Nova Geminorum, No. 2 (1912), made between March 12 and the end of May, are published and discussed by Herr J. Fischer-Petersen in No. 4608 of the *Astronomische Nachrichten*. The light-curve shows oscillations somewhat similar to those of Nova Persei in 1901, but of less amplitude and longer period. The maximum magnitude, 3·8, was reached on March 14, and then there was an abrupt fall, to 5·4, on March 16; subsidiary maxima occurred on March 24, 30, April 3 and 9, that on the first-named date being very marked (mag. = 4·8). After April 9 the undulations of the curve are very small.

THE DARK STRUCTURES IN THE MILKY WAY.—An interesting paper full of suggestion as to the structure of the universe is contributed by the Rev. T. E. Espin to No. 4, vol vi., of the Journal of the Royal Astronomical Society of Canada. Mr. Espin recalls Caroline Herschel's idea that a blank region in Scorpio was believed by Sir William Herschel to indicate "something more than a total absence of stars," and then, by the examination of other blank regions, he proceeds to show that in all probability there exist in the heavens masses of dark, light-absorbing vapours, which hide from us the light emitted by stars or parts of nebulæ in the background. The photographic evidence seems almost irrefutable, it being difficult to explain otherwise such observations of Dr. Kopff's that "nearly all faint stars have disappeared from the immediate surroundings of these nebulæ, though they are ten times more numerous, both in the nebulæ and far outside." But if we suppose the bright nebulæ which are shown on our photographs to have margins which are too diffuse to become illuminated, yet dense enough to absorb, the difficulty is removed, and if this absorbing margin, or extension, is projected, by the position of our view-point, on to the main body of the bright nebula, the "holes" and "lanes" observed in such nebulæ are similarly explained. A number of beautiful photographs to illustrate Mr. Espin's article are reproduced.

Dr. Chant also has a paper in the same journal, dealing with nebulæ and their forms, and this, too, is illustrated by many interesting reproductions.

STELLAR ACTINOMETRY AT THE YERKES OBSERVATORY.—A paper of great importance to astrophysicists and workers in stellar photometry is published by Mr. J. A. Parkhurst in No. 3, vol. xxxvi., of *The Astrophysical Journal*. For many years Mr. Parkhurst has been working on the relations existing between photographic and visual magnitudes, and has published details of a method whereby both could be measured photographically. He now publishes the results of a much more extended research, and gives both the photographic and visual magnitudes for some 650 stars, down to magnitude 7·5, in the Potsdam Photometric *Durchmusterung*, from 73° to the pole. The photographic magnitudes were measured from extra-focal images on Seed 27 plates, and the "visual" from reflector plates taken in the focus on colour-sensitive plates, and with a specially prepared colour-filter; Mr. Parkhurst fully describes the ingenious methods of eliminating or determining the numerous errors inherent to the observations. Then in his catalogue he gives the colour index of each star and, where possible, the type of spectrum; comparisons with the results obtained by other observers show fair agreement. The relation between spectrum and colour index, using the Harvard classification for the former, is best represented by a straight line, the differences being so slight as not to warrant the introduction of any complex curve to show the relation. There were 492 stars in this catalogue bright enough to give spectra which could be classified, and, of these, exactly half belong to the types B_2 to F_0, and half to types F_1 to M; 196, or 40 per cent., are of the A type. At the nearest approach to the galaxy, viz. 10° in R.A. 1h., each field showed some ten or twelve white stars, while at the greatest distance from it, viz. 44° in R.A. 13h., there were only two or three white stars per field.

THE IRON AND STEEL INSTITUTE.

THE autumn meeting of the Iron and Steel Institute, which was held at Leeds on September 30 and October 1–4, may fairly be described as a "practical man's" meeting, for although the programme contained approximately an equal number of "practical" and "scientific" papers, those read and discussed at the meeting belonged entirely to the former class. While this is no doubt satisfactory to a large number of members of the institute who take rather less interest in scientific metallurgy than might fairly be expected of them, it is rather hard on the authors of scientific papers and on those members who were attracted to the meeting by the array of such papers on the programme. It is true that on other occasions the programmes have erred in the opposite direction, and it may be hoped that at future meetings a judicious blending of both types of papers may be brought up for discussion.

Among the papers relating to steel-works practice, the greatest interest and importance attaches to those dealing with the question of the production of sound ingots. Sir Robert Hadfield, F.R.S., who presented papers on a method of producing sound ingots and on a new method of revealing segregation in steel ingots, introduced the subject by referring to the series of alarming rail-fractures which had occurred in America during the exceptionally severe weather of last winter. These failures, and others which occur under less severe conditions, he is inclined to ascribe to unsoundness in the steel ingots from which the rails are rolled. According to the treatment and additions which a steel has received, the resulting ingot may suffer from unsoundness of one of two distinct types; the ingot may be more or less full of cavities or blow-holes of varying size and distribution, and in that case it is a non-settling, non-piping steel in which gases have been liberated during solidification in the mould. On the other hand, by suitable additions of small quantities of silicon or of aluminium, the steel may be rendered "solid" or "settling" in the sense that the ingot will be free from blow-holes or small distributed cavities, but it will—in the absence of special treatment—have a deep central cavity or "pipe," the existence of which results either in the discarding of a large proportion of the finished steel by the rejection of the upper portion of the ingot, or, if the piped portion is not sufficiently discarded, an unsound rail may be rolled from it, possibly with disastrous consequences.

In one of his papers Sir Robert Hadfield suggests a method of studying the formation of such pipes by pouring molten copper into the ingot at a certain stage of its solidification. He illustrates this method by coloured sections of ingots thus treated, but in the discussion Dr. J. E. Stead, F.R.S., pointed out that the copper when poured in will partly alloy with the still molten steel, and will then, by its greater density, produce an upward displacement of the remaining liquid steel, so that Hadfield's pretty method is really only applicable if the copper is introduced immediately after the complete solidification of the steel. Even if introduced earlier, however, the copper makes it possible to trace the order in which the various parts of

an ingot have solidified, and even that information is of some importance.

