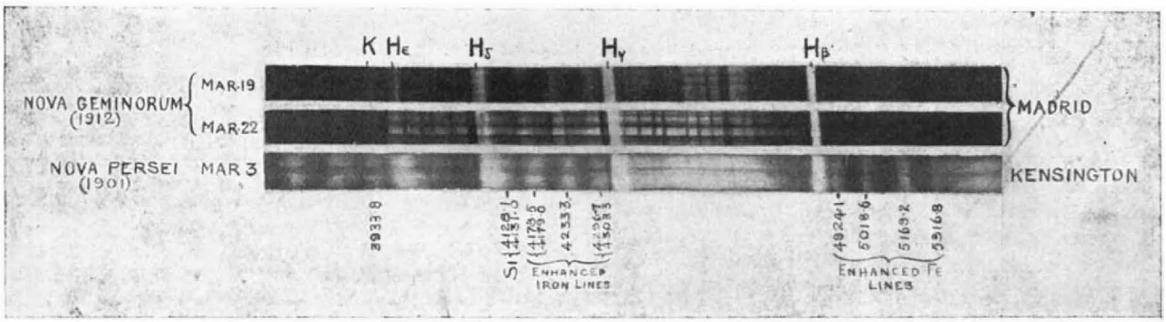
hundred million tons, and, on a moderate estimate, this would require some ten million tons of meteoric iron to be accounted for. Mr. Thomson advances many arguments, and evidently concludes that the crater was produced by a meteoric fall. To account for the non-discovery of the main mass, he suggests that, as the meteor would probably not fall vertically, bore-holes should be made under the southern and south-western walls of the crater where the strata are peculiarly disturbed; the twenty-eight bore-holes already made have all been near the centre and have revealed undisturbed sandstone at a depth of 850 ft. below the crater bottom.

NOVA GEMINORUM NO. 2.

THE brightness of Nova Geminorum would appear to have reached that stage when further diminution is very slow but steady. On Friday last at 8.45 p.m. an observation made in a 4-inch finder showed the nova to be but a shade brighter than the neighbouring star 984, of which the magnitude is given variously between 6·8 and 7·2.

By the courtesy of Father Iñiguez we have been permitted to examine four excellent spectrograms of the nova, secured by him at the Madrid Observatory on March 17, 19, 22, and 24 respectively, and transmitted to NATURE.



Father Iñiguez reports that between March 16 and April 10 the spectrum underwent important modifications, of which he especially mentions the changes in the structure of the hydrogen lines, the almost total disappearance of the bright calcium radiation, K, since March 20, and the marked diminution of the ultra-violet part of the spectrum. The principal radiations are those of hydrogen, each bright band being accompanied by the usual well-marked dark band on its more refrangible edge; during the last days of March the more refrangible bright hydrogen bands became relatively weaker, Hε becoming much weaker, relatively, than Hβ and Hγ, while the bright Hζ nearly disappeared.

In addition to the bright lines there are numerous dark lines, especially between Hβ and Hγ, which Father Iñiguez describes as absorption bands, and among which he recognises the helium lines at λλ4026, 4144, 4388, and 4472, and the spark line of magnesium at λ4481. He also directs attention to the apparent separation of the bright and dark hydrogen lines which attained its maximum between March 22 and 24; the apparition of a bright line traversing the dark companions gave the hydrogen pairs an appearance of duplication which, we believe, has also been recorded at the Cambridge Observatory.

Father Iñiguez states that considerable variation in the number, intensity, and definition of the numerous bright and dark lines has been very noticeable. From March 22, when a magnificent spectrum was photographed, the lines became more prominent and also became more uniform *inter se*, more particularly between Hβ and Hγ; generally speaking, the dark lines are relatively diffuse and ill-defined.

A recrudescence of activity in the star was observed on March 23–25, since when the nova has gradually decreased in brightness. The increase of redness contemporaneous with the decrease in the intensity of the ultra-violet spectrum is remarked upon by Father Iñiguez, who further discusses his spectra in No. 16 of the *Comptes rendus*.

