a representation of the Place du Vieux Marché at Rouen (the piece being *Jeanne d'Arc*), and, as it is strongly illuminated, at a given moment, from the centre, the light outside being low, a spectator at any point has an excellent view of the scene, while seeing nothing of the crowd beyond.

THE additions to the Zoological Society's Gardens during the past week include a Malbrouck Monkey (*Cercopithecus cynosurus* ♂) from West Africa, presented by Miss Florence Schuler; an American Black Bear (*Ursus americanus*) from Canada, presented by Mr. John Sands; a Common Otter (*Lutra vulgaris*) from Ross-shire, presented by the Hon. J. S. Gathorne Hardy, M.P., F.Z.S; two Cape Doves (*Œna capensis*) from South Africa, presented by Miss Grace Debenham; two Imperial Eagles (*Aquila imperialis*) from Spain, presented by Mr. Walter Buck; two Smooth Snakes (*Coronella lævis*) from Hampshire, presented by Mr. E. Penton, F.Z.S; a Hairy Armadillo (*Dasypus villosus*) from La Plata, a Greater Sulphur Crested Cockatoo (*Cacatua galerita*) from Australia, deposited; five Common Peafowls (*Pavo cristatus*), six Ring-necked Pheasants (*Phasianus torquatus*), three Gold Pheasants (*Thaumalea picta*), five Silver Pheasants (*Euplocamus nycthemerus*), seven Californian Quails (*Callipepla californica*), a Vulpine Phalanger (*Phalangista vulpina* ♀) bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on August 7 = 19h. 5m. 29s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 4485	—	—	19 12 17	+29 53
(2) G.C. 4499	—	—	19 26 19	+ 9 0
(3) D.M. + 30° 3409 ...	6	Yellowish-red.	19 0 43	+30 34
(4) ε Aquilæ	4	Yellow.	18 54 36	+14 55
(5) λ Aquilæ	3	Yellowish-white.	19 0 24	− 5 3
(6) 222 Schj.	9	Very red.	18 53 30	+14 13
(7) S Herculis	Var.	Reddish-yellow.	16 46 53	+15 8

Remarks.

(1) This cluster is thus described in the General Catalogue: "A globular cluster; bright; large; irregularly round; gradually very much compressed in the middle; easily resolved." Dr. Huggins has observed that the spectrum is continuous, with "a suspicion of unusual brightness in the middle," but he apparently made no attempt to determine the position of the brightness. Such a maximum of light in one part of the spectrum is suggestive of radiation phenomena, though of course it is possible that it may be simply a contrast effect due to the presence of dark lines or bands. In any case trustworthy measures may give some clue to the constitution of the stars of which the cluster consists.

(2) The G.C. description of this object is as follows: "Considerably bright; small; irregularly round; easily resolvable." It is thus apparently an undoubted cluster, and it is therefore very remarkable that Dr. Huggins records: "I believe that the spectrum consists of one bright line." If this be confirmed, the object must evidently be a cluster of "nebulous stars," and resolvability can no longer be a criterion for non-nebulosity."

(3) Dunér describes the spectrum of this star as a feebly-developed one of Group II.; only the bands 2, 3, and 7 being seen. As the complete series of bands has been recorded in stars of much smaller magnitude with the same instruments, it is clear that there are decided specific differences. A more detailed examination, with special reference to the presence or absence of bright lines or flutings and dark lines, is suggested.

(4 and 5) These are stars of the solar type and of Group IV. respectively. The usual observations are required in each case.

(6) The spectrum of this star is one of Group VI. The dark bands are strong, but the blue zone is very feeble. Further details should be looked for.

(7) This variable has a spectrum of Group II., and the approaching maximum of August 15 may be utilized for ascertaining whether, in common with other variables of the same group, bright lines appear at or near maximum. The magnitude at maximum appears to vary between 6·6 and 7·7, whilst that at minimum is about 11·5, the period being about 408 days. The line of hydrogen at G is apparently the most easily seen in this class of objects. The bright flutings of carbon should also be carefully observed as the star fades. A. FOWLER.

CATALOGUE OF RED STARS.—No. V. of the Cunningham Memoirs of the Royal Irish Academy contains a new edition of Birmingham's "Catalogue of Red Stars," by the Rev. T. E. Espin. The work undertaken by Mr. Espin is (1) the observation of such stars of Mr. Birmingham's Catalogue as seemed to merit special attention; (2) a search for new red stars; (3) the spectroscopic observation of all stars not previously observed with the spectroscope. This comprehensive programme was commenced about four years ago, and much important work has been done under each of the heads. The original catalogue contained ruddy and orange stars in addition to those having a decided red colour, but these are now given in a separate list.

In some remarks on the spectroscopic observations of the stars in the Catalogue, Mr. Espin brings forward "one of the most striking examples of the disagreements among spectroscopic observers," viz. the difference between the spectrum of 152 Schjellerup as observed by Secchi and Dr. Huggins. The former observer remarked that the dark zones coincided with the carbon flutings given by an alcohol flame. Dr. Huggins made the comparison, and, either from imperfect instrumental conditions or a different comparison spectrum, found there was no such coincidence, although later observations, by Vogel, Dunér, and others, have established Secchi's view.

