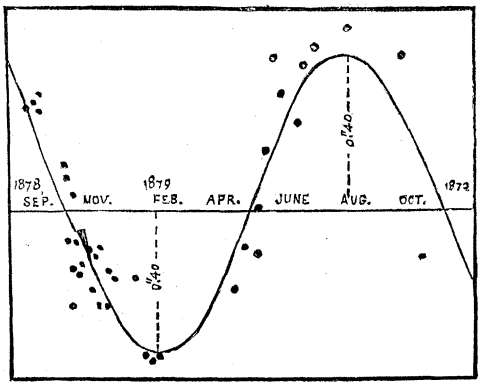
RESEARCHES IN STELLAR PARALLAX.

THE observatory of Trinity college, Dublin, has long been the most famous spot on earth for determinations of stellar parallax; and the labors of the present astronomer royal of Ireland, Dr. Ball, conducted in the same line of research, will make good the claim of this institution to such distinction for a long time to come. Before the time of Dr. Brünnow, formerly astronomer royal at Dunsink, no astronomers had, except in isolated instances, attacked the problem of stellar parallaxes for its own sake; that is to say, the determinations of parallax had come about rather incidentally, and had not been undertaken with the idea of determining stellar distances as the sole end of the research. The painstaking care which Dr. Brünnow exercised as an observer, and his conscientious thoroughness in the subsequent numerical work based on his observational data, were so skilfully combined as to show that the distances of the stars were readily determinable with a hopeful, and to a certain extent satisfactory, precision. The stars with which he was largely occupied were α Lyrae, Groombridge 1830, 85 Pegasi, and δ Draconis.

Dr. Ball, appointed astronomer royal some ten years ago, has wisely devoted the resources of the Trinity college observatory in the main to parallax research, and he has greatly amplified the plans of his predecessor. In the present volume he details the method by which his observations in systematic search for stars with a large parallax have been conducted; and it is plainly apparent how an enthusiastic worker can completely observe so many stars when special pre-arrangements are adopted for the economy of time and labor. With slight changes, these same methods would be equally applicable to the details of other observatory work, and would result in an equal saving: the methods are quite similar to those now so common in the details of library management, and have already been adopted by many astronomers in facilitating their work.

It will be a matter of interest to many to know how, from the myriads of stars in the sky, Dr. Ball was guided in the selection of a list embracing about a thousand objects. In the first place, only such objects were taken as were included between 30° and 65° of north declination, and every object of importance in Admiral Smyth's celebrated cycle of celestial objects was transcribed into the working-lists. Struve's catalogue was also drawn upon, and likewise catalogues of red stars by Schjellerup and Birmingham; the hypothesis with regard to objects of this type being that their color may be due to their small size, and thus presumably less far removed from the solar system. A number of the variable stars, also, are probably very small, and they were included in Dr. Ball's lists for a like reason.

It will not be understood that Dr. Ball's work amounts to a conclusive determination of the distances of all these objects: the objects of his research are at present very different from this; and his labors were directed with main reference to a decision, in all cases, whether the observed stars indicate a sufficiently large parallactic displacement to merit further immediate attention. Of course, there was no disappointment in finding that a very small proportion of the objects examined gave satisfactory evidence of a measurable parallax; but the labors of Dr. Ball are none the less important to future observers as indicating clearly the direction in which there is no pressing need of similar investigation. So much for the inconclusive part of this work. And we may now speak of the positive results in the shape of accurate determinations of the parallax of 61 (B) Cygni, Groombridge 1618, and 6 Cygni (B).



PARALLAX IN DECLINATION OF 61 (B) CYGNI.

The first star belongs to the famous binary system, the first determination of whose distance was made by the illustrious Bessel; and Dr. Ball finds its annual parallax to be very little short of half a second of arc. In order to show the degree of accuracy attained in

Astronomical observations and researches made at Dunsink. Fifth part. Observations in search of stars with an annual parallax. By ROBERT S. BALL, LL.D., F.R.S., astronomer royal.

Heliometer determinations of stellar parallax in the southern hemisphere. By DAVID GILL, LL.D., F.R.S., her Majesty's astronomer at the Cape of Good Hope, and W. L. ELKIN, Ph.D. Forming part i. of the forty-eighth volume of the memoirs of the Royal astronomical society.

such observations, we reproduce Dr. Ball's diagram representing his present series of observations on the assumption of his finally deduced parallax, 0″.4676. If this is the star's true parallax, it cannot affect the observed declinations to a greater extent than 0″.40, which is the maximum length of the ordinates in the curve. The large black dots indicate the observations, while the curve shows at every point the calculated effect of parallax. Of the discrepancies between the two, Dr. Ball remarks, that though some of them "seem large, relatively to the total amount to be measured, yet the greatest divergence of the observation from the curve is not more than the angle subtended by a penny-piece at the distance of fifteen or twenty miles."

