

S Cephei, which has a similar spectrum, are the two reddest stars known at the present time.

THE TOTAL SOLAR ECLIPSE OF 1916, FEBRUARY 3.—A summary of the results of observations of this eclipse made at Tucacas, Venezuela, by an expedition from Cordoba, has been given by Prof. C. D. Perrine (*Monthly Notices*, R.A.S., vol. lxxvii, p. 65). The morning of the eclipse was unpromising, with heavy rain, but conditions improved to such an extent that there was only a slight haze during totality. The corona was of the intermediate type, somewhat resembling that of 1898, and the negatives show streamers to a distance of one and a half solar diameters. Five groups of prominences appeared at the bases of the four principal wings of the corona, and a series of well-marked hoods surrounded the prominences in the south-west quadrant. Photographs of the coronal spectrum were obtained with the prismatic camera, and with a slit spectrograph, but none of them show any trace of gaseous radiation. Good records of the chromospheric spectrum at the beginning and end of totality were secured, and these will give valuable data relating to the heights of different vapours in comparison with previous results. The photometric plates show that at the beginning of totality the total light of the prominences and chromosphere was greater than that emitted by the corona proper.

PARIS ACADEMY OF SCIENCES.

PROGRAMME OF PRIZES FOR 1918.

MATHEMATICS.—The Poncelet prize (2000 francs), to the author, French or other nationality, of the work most useful to the progress of pure mathematics; Francœur prize (1000 francs), for discoveries or works useful to the progress of pure or applied mathematics.

Mechanics.—The Montyon prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts, and the practical and speculative sciences; the Fourneyron prize (1000 francs), question for 1918: the theoretical and experimental study of ball bearings; question set for 1916 and carried on to 1918: important improvements in motors used in aviation; the Boileau prize (1300 francs), for researches concerning the motion of fluids contributing to the progress of hydraulics—these researches, if theoretical, must be verified by the results of experiment or observation; Henri de Parville prize (1500 francs), for original work in mechanics.

Astronomy.—The Lalande prize (540 francs), for the most interesting observation or memoir most useful to the progress of astronomy; Benjamin Valz prize (460 francs), for work in astronomy, conforming to the same conditions as the Lalande prize; the Janssen prize (gold medal), to the author of a work or discovery in physical astronomy; Pierre Guzman prize (100,000 francs), to anyone (without distinction of nationality) who finds a means of communicating with a celestial body—*i.e.* to make a signal to the body and receive a reply. (The planet Mars is excluded.)

Geography.—The Delalande-Guérineau prize (1000 francs), for services to France or to science; the Gay prize (1500 francs), subject proposed for 1918: recent progress in geodesy; the Tchihatchef prize (3000 francs), for recompense or assistance of naturalists of any nationality distinguished in the exploration of the Asiatic continent or the adjacent islands, especially the less known regions—the explorations may be in any branch of natural, physical, or mathematical science;

the Binoux prize (2000 francs), for work on geography or navigation.

Navigation.—The prize of 6000 francs for work increasing the efficiency of the French naval forces; the Plumey prize (4000 francs), for improvements in steam-engines or for any other invention contributing to the progress of steam navigation.

Physics.—The La Caze prize (10,000 francs), without restriction of nationality, for the best work in physics (the prize cannot be divided); the Hébert prize (1000 francs), to the author of the best treatise or most useful discovery in popularising or using electricity; the Hughes prize (2500 francs), to recompense the author of an original discovery in physical science, especially electricity and magnetism or their applications; the Danton foundation (1500 francs), for the encouragement of researches relating to radiant phenomena; the Victor Raulin prize (1500 francs) (limited to Frenchmen), for facilitating the publication of works relating to meteorology and the physics of the globe.

