

The Bruce Photographic Telescope.

By *Edward C. Pickering.*

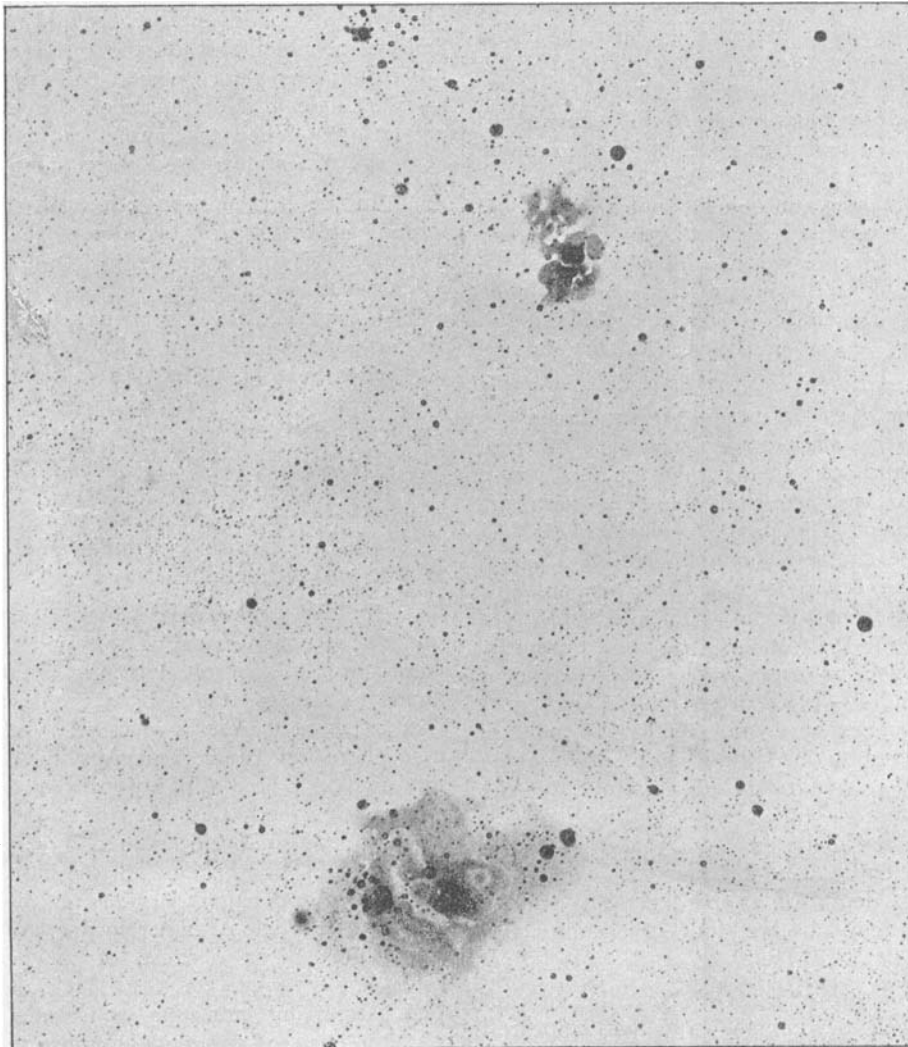
The advantages of a doublet for photographing the stars were advocated by the writer in 1883 (*Astr. Register* XXI, 151, *Observatory* VI, 201) and again in 1886 (*Mem. Amer. Acad.* XI, 179). In the latter article (p. 207) it was urged that charts should be photographed of the same size and scale as the charts of Peters and Chacornac, that is

on a scale of 6 cm to 1°, and covering a region 5° square. It was there proposed that photographs taken with the 8 inch

