the catalogues of Mr. Main and Mr. Stone.* The probability of the stars being collected into such systems was early suggested by Mitchell and the elder Herschel.† One of the most remarkable instances pointed out by Mr. Proctor are the stars β, γ, δ, ϵ of the Great Bear, which have a community of proper motions.‡ while α and η of the same constellation have a proper motion in the opposite direction. Now, the spectroscopic observations show that the stars β, γ, δ, ϵ, ζ have also a common motion of recession while the star α is approaching the earth. The star η indeed appears to be moving from us, but it is too far from α to be regarded as a companion to that star.

TABLE I.—Stars moving from Sun

Star.	Compared with	Apparent motion.	Earth's motion.	Motion from sun.
Sirius . . .	H	26 to 36	—10 to 14	18 to 22
Betelgeux . .	Na	37	—15	22
Rigel . . .	H	30	—15	15
Castor . . .	H	40 to 45	—17	23 to 28
Regulus. . .	H	30 to 35	—18	12 to 17
β Ursæ Maj. .	H			
γ ,, ,, .	H			
δ ,, ,, .	H	30	— 9 to 13	17 to 21
ϵ ,, ,, .	H			
ζ ,, ,, .	H			
β Leonis . .	H			
δ Leonis . .	H			
η Ursæ Maj. .	H			
α Virginis . .	H			
α Coronæ B. .	H			
Procyon . .	H			
Capella. . .	H			
Aldebaran ? .	Mg			
γ Cassiopeiæ .	H			

TABLE II.—Stars approaching the Sun

Star.	Compared with	Apparent motion.	Earth's motion.	Motion towards sun.
Arcturus . .	Mg	50	+ 5	55
Vega . . .	H	40 to 50	+39	44 to 54
α Cygni. . .	H	30	+ 9	39
Pollux . . .	Mg	32	+17	49
α Ursæ Maj. .	Mg	35 to 50	+11	46 to 60
γ Leonis . .	Mg			
ϵ Bootis. . .	Mg			
γ Cygni. . .	H			
α Pegasi . .	H			
γ Pegasi ? . .	H			
α Andromedæ.	H			

Although it was not to be expected that a concurrence would always be found between the proper motions which indicate the apparent motions at right angles to the line of sight and the radial motions as discovered by the spectroscope, still it is interesting to remark that in the case of the stars Castor and Pollux, one of which is approaching and the other receding, their proper motions also are different in direction and in amount; and further, that γ Leonis, which has an opposite radial motion to α and β of the same constellation, differs from these stars in the direction of its proper motion.

* See "Preliminary Paper on certain Drifting Motions of Stars," Proc. Roy. Soc vol. xviii, p. 169.

† Sir William Herschel writes:—"Mr. Mitchell's admirable idea of the stars being collected into systems appears to be extremely well founded, and is every day more confirmed by observations, though this does not take away the probability of many stars being still as it were solitary, or, if I may use the expression, intersystematical. . . . A star, or sun such as ours, may have a proper motion within its own system of stars; while at the same time the whole starry system to which it belongs may have another proper motion totally different in quantity and direction." Herschel further says, "and should there be found in any particular part of the heavens a concurrence of proper motions of quite a different direction, we shall then begin to form some conjectures which stars may possibly belong to ours, and which to other systems."—Phil. Trans. 1783, pp. 276, 277.

‡ Mr. Proctor, speaking of these stars, says:—"Their drift is, I think, most significant. If, in truth, the parallelism and equality of motion are to be regarded as accidental, the coincidence is one of most remarkable character. But such an interpretation can hardly be looked upon as admissible when we remember that the peculiarity is only one of a series of instances, some of which are scarcely less striking."—"Other Worlds than Ours," p. 269, and paper in Proc. Roy. Soc. vol. xviii. p. 170.

It scarcely needs remark that the difference in breadth of the line H β in different stars affords us information of the difference of density of the gas by which the lines of absorption are produced. A discussion of the observations in reference to this point, and to other considerations on the physical condition of the stars and nebulæ, I prefer to reserve for the present.

