminish. But thanks to Watson's keen eyes, nova Pictoris was found before maximum. For days after Watson's discovery it continued to brighten, until, by June 7, it was of the first magnitude. Then it was about as bright as Spica, the bright star in the constellation of the Virgin, in the southern sky in nights of the late spring. Early in July it had almost declined to the fourth magnitude, when it started to brighten again. By July 27 it was nearly of the first magnitude. Again it became fainter, going below the third magnitude by August 4. But once again it brightened, and five days later, on August 9, it was nearly as bright as on July 27. Since that time it has continued, on the whole, to get fainter, though the curve of its brightness—what the astronomer calls the light curve—shows great irregularities.

What was observed to happen in the spring of 1925 is a question that astronomers are still discussing.

The Harvard College Observaotry maintains a branch station in Bloemfontein, South Africa, to keep track of such stellar events as this, which cannot be seen from the United States. A few months ago Dr. John S. Paraskevopoulos, former astronomer of the Athens Observatory, who is now in charge of the Harvard branch *(Turn to next page)*



A CODE MESSAGE FROM THE STARS. The spectrum of nova Pictoris, obtained by the Harvard Observatory's southern branch by passing its light through the prisms of a spectroscope. To the astronomer, who can decode this cryptic message, is revealed a large part of the star's history. The red end is towards the left

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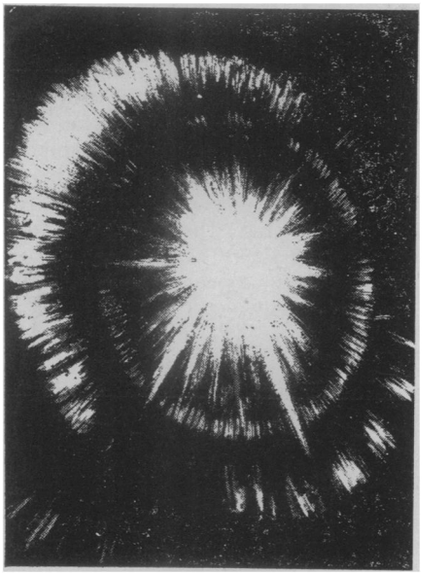


AN IMAGINARY DRAWING showing how nova Pictoris might appear if we were sufficiently close to it

reported to his headquarters in Cambridge that the star was surrounded by a nebulous ring.

Then word came at the end of March that another South African astronomer had observed the star to be double, consisting of two components, of similar brightness, and each rather nebulous. The ordinary star image is a sharply defined point of light. Their distance apart was said to be about half a second, which is one thirty-six-hundredth of the diameter of the full moon. Dr. Paraskevopoulos reported to Cambridge right after this that photographs he had taken did not reveal the extra star but that may have been because the two were so close together. The Johannesburg telescope is much larger than any that have yet been installed at the Harvard station.

One of the latest chapters in the strange history of nova Pictoris was written with the discovery of Dr. Harry E. Wood, also at Johannesburg, that the star is surrounded by a large ring, about a tenth of the moon's diameter, inside of which are two others.

In the history of past novæ, such an effect has been observed, and has been interpreted as waves of light emanating from the exploded star. That is, there is already material of some kind around the star before it bursts out, but as it is dark, we are not aware of its presence. Then whatever causes the stellar explosion, there is a sudden flash of light. As the light waves travel outward they illuminate this dark material, from which the light is reflected to the earth. Light travels fast enough to encircle the earth seven times in a second, but from our distant point of vantage we can see the gradual illumination of points farther and farther from the nova as the light waves advance.

This effect was first discovered by Prof. George W. Ritchey, an American astronomer then at the Yerkes Observatory, in the case of a nova that appeared in the northern constellation of Perseus.