Bache telescope should be enlarged three times. A similar plan was recommended to the *Congrès Astrophotographique International* in a letter dated Decb. 10, 1887 (*Annexe*, No. 5, p. 95). Later, it was shown in a paper presented to the *National Academy* at a meeting held in Washington in April, 1888, that the best results might be expected from a telescope having an aperture of 60 cm and a focal length of 343.8 cm. The same plan was recommended in a circular dated November 20, 1888, and entitled, *A large Photographic Telescope*. The generous liberality of Miss Catherine W. Bruce (*The Bruce Photographic Telescope*, June 26, 1889), permitted this experiment to be

tried. The instrument was constructed by Messrs. Alvan Clark and Sons, and was mounted provisionally and tested in Cambridge. It was sent to Arequipa last winter by way of the Straits of Magellan, thus avoiding the dangers of transshipment upon the Isthmus of Panama. It arrived safely in Arequipa, was mounted successfully, and is now

kept in constant use by Professor Bailey. The excellent results since attained with it are largely due to his skill and perseverance. The accompanying plate serves to illustrate the work already accomplished with this instrument. The original negative was taken on June 11, 1896, with an exposure of 180 minutes upon a plate 14 × 17 inches.



Centre, RA. = $17^{\text{h}}56^{\text{m}}$ Decl. = $-23^{\circ}7'$ Trifid nebula. Taken June 11, 1896.
Exposure 180^m. Scale 1' = 0.1 cm.

The region covered extends in right ascension from $17^{\text{h}}40^{\text{m}}$ to $18^{\text{h}}10^{\text{m}}$, and in declination from $-20^{\circ}8'$ to $-26^{\circ}5'$. About a tenth of this region is represented in the accompanying

figure.*) The upper of the two nebulae is the Trifid Nebula, NGC. 6514. The lower and larger nebula is NGC. 6523. While this form of photoengraving is convenient to give a general idea of the appearance of the original negative, it is not adapted to a careful study of the plates. The images are formed of black dots upon a white background and accordingly it is impossible to derive from them the true relative positions or magnitudes of the stars represented, as is obvious if they are examined by a magnifying glass. Photoengravings have accordingly been prepared of two regions, and a limited distribution,

mainly to observatories, is being made of them. They are produced by contact printing from the original negatives and carry out the plan of mapping described above. That is, the photogravures are on a scale of one minute of arc to a millimetre, and cover a region five degrees square. Plate I represents the region whose centre is in RA. $16^{\text{h}}10^{\text{m}}$,

*) Der vom Verfasser eingesandte photographische Abdruck eignete sich nicht zur directen Wiedergabe durch Autotypie, sondern es musste zu diesem Zweck vorher eine Zeichnung auf Papier mit Tusche entworfen werden. Die Folge davon ist, dass insbesondere die Contouren der beiden Nebel etwas schärfer hervortreten, als es auf dem Original der Fall ist. K7.

Decl. -52° . The original negative was taken on June 6, 1896, with an exposure of 62 minutes. The cluster in the lower part of the plate is NGC. 6067. Plate II represents the region whose centre is in RA. $10^{\text{h}}40^{\text{m}}$, Decl. -59° . The original negative was taken on June 1, 1896, with an exposure of 240 minutes. The images are elongated, and this plate is issued as an example of the enormous number of stars which can be shown upon a single map, while Plate I illustrates the character of the images at the centres and corners, and the quality of maps to be expected.*) It is proposed to issue, from time to time, maps of other portions of the sky, such as the Magellanic Clouds. According to the original plan a map of the entire sky on the scale here represented was to be published. To avoid duplication of work this plan has been abandoned, since the Astrophotographic Congress has undertaken to supply this want. It is believed that a less expensive and more useful scheme will be to furnish contact prints on glass from the original negatives, to such astronomers as will

make use of them. A double contact print so closely resembles the original negative that it can only be distinguished from it with difficulty, and for purposes of measurement or exact study is, of course, far more valuable than any paper print.

