pupillary adjustment. For the former, the focussing is done separately for each eye by rotation of the eye-pieces, controlled by a scale for future setting. Although at first this may appear more inconvenient than the usual double screw motion of both tubes, this is not found to be the case during continued usage, and the makers are enabled to introduce the very desirable feature of making the prism cases quite dust and moisture proof, which is almost impossible when sliding tubes are employed. As issued, the magnifying power is 6, and the field of view about 7°. With respect to the varying opinions as to the best arrangement of the object-glasses for stereoscopic effect, Messrs. Leitz have decided that the advantages of placing them further apart than the pupillary distance are questionable, and so the object-glasses are fitted at the same interval as the eye-pieces. The binocular is made of a specially strong light metal, the weight being only 12 oz. without case. We can without hesitation speak very highly of the optical performance of this instrument. The definition is remarkably crisp, and the image very achromatic and quite sharp up to the edge of the field of view.

A GENERAL index to the annual volumes, sixteen in number, published by the Geological Survey of Canada since 1884, has been compiled by Mr. Frank Nicolas and issued at Ottawa by the Geological Survey. The index runs to 1014 pages, and contains about 180,000 references. It should prove of great service to investigators anxious to refer expeditiously to the annual volumes of the Canadian Survey. The present catalogue, combined with the index previously published, and dealing with the publications from 1863 to 1884, forms a complete means of reference to the English edition of the volumes issued by the Geological Survey of Canada.

## OUR ASTRONOMICAL COLUMN.

RADIAL VELOCITIES OF NINETY-NINE STARS.—The largest single contribution to line-of-sight work yet made appears in No. 5, vol. xxvii., of the *Astrophysical Journal* (pp. 301–24, June). The results were obtained by Prof. Küstner and Dr. Zurhellen, at the Bonn Observatory, during the years 1903–7, and include the provisionally determined velocities of ninety-nine stars of the second and third spectral types down to the fourth visual, or fifth photographic, magnitude.

A three-60°-prism spectrograph by Töpfer, giving a well-defined spectrum between λλ 4150 and 4500, was employed, the temperature being automatically controlled by electric means; at Hγ the linear dispersion is such as to give 15·2 tenth-metres per millimetre.

Although the present values for the radial velocities are only provisional, it is expected that they will not be greatly modified in the final definitive results. In addition to fifteen previously known variable velocities, the ninety-nine sets of results include those for three other stars, δ Tauri, ε Böotis, and μ Pegasi, the radial velocities of which are suspected to be variable. The comparison spectrum employed in each case was that of the iron arc, Kayser's values of the wave-lengths being taken; Rowland's values were taken for the stellar lines. As the observations included some 7500 complete measures of about forty-four different stellar lines, Prof. Küstner expects that their discussion will provide good exact values for the relative wave-lengths of the latter, and also indicate their dependence on the type. In discussing the determination of the constant correction, due, first to the absolute errors of the wave-lengths adopted, and, secondly, to the personal and instrumental errors, Prof. Küstner considers as invalid the control usually obtained from plates exposed on the sun, moon, or larger planets. He believes that a source of light, of precisely known radial velocity and *as similar as possible to the star*, should be observed, and suggests the employment of the brightest minor planets or of Jupiter's satellites for this purpose. After many experiments, and at Dr. Zurhellen's suggestion, he employed spectrograms of the bright isolated peaks seen at the moon's terminator, and found the results to be satisfactory. These indicate that a small negative correction of about −1·0 km. should be applied to the results now published. Of the constant radial velocities determined, that of η Cephei, −85·98 km., is the largest.

THE OBSERVATION OF COLOURED STARS.—In No. 4252 of the *Astronomische Nachrichten* (p. 57), Herr Osthoff discusses at some length the changes of the colour perception of the eye, and shows that these changes depend upon the physiological condition of the observer as well as upon the intensity of the colour of the observed object and upon the instrument used. A table containing the results of his own observations between January, 1894, and November, 1898, shows the variation of the difference between his estimates of colour and the catalogue colour of the stars observed; other tables show the variation of the eye's colour-perception for red and yellow stars respectively, and it appears that the eye is more uncertain in estimating the red than the yellow. The importance of this fact in observing the magnitudes of coloured variable stars is pointed out. There is some indication of a periodical change in the individual eye, but the observations are not sufficiently numerous to establish this.

