Comets, 7th edition, and Remarkable Eclipses, 4th edition, presented by the author; L. Weinek, Photographischer Mond-Atlas, Heft 4–6, presented by Professor Weinek; E. T. Whittaker, Report on the progress of the solution of the problem of three bodies, presented by the author; Bronze copy of the Stokes Jubilee Medal, presented by the University of Cambridge.

On the Binary System of Capella. By H. F. Newall.

A very brief announcement of the discovery of the binary character of *Capella* was made in a note communicated to the Society in 1899 November (*ante*, p. 2). A similar announcement was made by Professor Campbell, of the Lick Observatory, in the October number of the *Astrophysical Journal* (vol. x, p. 177). Two brief communications have been made to the Observatory (1900 February, pp. 92, 93). The object of the present note is to lay before the Society the result of a preliminary investigation of the photographs of the spectrum of *Capella* which have been obtained at Cambridge.

A new four-prism spectroscope was attached to the 25-inch equatorial in 1899 July. Some of the earliest photographs obtained with it were spectra of *Capella*; and it was at once noticed that the definition appeared poor and unsatisfactory. From night to night it varied in a curious manner; and it became clear that the peculiarities were real, and not due to instrumental defects, for excellent photographs were obtained of the spectra of other stars—notably of *Procyon* and *Sirius*.

After a preliminary study of ten or twelve photographs of the spectrum of *Capella*, it seemed clear that the spectrum was composite, and lines were picked out as belonging to one component, which we will call the solar component, and other lines as belonging to another component, which in the short range of spectrum dealt with has the characteristics of the spectrum of *Procyon* and γ *Cygni* and α *Persei*; it will be convenient to refer to it in what follows as the *Procyon* component. It is difficult to make out the spectrum; and I think it not unlikely that this choice of name may require revision.

Measurements were then made in the short range of spectrum $\lambda\lambda$ 4250–4325; and the results in the case of the solar component are given in the following table, and are plotted in the accompanying plate; ordinates representing the velocity of that component relative to the Sun, with time as abscissa. The curve drawn through the observations is a sine curve, to which further reference will be made below. In the table the first column contains the plate number, the second the date, the third the duration of exposure, the fourth the velocity deduced from the photograph (*i.e.* the velocity relative to Earth), the fifth the correction for orbital motion of the Earth, and the last column the velocity relative to the Sun.

Velocity of Solar Component of α Aurigæ.

	1899.	G.M.T.	Exp.	Vel. rel. to ⊕	Corr. to ⊙	Vel. rel. to ⊙
F. 21	Sept. 28	12.20	60	−23·5	+26·3	+ 2·8
F. 22	Oct. 2	12.19	60	−18·2	+25·7	+ 7·5
F. 32	16	10.58	75	+ 8·3	+22·8	+31·1
F. 33	17	10.30	75	+ 3·2	+22·6	+25·8
F. 34	18	10.54	75	+12·4	+22·3	+34·7
F. 38	Nov. 1	9.55	62	+33·2	+17·9	+51·1
F. 39	6	9.12	75	+34·4	+16·0	+50·4
F. 40	6	10.43	63	+37·3	+16·0	+53·3
F. 44	8	9·56	62	+37·9	+15·2	+53·1
F. 46	10	9.17	70	+41·1	+14·4	+55·5
F. 48	11	10.15	60	+41·8	+14·0	+55·8
F. 49	17	9.16	60	+39·6	+11·4	+51·0
F. 50	20	9.40	60	+39·6	+10·1	+49·7
F. 54	23	9.16	70	+37·8	+ 8·8	+46·6
F. 56	28	8.45	70	+32·3	+ 6·5	+38·8
F. 58	Dec. 1	8.47	70	+27·8	+ 5·1	+32·9
F. 62	2	9.6	60	+28·3	+ 4·6	+32·9
F. 64	11	6.40	50	+22·7	+ 0·3	+23·0
	1900.					
F. 67	Jan. 9	5.57	62			
F. 71	17	12.6	60	+26·6	−16·9	+ 9·5
F. 72	18	12.34	63	+30·1	−17·3	+12·8
F. 73	20	12.22	70	+38·1	−17·8	+20·3
F. 76	24	12.30	70	+42·8	−19·3	+23·5
F. 79	27	11.10	70	+48·4	−20·3	+28·1

The method adopted in deducing the velocity was as follows : The wave-lengths of the chosen lines in the spectrum of the star were determined with reference to the lines in the comparison spectrum of the iron spark, interpolation being performed by means of the relation $\lambda - \lambda_0 = c/(R_0 - R)$, to which Dr. Hartmann has called attention recently. The three constants, λ_0, c, R_0, are determined from three standard lines in the iron-spark spectrum.

The linear dispersion of the spectra obtained with the instrument is approximately six tenth-metres per millimetre, or 1·5 tenth-metres per revolution of the micrometer used for measuring the spectra. Wave-lengths of lines in the spectra can be determined with reference to the comparison spectra of the iron spark to within about 0·02 of a tenth-metre.

H H 2

The same three standard lines in the iron-spark spectrum have been used in the reduction of all the plates; hence any error that may be introduced by assigning to them the wave-lengths given by Rowland for the corresponding lines in the solar spectrum instead of values of wave-lengths in which account is taken of the effects of pressure in the spark, affects all the plates approximately equally.

Thus, in the plate F. 39, taken 1899 November 6, the following wave-lengths were deduced for chosen lines in the star spectrum:

Wave lengths (affected by velocity) of the Star-lines	Wave lengths in Rowland's Tables of Solar Spectrum.	Shift of Line $\delta\lambda$.	Corresponding Velocity.
4275·47	4274·99	+0·48	+33·7 km/sec
76·25	75·68	0·57	40·0
88·77	88·21	0·56	39·1
92·79	92·30	0·49	34·2
93·85	93·28	0·57	39·8
94·77	94·25	0·52	36·3
95·67	95·28	0·39	27·3
4302·13	4301·67*	0·46	32·1
07·07	06·59*	0·48	33·5
14·77	14·34	0·43	30·0
15·59	15·13	+0·46	+32·0
		Mean	+34·4
Correction for Earth's orbital velocity			+16·0
Velocity relative to ☉		... ...	+50·4 km/sec.

The velocities come out very consistently considering the difficulties in deciphering the superposed and shifted spectra of the two components. It will be realised that twice in each period the superposed spectra are coincident, line for line; the lines appear single and distinct, and the spectrum looks in nearly all respects like a well-defined solar spectrum. This occurs when the velocities of the two components are alike, namely, near the points marked A, C, E on Plate 11. At all other times the spectrum looks more or less ill-defined in a curious way; some lines look double, others are at first sight unexpectedly intensified, others apparently obliterated. Enlarged transparencies of well-defined single spectra have been made (i.) of the Sun, (ii.) of *Procyon*; when they are superposed on one another, the films being in contact, one spectrum can easily be shifted relatively to the other, and the resultant spectrum has been found to reproduce all the above-described effects in a very striking

* Bright spaces between absorption lines, wave-lengths determined in terms of Rowland from separate photographs.