While announcing the successful completion of the Bruce Photographic Telescope, attention should be called to the courage of the donor who permitted an experiment to be tried on a scale never before attempted, and whose liberality, both in the amount of her gift and in the terms on which it was made, rendered every aid to secure success. It is a great satisfaction to be able to show by these photographs that the results obtained are exactly as expected, and that no unforeseen difficulty interfered with the success of the experiment. Excellent results have already been obtained in photographing the spectra of very faint stars with prisms placed over the object glass of this instrument, and they will be made the subject of a subsequent communication.

Harvard College Observatory, 1896 Dec. 30.

Edward C. Pickering.

*) Beide Tafeln sind der Redaction zugegangen. Ich bin gern bereit, dieselben den Lesern auf Wunsch zur Ansicht zu übersenden. *Kr.*

First List of Double Stars

discovered at the Royal Observatory Cape of Good Hope.

(Communicated by *David Gill*, C. B., LL. D., F. R. S., H. M. Astronomer).

Star	1900		P.-A.	Dist.	Mags.	Notes
	RA.	S. Decl.				
Lac. 9755	$0^{\text{h}} 5^{\text{m}} 44^{\text{s}}$	$73^{\circ} 47' 0''$	340°	$0^{\text{h}} 8'$	7.3, 8.3	
Lac. 95	$0 23 27$	$55 10.6$	250	0.75	7.9, 9.1	
Lac. 236	$0 47 12$	$44 15.1$	355	1.8	7.3, 8.1	
Cord. ZC. $1^{\text{h}} 293$	$1 12 42$	$37 48.4$	140	1.0	9.4, 10.4	
Lac. 460	$1 30 6$	$46 12.4$	20	1.2	7.1, 10.0	
Cord. ZC. $1^{\text{h}} 1092$	$1 43 31$	$44 28.2$	180	1.0	8.5, 9.0	
Cord. DM. $-40^{\circ} 686$	$2 35 40$	$40 23.6$	320	2.0	10.1, 10.6	
Cord. ZC. $3^{\text{h}} 123$	$3 5 0$	$41 44.7$	320	0.7	9.4, 9.6	
P. III. 19	$3 8 55$	$44 47.7$	185	0.8	6.8, 7.3	a
Cord. ZC. $3^{\text{h}} 426$	$3 15 6$	$43 0.4$	260	2.5	8.6, 10.5	
B Velorum	$8 19 27$	$48 10.2$	s. f.	1.0	5.6, 7.6	
Cord. ZC. $8^{\text{h}} 2571$	$8 32 52$	$30 28.9$	f.	4.0	8.8, 10.3	
P. VIII. 148	$8 36 39$	$39 54.5$	n. f.	2	6.3, 9.0	
Bris. 2199	$8 42 57$	$42 12.0$	n. p.	1.5	7.7, 9.5	
Lac. 3539	$8 43 57$	$38 34.4$	s. f.	1.5	7.2, 9.2	
Bris. 2285	$8 53 44$	$49 17.7$	n. p.	5	7.7, 9.2	
Anon.	$9 23 2$	$52 56.7$...	3	9	b
Lac. 4315	$10 24 52$	$48 28.6$	s. p.	3	7.2, 10.0	
			n. f.	20	10.5	
Bris. 3101	$10 31 33$	$63 36.7$	s. p.	2	8.9, 10.5	
Anon.	$10 34 12$	$64 30$	s. f.	3	9.0, 9.5	
Cord. DM. $-30^{\circ} 9211$	$11 23 23$	$30 11.3$	n. f.	3	10.0, 10.5	
α^1 Centauri	$11 27 8$	$58 53.4$	s. f.	7	5.2, 9.0	
P. XI. 105	$11 28 45$	$40 2.1$	90°	1	6.5, 6.5	
Cord. ZC. $11^{\text{h}} 3331$	$11 49 46$	$41 50.2$...	0.8	8.6, 8.6	
Cord. ZC. $11^{\text{h}} 3367$	$11 50 20$	$41 20.8$	n. p.	2	8.3, 8.3	