All these results are derived from a considerable number of observations, and the mean result, $+0^\circ.3878$ in R.A. and $+1'''.540$ in N.P.D., is probably a very accurate value of the proper motion of this star. It differs slightly from that adopted in both the Greenwich Ten-Year Catalogue and the Radcliffe Catalogue for 1890, which is $+0^\circ.3860$ in R.A. and $+1'''.560$ in N.P.D.

We will now compare the latest place, that given in the Radcliffe Catalogue, with that deduced from Bradley's observations, as given in Professor Auwers's *Neue Reduction*. The place in the latter, which is for the epoch 1755, is R.A. $0^h.52^m.68^s.59$, and declination $+53^\circ.42'.35'''.50$ = N.P.D. $36^\circ.17'.24'''.5$. From this, by the aid of the successive precessions given by Auwers and that in the Radcliffe Catalogue (all founded on Struve's constant), we obtain for Bradley's place, reduced to 1890,

$$R.A. 1^h.0^m.5'01, N.P.D. 35^\circ.33'.38'''.70.$$  

The actual place for this date, as given in the Radcliffe Catalogue, is

$$R.A. 1^h.0^m.57'.167, N.P.D. 35^\circ.37'.10'''.15,$$

differing from the former by $+52'.157$ and $+3'.31'''.45$. The difference between the two epochs being 135 years, this gives for the annual proper motion $+0^\circ.386$ in R.A., and $+1'''.566$ in N.P.D.; a result in very satisfactory agreement with that which I have deduced above from the later Greenwich and Radcliffe Catalogues.

*Blackheath: 1895 December 9.*

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*Description of a Spectroscope (the Bruce Spectroscope) recently constructed for use in connection with the 25-inch Refractor of the Cambridge Observatory.* By H. F. Newall, M.A.

The spectroscope which is described in the present note has lately been constructed for use in connection with the 25-inch visual refractor (the Newall telescope) of the Cambridge Observatory.

It has been arranged solely for photographing spectra, and no provision has been made for visual micrometric measurements.

In designing the spectroscope, and especially in deciding on what may be described in general terms as a single-prism spectro-oscope, I have been guided by the following considerations. The brighter stars in the northern hemisphere have been studied in considerable detail, and provision has been made for their being further studied at many observatories. A new instrument to be used in connection with an equatorial of large light-collecting
power should be designed chiefly with a view to rendering work of high precision possible in the case of the fainter stars. For work of high precision it seems best at present to adopt a spectro-
scope with collimator and slit, and to provide arrangements for getting comparison spectra from terrestrial sources.

In the case of faint stars, the primary difficulty is to get a photograph at all, however little the purity or definition of the spectrum. It is therefore of the greatest importance to adopt arrangements which involve as little loss of light as possible in the spectroscope itself, and which ensure that as much as possible of the light collected by the object-glass of the equatorial shall pass into the slit of the spectroscope.

Preliminary work with spectroscopes of various constructions has shown that it would be necessary to modify the colour correction of the visual refractor by some auxiliary lens, or else to put up with a very limited range of spectrum. The difficulties which arise in consequence of imperfect achromatism, in spectroscopic investigations made in connection with large refractors, have been described by many observers: most recently by Keeler with reference to the Lick telescope (Astroph. Jour. 1895, I. p. 102), and by Belopolsky with reference to the Pulkova refractor (Astroph. Jour. 1895, I. p. 366).

The spectroscope may be briefly described as having a single large white-flint prism, transmitting a beam of light of circular section and 2 inches in diameter, and having a camera of fixed length, in which may be used either (1) an ordinary object-glass for giving a short spectrum of a very faint star, the spectrum being in this case 19.9 mm. long from $H_3$ to midway between $H$ and $K$, or (2) a telephoto-combination arranged so as to effectively double the length of the camera for giving a greater linear dispersion for medium stars, the spectrum being in this case 44.5 mm. long for the same range as above stated.

It is perhaps of interest to record here the linear extent of the spectrum from $H_3$ to midway between $H$ and $K$ (the same range as above) for some of the spectrographs lately used by Dr. Vogel at Potsdam (Astroph. Jour. 1895, p. 200).

No. I., used for velocity in line of sight, 69 mm.
No. II., used for spectra of Mars or Jupiter, 16 mm.
No. III., used for Nova Aurigae, 7.0 mm.
No. IV., used for $\beta$ Lyrae, 8.6 mm.

The mode of attachment to the refractor is, I believe, unusual, and may be briefly described as follows:—

A correcting lens is inserted in the cone of rays coming from the object-glass of the refractor. It is set about 5 feet from the uncorrected focus; and the corrected focus is nearer to the object-glass by about 18 inches. (The effective focal length of the combination is about 20½ feet.) The corrected focus is thus drawn up inside the refractor.
The spectroscope is pushed up partly into the tube of the refractor so that the slit coincides with the corrected focus.

In this arrangement many advantages are gained, notably the following:

1. An improved colour correction results.
2. Strength is gained in the attachment of the spectroscope to the eye-end.
3. Space is economised, for the spectroscope is 18 inches nearer to the object-glass of the refractor.
4. The whole spectroscope, being attached to a strong framework which is clamped to the focussing tube of the refractor, can be moved bodily in and out (for the purpose of focussing the star on the slit) without altering the adjustment of the parts of the spectroscope.
5. The convergency of the cone of rays from the object-glass of the refractor can be arranged to have a very convenient value; the convergency for the uncorrected object-glass is about 1 in 14°, and with the correcting lens it becomes 1 in 10.
6. As a consequence of the altered convergency, the requisite resolving power can be attained in the single prism with shorter collimator.

The one drawback that I realise at present is that, since the relation between the purity $P$, the resolving power $R$, and slit width $s$, and the ratio $\psi$ of aperture to focal length, is

$$P = \frac{\lambda}{s\psi + \lambda} R,$$

it is clear that the slit-width must, for a given purity and resolving power, vary inversely as $\psi$. This I regard as a great disadvantage; but it has seemed to me that there was a balance of advantage in favour of the lens.

I was at first inclined to think that the inaccessibility of the slit was an insuperable objection. But the adoption of Huggins' admirable plan of a reflecting slit-plate has got over all the anticipated difficulties.

Having thus briefly indicated the general method adopted, I proceed to describe some of the details.

The Eye-end or Breech-piece of the 25-inch Refractor.

No doubt many of the conveniences of the adopted method of attaching the spectroscope depend on the arrangement of the eye-end of this special refractor. The sturdy massiveness of Cooke's work has formed a splendid foundation, to which the spectroscope has been fitted.

The steel tube of the refractor is cigar-shaped, wider in the middle than at the ends. At the eye-end the steel tube has a diameter of 21 inches, and to it is fitted a strong iron casting