EXCURSION OF THE GEOLOGISTS' ASSOCIATION TO GUILDFORD AND CHILWORTH, JUNE 1

THE party first proceeded to examine the section of the "Woolwich and Reading Beds," just north of the station. This section was described by Mr. Prestwich in 1850 (see Quarterly Journal Geological Society, vol. vi. p. 260, fig. 6) not long after it had been exposed by the railway-cutting. A year ago it was laid bare afresh when widening the railroad; but already the slipping of the clays has obliterated some points of interest. Traces of the shell beds, with *Cyrena* and *Ostrea*, below the representatives of the "Oldhaven beds," are to be found at the base of a telegraph post, 104 yards south of the road bridge; and the underlying mottled clays, with a dip of 4° to the north, are easily recognised for about 190 yards to the south, where a small valley (about 50 yards across) has been formed by denudation out of the sand and lowest green sandy clays resting on the Chalk, which forms the northern foot of the Hogsback or Surrey range. Here the Chalk is seen to be traversed in every direction with fissures, often "slickensided," horizontally or nearly so, some empty, some filled with vein flint, and some with loamy stuff. Nodules and occasional thin laminæ of flint follow the dip of about 6° to the north, and many are in a crushed condition. Bands of marly chalk also lie on the same plane. Some Echinoderms were met with. The party then proceeded to visit the much larger excavation in the Chalk at the entrance of the railway tunnel. Here the dip, well marked by flints and marly bands, is about 12° to the north. Fossils (Sponges, Echinoderms, Inoceramus, &c.) abound in this pit. The usual chalcedonic and quartzy interiors of hollow flints attracted notice, and Prof. R. Jones drew attention to facts that seemed to him to bear evidence of flint being a pseudomorph after chalk. They next visited a quarry in the Lower Greensand, on the escarpment overlooking the pathway to Losely. In this section of those Neocomian beds known as the Bargate Stone, the waterworn sand of quartz, ironstone, lydite, and hard green silicates, is so largely mixed with calcareous fragments (the *débris* of shell beds, polyzoan reefs, &c.) that it is here and there cemented together hard and compact enough to serve as a building stone and road-metal. Mr. Meyer here directed attention to the horizon at which he obtained an unrolled tooth of *Iguanodon*, indicating the existence of this great Dinosaur at, perhaps, the latest period to which any of its remains as yet known belong. The "false-bedding" of the sands—due to the southward set of prevalent tides and currents, and the probable origin of their materials from the "old palæozoic ridge or shoal," were also studied, and the formation of the escarpment, with the correlative parallel cracks and fissures of the strata. The party then crossed the Ferry, where St. Catherine's Spring issues, beneath the hill, from a little cave in the red-orange-tinted sand. Here for thirty feet at least the Guildford gap has been found by boring to be occupied by bouldered chalk and other detritus due to the destructive, and yet conservative, agencies of nature. The soft irony beds of the Lower Greensand were next met with, and followed followed for about a mile, until a short field-lane, crossing the Gault and Upper Greensand, led into the Chalk-marl quarry below Warren Farm. Here the loss of the clay beds (Gault) from below, by their having been squeezed out along the southern side, had allowed the hard marl-rock to subside inwards and suddenly at the escarpment, and to rest at high angle (70° and more), whilst the Chalk of the hill range above dips only 5° or 6°. As the hard rock bands, here quarried for lime, are followed end-on along the strike (open to-day), the backs of lower beds form one side of this deep narrow pit; and the truncated edges of these somewhat bent and much fissured strata warn the instructed eye of the danger of standing either below them or above them, lest either rain or drought should detach their clinging surfaces from the sloping bed-plane. Large Ammonites and Nautili are the chief fossils met with here; but *Pecten Beaveri* and *Terebratula* are also found. In an old excavation in the lane *Siphonia* has been found in the representative of the Upper Greensand

which is overlain by dark-green sandy clay and Gault, turned up at a high angle (and probably squeezed out) in the breadth of a few yards, before the iron-sands are reached on returning to the hill-side. The party next came to the foot of St. Martha's Hill, or Martyrs' Hill. Before mounting this hill of sand, seamed irregularly with ironstone, some of the geologists descended the Halfpenny Hatch lane, leading down towards the East Shalford bottom, and saw a section of sand and calcareous sandstone, with a fuller's earth band and pebbly beds, similar to those in the quarry on the other (western) side of Guildford. The underground structure of South-Eastern England is connected with that of the Boulonnais, of Belgium, the Ardennes, and Westphalia; and the folds and ridges of palæozoic rocks, that in those countries bear up, either at the surface or just beneath the Chalk, or the attenuated Oolites, valuable coal-beds, are continued through, in a broad sweeping line, underneath parts of Surrey, Kent, and Sussex, until visible again near Frome, in the Bristol coal-area, in North Devon, South Wales, and the South of Ireland. The old faults and fissures affecting this linear tract of old strata had long before the Coal-period raised and depressed the lands and sea-beds; and, as a great spur of the old Scandinavian lands, this tract afforded ground for the littoral growth of the jungles that formed the coal on its oscillating borders and in its lagoons, now shut up by bars, and now losing their marsh features by influx of the sea. Succeeding ages still brought oscillations and changes, until the Jurassic seas crept over this old ridge or shoal, and the Cretaceous seas quite buried it, at first in sands and ultimately by the calcareous ooze of oceanic depths. But again another contracting crush of the earth's crust operated on the old weak lines, and the buried ridge slowly uprose, and its coating of thick strata were worn off by sea and rain, making pebbles and sand for the Lower Tertiaries; and still rising, it was at length laid bare in the Franco-Belgian and the Bristol areas; whilst our Wealden valleys of elevation, and those of Kingsclere, Shalbourn, and Pewsey, show where its uneven back approaches near the soil.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 20.—"On the 26-day Period of the Earth's Magnetic Force," by Mr. J. A. Broun, F.R.S.