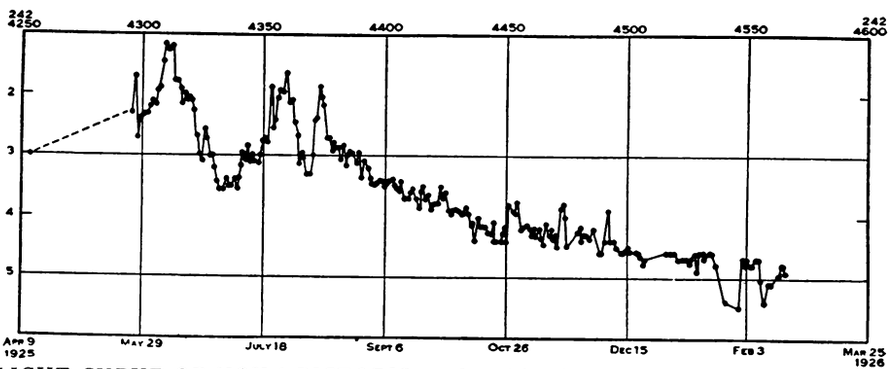
The rings around nova Pictoris, however, are probably not so caused. If they are due to light, it should not have taken almost three years for them to become apparent, unless the thing is much farther away than most astronomers suppose. Probably the rings are actual matter, thrown out from the star when it exploded. The fact that there are three rings may be due to the stuff that left the surface of the star at the first outbreak, seen on June 7, causing the outer ones, while the inner ones consist of stuff that left at the later explosions of July 27 and August 9. Another suggestion, made by Dr. Harlow Shapley, director of the Harvard Observatory, is that the material all left at the same time, but that it was of three kinds, the lightest traveling fastest and farthest, and so causing the outer ring, while the inner ones are due to heavier matter. Future observations of the relative distance of the rings will answer this question.

Since the appearance of these rings, there has been another suggestion to account for the appearance of two stars. Perhaps the stuff thrown out is not uniformly distributed in all directions, but most of it went in one particular way. This might now be gathered into a condensation that, with relatively small telescopes, might seem like a companion. A larger telescope would show its true character, possibly much like that of the illustration. Unfortunately the phenomenon occurred before the big 60" reflecting telescope, that is being constructed for the Harvard Observatory branch, is in use. At present there is no large reflecting telescope, comparable with the great instruments at Mt. Wilson, in the southern hemisphere, and so nova Pictoris cannot be studied with the biggest telescopes.

A new star is by no means a rare occurrence. At the Harvard College Observatory, where an elaborate file of astronomical photographs is collected, it had been found that, on the average, there are ten novæ a year. Most of these, it is true, are much too faint to be seen with the naked eye, and one of the brightness of nova Pictoris is uncommon. Not since 1918, when such a new star appeared in the constellation of Aquila, the eagle, had such a bright one been observed.

But the fact that most novæ are faint does not mean that they are not as violent as nova Pictoris or nova Aquilæ. It simply means that they are so far distant that they appear faint, and, if we were as close to them as we were to the most famous ones, they would doubtless look as bright.

Perhaps the catastrophe of nova formation can occur to any star. There are about a billion stars within reach of a great telescope, and if there are ten times this many that may become novæ, it would mean that, on the average, every star would be a nova once in a billion years. Vast though this period of time may seem, *(Turn to Page 19)*



LIGHT CURVE OF NOVA PICTORIS as plotted by the Harvard Observatory, showing how it brightened three separate times

Exploding Star an Astronomical Mystery—*Continued*

it is small compared with the lifetime of a star, and so many stars may have been novæ several times in their history.

Whether the sun has been a nova or not, or whether it will become one a year, a hundred years or even a million years hence, no astronomer can say. After a new star has burst out, it gets fainter again, and finally ends up pretty much the same as before the explosion occurred.

What is the cause of a nova? One of the first of the modern theories was that the outburst is due to the collision of two stars. All the stars are moving, and occasionally two might hit. Travelling at immense speeds, something would be bound to happen when they hit, and thus, it was said, caused the appearance of a nova. Simple as this theory might seem, it has one serious objection. The distribution of the stars in space is known, and they are so scattered that such a collision could not occur oftener than about once in a million years. And novæ happen much oftener than that.