Of Groombridge 1618, a star remarkable for its proper motion, we need only say that the parallax resulting from an elaborate series of observations is 0″.322 ± 0″.023; and, of the star (P iii. 242) suggested by Struve as suitable for a parallax series, that Dr. Ball finds its parallax inappreciable. Of the star 6 Cygni (B), however, more should be said, as comparison with 61 (B) Cygni shows both stars to be binary systems, with a large proper motion common to both, and color and magnitude substantially identical. Dr. Ball's investigations point to a parallax of 0″.482 ± 0″.054, so that to the other features of resemblance of the two systems we are to add the fact that the two objects appear to be equally distant from the solar system.

The parallax determinations of Dr. Gill and Dr. Elkin at the Cape of Good Hope are, without doubt, the most thorough and accurate work of the kind ever performed. The heliometer was not a large one, having an aperture of only four inches, and the interval of time set aside for the accomplishment of their programme was but eighteen months. It was considered essential that several of the parallaxes should be investigated independently by both observers, and with different comparison-stars, in order to obtain some test of the general accuracy of the conclusions reached; and, after much consideration and trial, the following stars were finally selected: α Centauri, Sirius, and ϵ Indi, for observation by both Gill and Elkin; Lacaille 9352, o_2 Eridani, and β Centauri, for observation by Gill alone; and ζ Tucanae, e Eridani, and Canopus, for observation by Elkin alone. In *Science*, vol. iii. p. 456, attention has already been called to the results of these investigations, and the remarkable degree of precision attained in the measurements. Every source of error of which it seems possible to conceive was most carefully considered, and terms for the elimination of such errors were suitably introduced into the equations of condition representing all the observations. The observers express their entire confidence, which must be shared by every one who critically examines their work, in the degree of exactitude which is indicated mathematically by their final results. All interested in the progress of stellar astronomy of precision will be glad to know that the important conclusions and suggestions in the memoir, with regard to future extended work in the same fields, are now to be put to the practical test by Dr. Gill and Dr. Elkin conjointly.

David P. Todd.

NOTES AND NEWS.

Among the prizes awarded at the annual meeting of the French academy on the 23d of February were the following: the Francoeur prize, to Mr. Emile Barbier; a prize of six thousand francs, for the progress in efficiency of naval forces, was divided between the hydrographic mission to Tunis, and Mr. Bails for a work on artillery ('Traité de balistique rationelle'). Other prizes were given to Messrs. Manen and Hanusse (mechanics); to the Swiss engineer Riggenbach, the Monthyon prize, for his mountain railways; to Mr. Hoüel, the Poncelet prize, for his various contributions to pure mathematics; to Mr. du Rocher du Quengo, for his improvements in screw steam navigation; to Mr. Radau, the Lalande prize, for his memoir on diffractions; Mr. Ginzel, the Valz prize, for a paper on secular acceleration of the moon's motion; to Mr. G. Cabanellas, for his theory of the application of electricity to the transmission of power; Mr. Durand-Claye, for his researches on the diffusion of typhoid-fever; Mr. Chancel, for his work on the acetones; Messrs. Gustave Cotteau and Emile Rivière (geology); Messrs. Otto Lindberg, G. Sicard, L. Motelay, and Vendryès (botany); Mr. P. Fischer (zoölogy); Drs. Testut, Cadet de Gassicourt, and Leloir (medicine and surgery); Mr. Tourneux (embryology); Messrs. Cadiat and Kowalevski in anatomy; Messrs. Jolyet and Laffont in experimental physiology; Capt. H. Berthaut and Jules Girard in physical geography; Mr. Marsaut, 1,500 francs, for his investigations of safety-lamps for miners; Mr. de Tastes, for his work in meteorology; Mr. Valson, the Gegner prize, for his work in mathematics and physics; Dr. Neis, for geographical explorations; Dr. J. Boussingault, for applied chemistry. The Bréant prize of a hundred thousand francs for cholera researches was not awarded.

— The following account of unusual phenomena was received March 10, at the Hydrographic office, Washington, from the branch office in San Francisco. The bark Innerwich, Capt. Waters, has just arrived at Victoria from Yokohama. At midnight