A useful list is given of stars with bright lines in their spectra discovered up to the date of publication, and no one has worked more assiduously in this direction than Mr. Espin himself. After an admirable and extended account of the discovery and the spectra of these stars the following conclusions are arrived at:—

(1) That in stars of type I.*c* (Group I.) where the hydrogen lines and D_3 are bright, the lines vary, and this variation is not simultaneous.

(2) That in stars with type III.*c* one or more of the hydrogen lines may be brilliant and the others invisible, as in Mira, where γ and δ were conspicuous, but there was no trace of *e* and F.

(3) In the cases of R Andromedæ, R Cygni, and S Cassiopeiæ, the extremely brilliant F line was detected *after* the maximum.

(4) In Vogel's type I.*b*, the hydrogen lines may really be faintly bright, and in one of the stars of this class the existence of other bright lines is proved, and they will hence, probably, be found in others.

It should be remarked that the stars of Group II. which have bright lines in their spectra (*e.g.* Mira Ceta) are classified by Mr. Espin as a new type, III.*c*.

The total number of stars contained in the Catalogue is 1472, of which 766 are given in the red star catalogue, 629 in the list of ruddy stars, and 77 in an addendum. Besides these there are 52 "bright-line" stars. Seven new variables were detected by Mr. Espin during the four years of observation, and he concludes that the work of discovering new red stars in the northern heavens is complete as far as magnitude 8·5. Every spectroscopist appreciates this valuable and important Catalogue, and Mr. Espin is to be congratulated on having been able to complete it in so short a time.

ANCIENT ECLIPSES.—In the *Astronomical Journal*, No. 220, Mr. John Stockwell continues his discussion of the secular and long-period inequalities in the moon's motion. The following are the dates of the sixteen eclipses that have been investigated, and some particulars referring to them.

No.	Date.	No.	Date.
1.	A.D. 1140 March 20	9.	B.C. 480 April 19
2.	A.D. 1030 August 30	10.	B.C. 546 October 23
3.	A.D. 364 June 16	11.	B.C. 556 May 19
4.	A.D. 360 August 28	12.	B.C. 584 May 28
5.	A.D. 348 August 29	13.	B.C. 602 May 18
6.	B.C. 309 August 15	14.	B.C. 609 September 30
7.	B.C. 423 March 21	15.	B.C. 762 June 15
8.	B.C. 430 August 3	16.	B.C. 1184 August 28

1. This eclipse is mentioned by Halley, by William of Malmesbury, and in the Saxon Chronicle. It is shown that the line of central eclipse passed over Cambridge.

2. This is the eclipse of Stiklastad, and Mr. Stockwell's computations appear to satisfy the account given by Hansen in vol. ii., p. 388, of his "Darlegung."

3. Observed at Alexandria by Theon.

4. An annular eclipse which occurred before sunrise in any part of Mesopotamia, so that it could not have occasioned the phenomenon mentioned by Ammianus Marcellinus (book xx. chap. 3).

5. This eclipse was total in the eastern parts of Mesopotamia at 9h. 50m., and satisfies the phenomenon described by Ammianus.

6. The eclipse encountered by the fleet of Agathocles while on its voyage from Sicily to Africa.

7. The eclipse described by Thucydides as having occurred during the eighth year of the Peloponnesian War.

8. This eclipse is shown to be identical with that described by Thucydides as having occurred during the first year of the Peloponnesian War, when the darkness was so great that some of the stars were visible.

9. The account given by Aristides ("Scholiast," ed. Frommel, p. 222) of the eclipse which took place while Xerxes was on the march from Sardis to Abydos at the beginning of the Persian War is confirmed by the computations.

10. This is shown to explain the disappearance of the sun described by Xenophon ("Anabasis," Book iii.) as having occurred at Larissa.

11. Contrary to the conclusions of Hansen and Prof. Airy, Mr. Stockwell finds that this eclipse does not satisfy Xenophon's account.

12, 13, and 14. Each of these has been supposed to be Thales's eclipse. Mr. Stockwell finds that both 13 and 14 satisfy equally well the astronomical conditions of the problem, but thinks the former is rather the more probable of the two.

15. The record of this eclipse was discovered on the Assyrian tablets in the British Museum, and the computations show that an eclipse happened at Nineveh at two o'clock in the afternoon on the date given.

16. Homer mentions a singular darkness that occurred during one of the great battles of the last year of the Trojan War ("Iliad," Book xvi.). Mr. Stockwell explains the darkness by means of this total solar eclipse.

Many of the conclusions arrived at with respect to the dates of eclipses differ widely from those generally accepted, and are open to much discussion.

COGGIA'S COMET (*b* 1890).—*Edinburgh Circular* No. 9 contains the following elements and ephemeris, computed by Dr. Berberich, of Berlin, from observations made at Marseilles on July 19, and at Kiel on July 21 and 22. Dr. Berberich finds there must be an error in the comet's place deduced at Marseilles on July 18, the date of discovery. He also points out that the orbit closely resembles that of the comet of A.D. 1580.