Nova Pictoris, however, is unusual in more ways than one, and presents peculiarities never before observed in a nova. One is the doubling. Another is the multiple system of rings that has appeared. The third is the slowness of the changes. The usual nova returns pretty much to the *status quo* within a few months after the otburst, but here is nova Pictoris, three years later, and still of the seventh magnitude, far brighter than it was before it blew up. In fact, some astronomers think that possibly it may never return to the original brightness. This all indicates that something pretty serious happened to it, and different from the usual run of novae. Some astronomers have expressed the opinion that this is an actual collision. Perhaps, despite the infinitely remote chance estimated at once in 10,000,000,000 years, the thing has actually happened before the eyes of present-day man.

Another theory, that is widely accepted, takes account of the dark stuff that is scattered through the stellar system. These dark nebulæ, as they are called, are only visible when they happen to be in front of some brighter objects. Then we can see the outline of the dark stuff. Elsewhere it is probably present, though it is not visible. If a star comes along, and enters a cloud of this dark matter, the friction created will cause an outburst such as that of a nova. The alternate brightening and fading several times, as occurred in nova Pictoris, would be explained on this view as the result of the star encountering denser and rarer portions of the dark nebula.

But the latest ideas of astronomical science propose quite a different sort of origin, at least, for the typical novæ. Instead of the energy of outburst coming from outside sources, it is within the star itself, stored up in the atoms of which it is constituted. As yet physicists, and astronomers also, confess themselves in the dark as to just how this store of energy operates, but the continuous emanation of energy from radium, as it breaks up into simpler elements, gives a glimpse of the energy in the atoms.

What would cause this stored energy to be suddenly released at a given time? One suggestion is that the collision not of another star, but a small body, perhaps no larger than a meteor, might act as the trigger to set off the explosion.

Prof. Henry Norris Russell, famous Princeton astronomer, has given a picture of the way this might occur. A meteor hits the star, and travels deep into the star's interior before encountering layers dense enough to stop it. Then the energy that it had by virtue of its motion is changed to heat and a "pocket" of extremely "hot stuff" is formed. It might be millions of degrees in temperature. This great temperature might then cause further release of energy from the atomic sources, then the gases of which the star is made at that point expand so rapidly that there is a literal explosion, carrying with it the higher layers of the star. This causes an expanding shell of matter that seems to be characteristic of all novæ.

After the explosion the temperature drops back to an ordinary stellar magnitude, the pressure is relieved, and, on the whole, the star is pretty much the same as before. True, the great amount of heat suddenly liberated might travel to a set of planets surrounding the star. There might even be living creatures on the planets who would be instantly killed. But this is a trivial incident. What are a few million human beings compared to the life history of a star?

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The first person to have his portrait on a coin was Alexander the Great.

New Airship Era Seen

Aeronautics

Remarkable demonstrations of the airship will be made before the end of this year, Gilbert Betancourt, airship engineer of Detroit, predicted to the aeronautic division of the American Society of Mechanical Engineers at its recent Detroit meeting.

"Two British airships and one German, all larger and better than any heretofore built, are to be completed and launched for demonstration flights all over the civilized world within the present year; and a naval contract for two American Zeppelins of great size is soon to be signed, and construction will be started before the end of the year," he said.

A real issue before the country at the present time, he said, is whether this nation shall strive for the lead in rigid-airship development and construction, or continue trailing behind the three airship-wise European nations.

"The development of the rigid airship started in Germany some thirty years ago," Mr. Betancourt said, "and as yet there is but one such craft in this country, the Los Angeles, and this was built in Germany. Great Britain, Germany and Italy are some three to five years ahead of us in airship building since the war. The reasons are obvious. As a German invention, the rigid airship was energetically developed into an efficient and safe craft which was used by the Germans during the war. England was near enough to the development of this new machine to give it serious study; but America was too far away to realize the possibilities of this form of aircraft. One good rigid airship was built in this country some five years ago; since then attempts have been made to interest the government in building more, but the people of the country at large do not know yet what the airship can do, or its possible use in our transportation system.

"No doubt, the world-wide demonstration of the three new European rigid airships will aid materially in clarifying the practical uses of airships. But it is certainly not to our credit to lag so far behind Europe in the development of airships.

"Another serious handicap is the cost of manufacturing this type of aircraft. Either Germany or England can build a rigid airship for about half as much as we can at present, because *(Turn to next page)*