Referring to the Astronomer Royal's important communication on this subject, the author confesses that, projecting his results for the horizontal force, he cannot agree in his final conclusions from them. In his paper he limits himself wholly to the observations of the horizontal force, as he has found that element, when accurately corrected for temperature, best fitted to show the period in question.

As far as the existence of a period of near 26 days is concerned, he thinks there cannot be the slightest doubt; the examination of great masses of observations has confirmed his belief; but we know nothing certainly as to its cause. It appears to be most probably connected with the sun's rotation; but in what way this may act nothing is known. The single periods show great breaks, and what may be termed *accidental* minima, in opposition to the minima belonging to the period; these accidental are connected with great disturbance, probably allied to the solar eruptions, or to causes which generally produce spots and protuberances. We might suppose that the sun during its rotation produces an action on the magnetic or electric ether in motion, which, as far as it acts on our magnet, may be supposed in greater quantity or more condensed in certain parts of the earth's orbit, and in certain years; and, as has been supposed in the case of the frequency of the solar spots, this ether may also be acted on by the planet, and produce an irregularity in the length of a few successive periods. These suppositions are made merely to show that we are perhaps not in possession of all the conditions of the problem, without which perfect exactness in the calculations is impossible.

In conclusion, he refers those interested in the subject to plate xxvii. in the Transactions of the Royal Society of Edinburgh, vol. xxii. where the daily means of horizontal force are projected for four stations on the earth's surface, all of which agree in showing the same movements, some of which have an amplitude of ·002 of the whole horizontal force (the Astronomer Royal's result for 1870 gives a *mean* value of nearly the half of this), and with intervals of about 26 days.

PARIS

Academy of Sciences, July 1.—M. M. Marie read a memoir on some general properties of the imaginary envelope of the conjugates of a plane place.—M. H. Resal communicated general equations of the movements of a solid body referred to its movable axes; and M. Montucci forwarded a note describing an experiment for the appreciation of the resistance of a sheet of brass to atmospheric pressure.—M. J. Bourget presented a memoir on the mathematical theory of the movement of a cord, one of the extremities of which possesses a given movement.—M. G. Tissandier communicated a notice of an optical phenomenon observed during a balloon ascent, describing a case in which the shadow of the balloon was thrown distinctly upon a white cloud, and surrounded by a pale elliptical halo, exhibiting the colours of the rainbow.—M. Faye communicated a letter from M. Tacchini noticing the occurrence of magnesium in the chromosphere of the sun.—M. J. A. Brown presented a note on the simultaneity of barometric variations between the tropics.—General Morin communicated an extract from a letter by M. Vinson describing a severe cyclone which followed the aurora australis of Feb. 4, 1872, at Reunion.—M. W. de Fonvielle gave an account of observations made during the ascents of the balloon "Lea," in which he refers to the above-mentioned note by M. Tissandier, giving the credit of the first observation of the halo round the shadow of balloons to Mr. Glaisher, and especially to the oscillation and rotation of balloons.—M. L. Sollier forwarded a note on the destruction of *Phylloxera vastatrix* by means of a decoction of tobacco.—M. C. Bernard presented a fourth note by M. Paul Bert, on the influence exerted by changes of barometric pressure upon the phenomena of life; and M. Wurtz communicated a third note, by M. Oré, on the question whether strychnine is to be regarded as an antidote to chloral.—M. Decaisne communicated an interesting paper by MM. Van Tieghem and Le Monnier, "On the Polymorphism of the Reproductive Organs in the mucorine genus *Mortierella*."—M. Leymerie presented a brief reply to a note by M. Garrigou on the constitution of the Pyrenees.

BOOKS RECEIVED

ENGLISH.—Town Geology: Rev. C. Kingsley (Strahan and Co.).—The Life of Richard Trevithick, vol. i.: F. Trevithick (E. and F. Spon).—Health and Comfort in House Building: J. Drysdale and J. W. Hayward (E. and F. Spon).—Nautical Surveying: J. K. Laughton (Longmans).—Sewer Gas, and how to keep it out of Houses: O. Reynolds (Macmillan).

FOREIGN.—Zeitschrift für Biologie: Pettenkofer, Radlkofer, and Vogt, Band 7, Heft 3, 4, Band 8, Heft 1.—Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen, Band 3, Heft 1.—Die Echinoiden der oesterreichisch-hungarischen oberen Tertiärablagerungen: Dr. Laube.—Die Erforschung des Süden-polar Gebietes: Dr. G. Neumayer.—Zur Kenntniss der Chlorophyllfarbestoffe: Dr. G. Kraus.—Jahrbuch der k. k. geologischen Reichsanstalt zu Wien, Jan.-March.—Notizblatt des Vereins für Erdkunde: L. Ewald.—Zur Morphologie des Säugethier-Schädels: Dr. J. C. G. Lucae.

CONTENTS

ERRATA.—Vol. v., p. 167, col. 8, l. 20, for "sufficient from" read "sufficient heat from;" p. 168, col. 1, l. 11, for "inorganic" read "organic."