Elements of Comet Coggia.

T = 1890 July 7·9775 Berlin Mean Time.

$\pi - \Omega$ = 84° 20′ 52″
Ω = 14 4 56 } Mean Eq. 1890·0.
i = 63 28 17
log q = 9·88007.

Ephemeris for Berlin Midnight.

1890.	R.A. h. m. s.	Decl. ° ′	Log Δ.	Log r.	Brightness.
Aug. 7	10 43 24	+28 1·0	0·2526	9·9826	0·50
8	10 47 12	27 10·4			
9	10 50 53	26 20·3	0·2601	9·9929	0·46
10	10 54 27	25 30·7			
11	10 57 55	24 41·7	0·2676	0·0033	0·43
12	11 1 16	23 53·2			
13	11 4 31	23 53	0·2752	0·0137	0·39
14	11 7 41	22 18·0			
15	11 10 45	21 31·2	0·2827	0·0240	0·36

THE INSTITUTION OF MECHANICAL ENGINEERS.

THE annual summer meeting of the Institution of Mechanical Engineers was held last week in Sheffield. There could be no more appropriate centre around which either this Institution, or the sister Society, the Iron and Steel Institute, could gather. Sheffield has, however, of late years been somewhat tardy in offering a welcome to visitors. Six years ago it was proposed that the Iron and Steel Institute should hold a session in Hallamshire, but Hallamshire would not open its doors, and the Iron and Steel Institute had to journey to Chester. It is 29 years since the Mechanical Engineers met in Sheffield, and now, when they once more congregate there, they find but a partial welcome. The fact is, the big Sheffield steel makers—the Browns, Firths, Cammells, Jessops, and Vickers—have always pursued an absurd policy of secrecy. There is as much Abracadabra about these Sheffield steel makers as ever was practised by the alchemists of old. One can walk into the other steel works of the country with no more formality than presenting one's card, and see all that is to be seen; but these Sheffield works remain a sealed book. The reason given for this is that "The Foreigner" comes over here and learns too much, imparting no information in return. Unhappily for the cogency of this argument it is just the foreigner that the steel makers must admit. All those firms who do work for foreign Governments must admit foreign Government inspectors. These men come into the works to stay for months or even years. They are experts in the business they are engaged upon. They come and go where they will, ask what questions they will, make analyses, tests, and experiments at will; in short, they obtain a thorough and complete knowledge of everything that goes on. When they return home they would look on two or three hundred a year as an ample income, or a hundred pound note as a handsome consulting fee.

In the face of such facts is it not childish to shut out the necessary engineer, who simply wants to satisfy his scientific curiosity regarding the chief material he uses?

Although the big steel makers had shut their doors on the Sheffield visitors, there were still some things of interest left. Many of the older class of crucible steel makers were willing to explain the whole process of steel production as introduced by Huntsman one hundred years ago, and indeed were able to give practical illustrations of the same. Steel affords as much food for contemplation to the industrial economist as to the physicist and chemist. That the addition of less than one half of one per cent. of carbon should so entirely change the character of the metal is curious enough, although so familiar; but that the making of crucible cast steel should have stood, as it has, through the last century of industrial change and revolution is still more surprising. Watt, Faraday, and Thomson, nay, even Bessemer and Siemens, have lived and laboured without writing a single record on the process. Crucibles are still made by hand, charged by hand, pulled out of the fire by hand, teemed by hand, and in fact the steam-engine is not called into requisition throughout the process. The steel manufacturer makes no chemical analysis to find the grade of his steel. He breaks a piece, and his eye tells him by the fracture the percentage of carbon nearly enough for all practical purposes; *i.e.* as nearly as his neighbour knows, who does the same. And yet if one wants trustworthy steel of the highest grade one has to go to Sheffield for it, and pay the Sheffielder's price. All the science of all the engineers, chemists, and physicists of the last hundred years, allied with the industrial activity engendered by the fierceness of modern competition—even the mingling of science and commercial acumen, as in the persons of Siemens and Bessemer—has failed to unseat the ancient steel trade of Sheffield. No wonder the grimy town remains the stronghold of industrial empiricism, where they fall down and worship with the prophets of the rule of thumb.

But though the crucible steel maker is conservative in his method of working, he proved liberal in showing his work to others, and the members of the Institution had a good opportunity of seeing the way in which the finer kinds of steel they use are produced. The works of Messrs. Seebohm and Dieckstahll, Samuel Osborn and Co., and many others in which crucible steel making is carried on, were open to inspection; but, had not Park Gate come to the rescue, those who were unacquainted with the Bessemer or Siemens processes would have had to go to South Wales, Glasgow, or the north-east, where they could find works open to their inspection quite as well organized as any they missed seeing at Sheffield.

There were eight papers down for reading during the meeting, the sittings being held on the 29th and 30th ult. in the large hall of Firth College. The President of the Institution, Mr. Joseph Tomlinson, presided throughout. The papers on the agenda were as follows:—

"On Steel Rails, considered chemically and mechanically," by C. P. Sandberg, London.