PHOTOMETRIC OBSERVATIONS OF EROS.—During the period September, 1907, to January, 1908, Dr. Paul Guthnick made a number of photometric observations of Eros at the Berlin Observatory, and now publishes and discusses the results in No. 4249 of the *Astronomische Nachrichten* (p. 1, vol. clxxviii.). From his discussion he is unable to establish with certainty the existence of any short-period light-variation. On plotting the light-curve, taking into account the phase-variations, and trying periods of 5·24h., 5·28h., and 5·32h., he obtained a negative result. It appears certain that during the greater part of the opposition any short-period variation was imperceptible.

THE PHOTOGRAPHY OF VERY FAINT SPECTRA.—The expedient of slightly fogging plates on which it is proposed to photograph faint objects is generally known, but is apparently not so generally adopted. Having recently employed this procedure very successfully in the photography of faint spectra, Mr. R. W. Wood, of the Johns Hopkins University, describes his method and results in No. 5, vol. xxvii., of the *Astrophysical Journal* (p. 379, June). The curve representing the action of light on a sensitised plate is at its commencement flat, but after reaching a certain point it begins to rise much more rapidly; Mr. Wood's supplementary exposure carries the darkening of the plate to this point, so that the radiations he is wishing to photograph commence their action at that part of the curve where a given exposure is much more effective in producing density than if it were applied alone. By a judicious use of the method he has succeeded in reducing the exposure, necessary to produce a certain density, by one-half. The preliminary exposure needed is very small; with a gas flame turned down until the yellow tip was but 3 mm. or 4 mm. high, four seconds at a distance of about two metres was found to be sufficient.

## JULY AND AUGUST METEORS.

THE meteoric season of July has again returned, bringing with it all the interesting associations attached to this period in previous years. Early Perseids will now be occasionally seen with their rapid flights, and leaving streaks upon their paths, but they will be directed from the southern region of Cassiopeia instead of from the place 45°+57°, as at the maximum epoch on August 11–12. Many long-pathed and slow-moving Aquarids will also be noticed from the point about 339°−10°, and this display generally develops its richest features near the end of July, on about the 28th to 30th.

A few years ago I sifted all my observations at the July and August periods with a view to find the most active radiants determined at Bristol, and the number of meteors recorded from them. Omitting Perseids, the following is a list of the principal systems :—

| Radiant R.A. | Dec. | Periods July 20–Aug. 16 meteors | Aug. 19–25 meteors |
|---|---|---|---|
| ° | ° | | |
| 7 | +11 | 31 | 26 |
| 9 | +39 | 44 | 5 |
| 24 | +42 | 35 | 23 |
| 30 | +36 | 43 | 12 |
| 47 | +43 | 59 | 25 |
| 61 | +48 | 21 | 26 |
| 271 | +48 | 32 | 9 |
| 291 | +60 | 44 | 69 |
| 292 | +52 | 72 | 9 |
| 304 | −12 | 31 | — |
| 312 | +12 | 30 | 9 |
| 315 | +48 | 38 | 10 |
| 315 | +78 | 24 | 6 |
| 333 | +48 | 53 | 6 |
| 333 | +28 | 37 | 8 |
| 333 | +71 | 50 | 31 |
| 339 | −10 | 237 | 20 |
| 348 | +50 | 52 | 17 |
| 345 | + 1 | 28 | 29 |

The complete table of showers, rich and feeble, appeared in *Astronomische Nachrichten*, No. 3874. About eighty-five systems in all were displayed between July 16 and August 20.

It would be interesting if some of these streams could be re-observed during the oncoming return of the Perseids and their radiant points re-determined. The positions given in the table may be relied on as accurate to within 2° of probable error, but some of the radiants are more exact than others, the centres having been more sharply defined. In the case of showers of swift, streaking meteors, the intersecting points of the flights can generally be ascertained with great precision.

Special attention seems necessary to be given to the period about July 11–12, when the first signs of the Perseids decidedly begin to be manifested.

This year moonlight will seriously interfere with observations for about a week near July 13 and August 12. The maximum display of Perseids will be partially overpowered by the radiance of our satellite, but some brilliant meteors will be observed at about the epoch August 9–13 should the skies be clear. W. F. DENNING.