Chemistry.—The Montyon prize (unhealthy occupations) (a prize of 2500 francs, a mention of 1500 francs), for the discovery of a means of rendering some mechanical art less unhealthy; the Jecker prize (10,000 francs), for work most useful to the progress of organic chemistry; the La Caze prize (10,000 francs), for the best work in chemistry (open to foreigners and cannot be divided); the Cahours foundation (3000 francs), for the encouragement of young chemists of promise; the Houzeau prize (700 francs), similar conditions to the Cahours foundation.

Mineralogy and Geology.—The Cuvier prize (1500 francs), for the most remarkable work in mineralogy and geology.

Botany.—The Desmazières prize (1600 francs), to the French or foreign author of the best publication during the year on cryptogams; the Montagne prize (1500 francs), for important discoveries or work on the cellular plants; the de Coincy prize (900 francs), to the author of a work on phanerogams, to be written in Latin or French.

Anatomy and Zoology.—The da Gama Machado prize (1200 francs), for the best memoirs on the colour of animals, including man, and its origin in the animal kingdom; the Savigny foundation (1500 francs), for the assistance of young travelling zoologists, not receiving grants from the Government, and who occupy themselves more especially with the invertebrates of Egypt and Syria; the Jean Thore prize (200 francs), for a memoir on the habits or anatomy of a species of European insect.

Medicine and Surgery.—The Montyon prize (three prizes of 2500 francs, three honourable mentions of 1500 francs, citations), for improvements in medicine or surgery; the Barbier prize (2000 francs), for a valuable discovery in surgical, medical, or pharmaceutical science, or in botany in relation to the art of healing; the Bréant prize (100,000 francs), to the discoverer of a means of curing Asiatic cholera or of the causes of this disease (failing the award of the capital sum, the interest will be given as a prize for contributions to our knowledge of cholera or any other epidemic disease); the Godard prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the genito-urinary organs; the Mège prize (10,000 francs), to the author who continues and completes the essay of Dr. Mège on the causes which have retarded or favoured the progress of medicine, from antiquity to the present time; the Bellion prize (1400 francs), for work or discoveries especially profitable to the health of man; the Baron Larrey prize (750 francs), for the best work presented to the academy in the course of the year, by a doctor or

surgeon in the Army or Navy, dealing with medicine, surgery, or military hygiene.

Physiology.—The Montyon prize (750 francs), for the most useful work on experimental physiology; the Lallemand prize (1800 francs), to recompense or encourage work relating to the nervous system; the L. La Caze prize (10,000 francs), for the work which has most contributed to the progress of physiology (the prize cannot be divided, and foreigners can compete); the Pourat prize (1000 francs), for the experimental study of some of the conditions which produce a variation in the quantity of water in different tissues; the Martin-Damourette prize (1400 francs), for therapeutic physiology; the Philipeaux prize (900 francs), for experimental physiology.

Statistics.—The Montyon prize (1000 francs) and two mentions (500 francs), for statistical researches.

History and Philosophy of Science.—The Binoux prize (2000 francs).

Medals.—The Arago, Lavoisier, and Berthelot medals.