For the purpose of comparison we reproduce two of Father Iñiguez's spectrograms, taken on March 19 and 22 respectively, alongside a spectrum of Nova Persei photographed at South Kensington on March 3, 1901. It will readily be recognised that although there are important differences in the minor details, the two spectra are, in general, very similar; consequently the explanations of the chemical origins of the lines in Nova Persei given by Sir Norman Lockyer in 1901 hold good, generally, for those in the spectra of Nova Geminorum. In that paper it was shown that the chief bright lines other than hydrogen could be adequately represented by the principal enhanced lines of iron, and, in a less degree, of other metals.

Comparing the Madrid spectra, the abnormal decrease of the bright calcium radiation, K, between March 19 and 22 is very readily discerned. Attention should also be directed to the apparent reversal of the dark hydrogen lines, especially noticeable in Hγ on March 22, which is evidence in favour of these dark bands, at least, being true absorption phenomena.

While the comparison shows that the spectra of the two novæ are in general very similar, there are differences in the details, as is shown in the subjoined description by Mr. F. E. Baxandall, based upon a careful examination and discussion of the several photographs at the Solar Physics Observatory:—

Spectra of Nova Geminorum.

A comparison of the excellent spectra of Nova Geminorum obtained on March 19 and 22, by Father Iñiguez, of the Madrid Observatory, with that of Nova Persei photographed at Kensington on March 3, 1901, shows that in the main features the spectra of the two novæ are the same. The well-marked bright hydrogen lines in Nova Geminorum are accompanied by strong absorption lines on the more refrangible side, and the isolated bright bands between Hγ and Hδ typical of novæ spectra are present. The Nova Persei band at λ4130, probably due to protosilicum $\left\{ \begin{matrix} \lambda 4128{\cdot}2 \\ \lambda 4131{\cdot}0 \end{matrix} \right\}$ and identical with the conspicuous double line in such stars as α Cygni, Rigel, and Sirius, is either lacking in Nova Geminorum or occurs only very faintly.

Between Hγ and Hβ the spectra show the usual complex set of bright lines seen in previous novæ.

Amongst these are what appear to be absorption lines, but, judging from other regions of the spectrum, the *bright* lines are the authentic ones, and the apparent absorption lines are more likely to be interspaces between bright lines, and have little or no significance as spectrum *lines*.

The well-known series of bright nova lines on the less refrangible side of Hβ at λλ4924, 5018, 5169, 5276, 5317, seen in Nova Persei and Nova Aurigæ, are not well shown in the Madrid spectra, only the first two of these being faintly seen. This is probably due to the plates used by Iñiguez being not very sensitive to this part of the spectrum, and not due to any real lack of lines in the spectrum.

These bright lines and those previously mentioned between Hγ and Hδ (λλ4176, 4233, 4300) were recorded by Sir Norman Lockyer in a series of Royal Society papers on Nova Persei in 1902, as being due to the enhanced lines of iron $\lambda\lambda \left\{\begin{matrix}4173\cdot5\\4179\cdot0\end{matrix}\right\}, 4233\cdot3, \left\{\begin{matrix}4296\cdot7\\4303\cdot3\end{matrix}\right\},$ 4924·1, 5018·6, 5169·2, 5276·2, 5316·9. These are the only enhanced lines of iron in the two regions mentioned, and they are *all* represented by strongly marked lines in α Cygni. A direct comparison of the α Cygni spectrum with that of Nova Persei will show that these isolated strong lines of α Cygni fall exactly on the middles of the broad, bright nova lines.

Some of the lines mentioned have, in previous publications on novæ spectra, been ascribed to various origins. The λ4924 and λ5018 lines have often been referred to as helium lines, although much stronger lines of the same element have been lacking. The line λ5018 is also sometimes identified with the chief nebular line. The line λ5169 is often referred to as being probably the "*b*" group of magnesium, and the line λ5316·9 as being probably the chief corona line. The fact that all these lines occur together as strong lines in the spectrum of a normal star—α Cygni—and that they can all be adequately accounted for by specially behaved lines of one chemical element—and those the *only* special lines of that element in the region discussed—must surely be taken as convincing evidence that the identity is a real one.