## *MAGNETIC RESOLUTION OF SPECTRAL LINES.*

PROF. P. ZEEMAN, continuing his investigations on the occurrence of asymmetric separation of spectral lines in a magnetic field (see NATURE, April 30, vol. lxxvii., p. 615), describes a series of observations on asymmetrical triplets (*Konink. Akad. Wetens. Amsterdam*, p. 566, March 27). As a method giving independent confirmation of the previous work was desirable, he decided to investigate the new series by means of the Fabry and Perot interferometer, using the *étalon*—that special form of the instrument in which the distance between the silvered surfaces is kept constant, about 5 mm. The variations of wave-length may in this case be determined either by continued measurements of the same interference ring or by the method of coincidences, regulating the magnetic force in such a manner that a ring which expands by increasing magnetic intensity coincides with a contracting ring. The system of rings was formed in the focal plane of a small achromatic lens of 18 mm. aperture and 12 cm. focus. This focal plane coincided exactly with the plane of the slit of a one-prism spectroscope, the width of the slit being so reduced that the rings produced by the two yellow mercury lines at λλ 5791 and 5770 could be observed separately.

Reproductions of the appearances presented with magnetic field off and on are included with the paper, made from enlarged negatives. The measurements given indicate conclusively that the positive results concerning asymmetric resolution in strong fields have a real significance, and a very interesting discussion of the results is appended. Taking Lorentz's equation for determining $e/m$, and accepting J. J. Thomson's value of $e = 1{\cdot}1 \times 10^{-20}$ electromagnetic units, the number of electrons per unit volume causing the radiation of the yellow mercury line 5791 in a vacuum tube appears to vary from $8 \times 10^{16}$ to $4 \times 10^{16}$ with magnetic fields varying from 29,220 to 9130 Gaussian units. In these experiments the temperature of the vacuum tube was between 100° C. and 120° C.; the corresponding vapour pressures of mercury, according to Hertz, would be 0·29 mm. and 0·78 mm. respectively, and it is calculated that the number of electrons participating in the emission of line λ 5791 is of the same order of magnitude as the number of atoms present.

A number of observations made by Mr. Jack in the physical laboratory at Göttingen are also recorded, showing the asymmetrical separations of lines of wolframium and molybdenum. The paper concludes with a question as to the possibility of the wave-length of the central line of a triplet being changed by the action of the magnetic field as compared with the unmodified line, and some observations made with an echelon appear to indicate that some lines undergo in strong fields displacements of the order of six or ten thousandths of an Angström unit, in most cases towards the red. This is to be further treated in a subsequent paper.

## *SOCIAL ANTHROPOLOGY.*

PROF. J. G. FRAZER has made a good start in the work of his chair at the University of Liverpool by his opening address on "The Scope of Social Anthropology." It is characterised by all the lucidity of exposition and grace of style which we are accustomed to expect from the author of "The Golden Bough." His main object is to plead for the systematic study of savages, who represent an arrested, or rather retarded, stage of social development. They are, he is careful to point out, primitive only in a relative, not in an absolute, sense; that is, they are primitive in comparison with ourselves, not in comparison with primæval man, of whom we know nothing, and, so far as we can see at present, are likely to learn nothing.

The province of social anthropology falls into two departments, one embracing the customs and beliefs of savages, the other including such relics of these as have survived in the thought and institutions of more cultured peoples. The first department may be called the study of savagery, the second the study of folk-lore. The government of mankind, he goes on to show, is always and everywhere essentially aristocratic, that is to say, the dull-witted majority always follows the keener-witted minority. In the mental, no less than in the physical sphere, the struggle is internecine; but in the end the better ideas, which we call the truth, carry the day. Hence, even in a civilisation like our own, we find the lower classes still following magical and other primitive practices of the same kind. Not that schemes for the regeneration of society form part of his programme. The study of the past must throw light upon the problems of the present, but the exploration of schemes of social reform is the business of the sociologist, not of the social anthropologist.

Dr. Frazer closes a remarkable address by an impassioned appeal for the more careful study of that savagery which is so rapidly disappearing. "How shall we of this generation look when we stand at the bar arraigned on a charge of high treason to our race, we who neglected to study our perishing fellow-men, but who sent out costly expeditions to observe the stars and to explore the barren ice-bound regions of the poles, as if the polar ice would melt and the stars would cease to shine when we are gone?"