Sir Robert Hadfield's method for producing sound ingots consists in producing solid "piping" steel, and then arranging matters in such a way that the tendency to form a pipe is neutralised by a full supply of hot liquid steel from above. This is attained by attaching to the top of the ingot-mould a "feeding head" lined with sand; this practically constitutes an upward continuation of the ingot-mould, and when the mould is filled the steel is allowed to rise to some distance into this attachment. The steel in this feeding-head is, however, to be kept molten until the solidification of the ingot proper is completed, and this is attained in Hadfield's process by covering the surface of the steel first with a thin layer of cupola slag, which serves to protect the metal against both thermal loss and chemical contamination, and then with a layer of charcoal, which is brought into a lively incandescence by the action of a blast of compressed air. The author gives numerous examples and full particulars of results attained in this way, and although in the discussion on this subject doubts were expressed as to the practicability of the process, and to some extent as to its novelty, its efficacy was admitted.

Another method intended to serve the same purpose of producing sound ingots was described by Dr. Hans Goldschmidt, who claims for it favourable results with thousands of actual ingots. This method consists in the introduction into the central, fluid part of a partially solidified ingot of a cartridge of "thermit." The amount of thermit used is small—about one pound per ton of steel—so that the heat generated is strictly local and quite negligible. The introduction of the thermit cartridge, which consists of an iron canister pushed down with an iron rod, results in a boiling or frothing up, followed by a settling of the steel in the mould, this shrinkage being made good by the addition of a further small amount of molten steel from the ladle. The author suggests that the thermit reaction taking place near the bottom of the solidifying ingot results in the removal of gas and of entangled slag, but this point of view was not at all appreciated in the discussion; in fact, Dr. Goldschmidt's proposals were scarcely taken seriously. Thus Stead suggested that the addition of a small amount of aluminium to the steel in the ladle would produce the same effects—a suggestion strongly repudiated by Goldschmidt. In view of the large amount of practical evidence brought forward in the paper, this treatment was a little surprising.

In the course of the discussion on these papers, Dr. J. E. Stead described a method introduced by Talbot for the production of sound ingots. In this process the ingots are passed through the "cogging mill" before their interior portions have become solid, and in this way the wider end of the ingot is compressed and the liquid steel is forced to fill up any shrinkage cavities which might be in course of formation. In principle this process is similar to the Harmet method of compressing steel ingots during their solidification, but if it proves to be practicable to handle and lightly roll ingots consisting of molten steel with a mere external crust of solidified metal, the method may justify the enthusiastic predictions of its sponsor. Talbot's own account of his procedure, with the statistical data demanded by Hadfield, will, however, be awaited with interest.

Among the more scientific papers which were taken as read at the meeting, the most interesting from the general point of view is that of Benedicks on allotropy in general and that of iron in particular. In this paper the author begins by raising the question whether allotropic or polymorphic changes are necessarily sudden, *i.e.* whether they must occur at one definite temperature or whether they may in certain cases occur continuously over a certain range of temperatures. He arrives at the latter conclusion, and expresses it by saying that all degrees of mutual solubility of the two allotropic modifications in one another are theoretically possible. In the case of a considerable mutual solubility an allotropic "transformation point" would cease to exist, but where the solubility is one-sided, the modification ii. being slightly soluble in the modification i., but not *vice versa*, there would be a gradual change upon one side of the transformation point with a large sudden change at that point itself. By means of accurate dilatometric measurements on silver iodide, Benedicks shows that the transformation of this body is of the type just indicated, the curve of dilatation giving the precise shape required on the assumption that the high-temperature modification is to some extent soluble in the low-temperature modification at temperatures just below the transition point, the solubility decreasing with falling temperature. This accounts for the negative dilatation at room temperatures.

When this view is applied to the case of iron, the author considers that the critical point at or near 890° C. is a definite allotropic change-point, but he does not regard beta iron as a separate allotropic form, explaining the existence of the beta range on the basis that gamma iron is soluble in alpha iron to an extent which increases with the temperature until the critical point is reached. Benedicks considers that this view would greatly simplify the metallography of iron, since it would reconcile the three theories now accepted as most probable regarding the nature of martensite. This interesting paper would undoubtedly have given rise to one of those spirited discussions for which this particular subject is noted, and it is a pity that so important a communication should have been passed over; it may be hoped, however, that it will receive full attention in the discussion by correspondence which forms so interesting a feature of the Journal of the institute.

HEREDITY AND EUGENICS.

THE third and last number of *The Mendel Journal* contains an interesting article on the alternative heredity of mental traits, by Dr. Frederick Adams Woods, of the Massachusetts Institute of Technology. Dr. Woods's previous studies of heredity as exemplified in Royal families attracted a great deal of attention, and the present short paper based on the same class of material is well worthy of study. He advances the argument that the contrasts shown in the characters of children born of the same parents and brought up in the same environment are evidence for, and not against, the inheritance of mental traits. Those who would insist, as many do, that psychical characters are wholly the expression of the environment will find these contrasts very difficult to explain, but to their opponents who attribute the preponderating influence to heredity they present no difficulties, since the possibility of alternative inheritance has never been disputed. Among the other contents of the number is an article on primitive eugenics, by Mr. E. Torday, in which the eugenical value of the customs of certain central African tribes is pointed out and their good effects described.

The American Eugenics Record Office was founded in 1910, and is now well established in a career of useful activity. Among its latest publications is Prof. C. B. Davenport's "Trait Book" (Bulletin No. 6).