In the region between Hγ and Hβ, the nova spectrum is far more complex, but so also is that of α Cygni, and here again the chief lines in the nova spectrum agree in position with lines or groups of lines in α Cygni. In this part of the α Cygni spectrum there are enhanced lines of iron, magnesium, chromium, and titanium, but there is little or no doubt that in the nova spectrum the chief lines, other than those of hydrogen and calcium, are due to iron.

The most striking changes between the spectrum of March 19 and that of March 22 are: (1) the occurrence of what seems to be a fine bright reversal in the middles of the dark Hγ and Hδ bands (more particularly the former), and (2) the appearance of a bright band, the centre of which is at about λ4440, superposed on what was a broad, dark band on March 19. One of the strongest lines in Wolf Rayet spectra occurs at or near this position (4442), and the two lines may possibly be identical. Unless, however, some of the other strong Wolf Rayet bands, such as λλ4652, 5692, 5813, are also found in the spectra, little weight can be attached to the suggested identification.

F. E. BAXANDALL.

Magnitude observations of the nova are published in Nos. 4566–67 of the *Astronomische Nachrichten*, and Dr. Rosenberg describes his observations of the spectrum at the Tübingen Observatory. On March 19 a red-sensitive plate showed well-marked radiations corresponding to Hα, Hβ, and Hγ. Their breadth was about 30 A.U., of which 9 A.U. was shifted towards the red, and 21 A.U. towards the violet from the normal positions. Hγ presented three maxima at λλ4348, 4339, and 4332 respectively, and an examination of the spectrum for polarisation effects gave a negative result.

In a report to the Harvard College Observatory Prof. Frost states that a spectrogram taken on March 15 shows the H and K lines bright, at about their normal positions; they are strong and broad and crossed by very sharp, dark lines. The lines at λ4923 and λ5016, which Prof. Frost ascribes to helium, are strong, both bright and dark, but the line at λ4472 is not conspicuous, although probably present.

WILLIAM E. ROLSTON.

THE LOSS OF THE "TITANIC."

THE terrible loss of life on account of the disaster to the *Titanic* has directed emphatic attention to various aspects of the employment of wireless telegraphy in times of crisis at sea. The point which is at the moment attracting most of the public attention is that of the erroneous messages, or alleged messages, which appeared in the newspapers in the day or two following the disaster. Possibly some of these messages may have been invented by imaginative reporters, but others seem to have been perversions of messages which had actually passed between vessels at sea, but which were not concerned with the accident. This kind of mistake is well illustrated by the transformation undergone by a message containing the words, "Am towing oil-tank to Halifax." Such mistakes as these are possible in all kinds of telegraphy, but they probably arose in the present case at the hands of some of the amateur wireless telegraphists that swarm on the American coast. Some of these amateurs, it is widely believed, may indeed have originated of set purpose a number of the early reassuring messages, and it is clear that the possibility of rigging the insurance market by such messages affords motive enough for their concoction. It is most unlikely that intelligence of this character should have been sent in irresponsible moments by operators on liners, for the operators are under the direct control of the captains, the service discipline is strict, and every message has to be recorded.

All this raises more prominently than ever the chaotic condition of wireless telegraphy in the United States. For years the legitimate users of wireless telegraphy have complained of the unbounded freedom enjoyed and abused by the American amateur; perhaps they may now look forward to the imposition of some salutary restrictions. But besides that aspect of the matter just discussed, there is another which this catastrophe has brought into prominence. It is now impressed on us that the most urgent call for help will pass unheeded if none of the operators on the ships within hail are on duty. In fact, it seems to have been a mere chance that the *Carpathia* operator was at his apparatus at the time the *Titanic* called. On ships that carry only one operator—and very few carry more—the man cannot always be on the look-out. For this deadly contingency one obvious remedy is for each ship to carry more operators; another remedy lies in the provision of an apparatus that will ring up the telegraphist when a message reaches it. This latter desideratum is, unhappily, as yet unattained.

Engineering aspects of the disaster are discussed in the leading article in *Engineering* for April 19. As but little definite information is available as yet, the drawing of conclusions is premature, but several questions present themselves as ripe for discussion and settlement. The effect of centre-line or longitudinal wing bulkheads is one of these Such have