General Prizes.—Prize founded by the State (3000 francs), question for 1918; to improve in an important point the study of the successive powers of the same substitution, the exponent of the power increasing indefinitely; the Bordin prize (3000 francs), for a study of the effects of pressure on chemical combinations in general, and in particular on those which are susceptible of a practical application; the Estrade-Delcros prize (8000 francs, undivided), for work in the physical sciences; the Le Conte prize (50,000 francs; encouragements), one-eighth for encouragements, the whole or part of the remaining seven-eighths in a single prize for new and capital discoveries in mathematics, physics, chemistry, natural history, medicine, or for new applications of these sciences; the Houlevigie prize (5000 francs), for work in mathematics; the Parkin prize (3400 francs), for work on the curative effects of carbon in cholera and other diseases; the Saintour prize (3000 francs), for work in physical science; the Henri de Parville prize (1500 francs), for original work on science or the popularisation of science; the Lonchamp prize (4000 francs), for a memoir on the diseases of man, animals, and plants from the point of view of the introduction of excess of mineral substances as the cause of these diseases; the Henry Wilde prize (one of 4000 francs, or two of 2000 francs, without distinction of nationality), for a discovery or work on astronomy, physics, chemistry, mineralogy, geology, or experimental mechanics; the Caméré prize (4000 francs), for a French engineer who has personally conceived, studied, and realised a work resulting in progress in the art of construction; the Gustave Roux prize (1000 francs, undivided), as recompense to a young French scientific worker; the Thorlet prize (1600 francs); the Lannelongue foundation (2000 francs), to one or two scientific men (or their widows or children) in needy circumstances; the Laplace prize of books, for the highest student leaving the École Polytechnique; the L. E. Rivot prize, to the four students leaving the École Polytechnique and holding the first and second places in the two sections of the school; the Trémont foundation (1000 francs), for assisting works attaining an object useful and glorious for France; the Gegner foundation (4000 francs), to assist a poor scientific man, already known for the quality of his work, to enable him to continue his researches; Jérôme Ponti foundation (3500 francs), for the encouragement of mathematical science.

THE BONAPARTE FUND.

Grants from this fund are made for facilitating the researches of workers who have already given proof

NO. 2465, VOL. 98]

of their capability in original work, and who lack sufficient resources to undertake or pursue their investigations. Requests for grants may be made directly by the candidates or proposed by a member of the academy. The request should contain an exact description of the work proposed and indicate the sum necessary to carry it out. Twelve months after the receipt of a grant, a report must be sent giving details of expenditure and of the first results obtained; after two years a *résumé* of the work carried out with the aid of the grant must be forwarded. The whole of these reports will form a special publication under the title of "Recueil du Fonds Bonaparte."

WORKSHOP METHODS OF OPTICAL TESTING.

AT the request of the Ministry of Munitions the Optical Society held an exhibition of workshop methods of optical testing at King's College, Strand, on January 11, in order that by the interchange of workshop methods of test, the production of optical instruments for naval and military use might be expedited. Amongst others, Messrs. Chance Bros. exhibited a method for the rapid approximate assessment of strain existing in glass. A plate of mica is cemented between glass plates, the mica being of such thickness as to give a phase difference in the two beams of one wave for sodium light. This plate therefore gives approximately the sensitive first order purple colour between crossed Nicols. According to the orientation of the specimen double refraction will be evident from the change of the purple colour to a tint of a lower or higher order. Each tint corresponds to a definite phase variation produced by the double refraction of the glass, and hence an estimation of the tints exhibited gives an estimation of the phase difference produced in a beam on passage through the glass. The colours given in conjunction with the wave plate are independent of the intensity of the light; thus greater uniformity in testing for bad annealing is obtained than by the use of crossed Nicols alone, where the sensitiveness of the tests depends largely on the intensity of the source of light.

Messrs. Adam Hilger exhibited a new apparatus and process for finishing prisms and lenses which are imperfect in consequence of non-homogeneous material or inaccurate surfaces. The apparatus consists of a modification of the Michelson interferometer. A beam of light is passed through the optical element under test in such a way as to produce a series of interference fringes which constitute what may be called a contour map of imperfections. This map can be drawn on one of the surfaces of the prism or lens; superfluous material is then removed by local polishing until light is transmitted as in a perfect optical element.

Prof. Herbert Jackson exhibited samples of glass which had undergone a *weathering* test, by submission to the action of steam in an autoclave. The condition of glass surfaces after a standard test is an index of the behaviour of the glass when subjected to normal atmospheric exposure.

The National Physical Laboratory exhibited the photometer used in testing the luminosity of radium-painted dials. The dial under test is placed between two "artificial dials" illuminated by an electric lamp placed behind a suitable green filter; the candle-power of the lamp is varied by means of a resistance. The instrument is standardised by the use of a surface brightness photometer for various currents through the lamp. Samples of glass were also exhibited made from sands obtained in England, to replace sands hitherto obtained from the Continent.