Several small hunting spiders are to be found in the wasps nests which do not seem to leave any line behind them, and whose mode of life is very nomadic. I quite believe from observation that wasps can and do run these insects down by scent, although it is difficult to obtain direct proof of the fact. They seem quite capable of discerning between their prey and enemies, as shown above; and granting this, it does not seem a great stretch to a further development of instinct having the propagation of the species in view.

Can any of your readers explain to me in what manner the spiders are stupefied and not killed?

I have lately noticed cases of protective mimicry in birds which I think are worth recording.

While following a small wood-swallow (*Artamus minor*) a few evenings back, they suddenly disappeared near a large leaning gum-tree. Walking up to the spot they suddenly flew out of the trunk, which I found had been hollowed out by fire, leaving the inside charred and black. The birds had chosen this black surface as their roost, and when followed in the day-time invariably flew into this refuge. It was impossible to detect the birds when clinging to the charred surface, with which their plumage matched.

Artamus albiventris, I find, in like manner chooses a greyish back as a roost against which they are less liable to be detected. *Erythrina vespertilio* is a favourite tree with this species.

I have on several occasions taken *Podargus giganteus* and other species alive by hand in broad daylight. These birds sit perfectly still on a limb of an iron-bark or acacia, whose bark resembles their plumage in colour. W. E. ARMIT

Georgetown, Queensland, July 19

Agricultural Ants

I HAVE lately discovered a colony of agricultural ants near Georgetown. The species is very small and red.

My attention was first directed to these tiny harvesters by noticing heaps of chaff and hulls in a bare spot situated in a grove of young acacia trees.

The formicaries are entirely subterranean, being entered by a funnel-shaped tube.

Roads diverge from this gate in four or five directions, and during working hours are alive with what appear like white insects, the little ants being covered by their load. Some of these ants seem to clean the grain and carry out the husks, which form a heap round the opening to the nest. The clear space round each opening is small, certainly not more than eighteen inches in circumference, and a small mound not more than six inches in height is formed with the earth excavated in forming the nest. The only species of grain harvested is the seed of *Perotis rara*, whch is light when quite ripe. I cannot give the generic name of these little fellows, never having devoted any special study to the family, but shall be happy to furnish specimens in spirits to any naturalist who will forward his address. WILLIAM E. ARMIT

Dunrobin, Georgetown, July 19

Meteor

AT about 5.50 P.M. to-day I saw a most brilliant meteor fall quite close to the moon, which was shining brightly at the time: it was in full daylight, shortly after the sun had gone down. Its direction was nearly perpendicular, but inclined a little from north to south as it fell. It was of a bright green colour; its motion rapid, its path long, and the time during which it was visible about two seconds, and it left no visible trace behind it.

Harlton, Cambridge, October 8 O. P. FISHER

JANSSEN'S NEW METHOD OF SOLAR PHOTOGRAPHY

IN two papers published respectively in the *Comptes Rendus* for December, 1877, and in the *Annuaire* of the *Bureau des Longitudes* for the current year, M. Janssen has described a new method of photographing the solar disc, which he has successfully carried out at the Meudon Observatory, during the past twelve months; and he has also drawn attention to some striking features in the constitution of the photosphere, disclosed for the first time in the beautiful pictures which are among the first results of his process. These may be regarded as only the forerunners of further important discoveries. Through the courteous liberality of M. Janssen, I have lately had the advantage of studying the process in the Meudon Observatory, and a description of its distinctive features, and a brief notice of such of the results as M. Janssen has already published, will certainly be acceptable to many who are interested in the recent developments of solar physics, and have not ready access to the original papers.[1]

M. Janssen's pictures of the solar disc are distinguished from all those previously obtained with the photoheliograph, not only by their great size (30·5 ctm. diameter), but more especially by the remarkable sharpness and definition with which they display the details of photospheric structure, which are such that, for the purpose of their more effective study, it is found advantageous to enlarge the original pictures to three and even nine times their original linear dimensions. The greatly extended means of research which M. Janssen's invention places in the hands of the solar physicist will be obvious, when we consider the difficulties which attend any prolonged ocular inspection of the solar disc, hitherto the only practicable method of examining its detailed structure. "In spite of the interposition of coloured glasses, helioscopes, &c., the eye must seize on the details in a dazzling field, and perform its functions under conditions which are quite unfamiliar. The true variations of luminous intensity in different parts of the image can no longer be appreciated, and the impressions produced do not correspond to reality. Thus may be explained the diversity of the opinions which have been put forward respecting the forms and dimensions of the granulations, and of the constituent parts of the solar surface"—diversities well illustrated by the old controversy of the "willow-leaf" and "rice-grain" bodies in the photosphere. In M. Janssen's pictures the forms, sizes, and arrangement of the bodies described under these appellations are exhibited in the most satisfactory manner, and as, in a favourable state of the atmosphere, the pictures may be repeated at as short intervals as the operator pleases, the movements and changes of form exhibited by these bodies may be studied with the utmost ease in a register which preserves the most fugitive phases of their appearance, and is available for leisurely re-examination at any future time.

Before noticing the novel facts which M. Janssen has thus brought to light, I will briefly describe the principles of the process itself. The main difficulty to be surmounted in order to obtain a sharply defined photographic picture of the details of the solar disc is presented by the phenomenon known as photographic irradiation, in virtue of which a brilliantly illuminated surface occupies, on the negative picture, a proportionally exaggerated space; its borders being extended over the darker objects around. This phenomenon, M. Janssen remarks, "is very striking in all the photographs of total eclipses which have been obtained since 1860, which exhibit the images of the protuberances encroaching on the lunar disc, to the extent, in some cases, of ten and twenty seconds of arc, and even more." The granulations (to employ M. Janssen's terminology) visible on the solar disc have a mean diameter of not more than one second of arc, and in ordinary photoheliograms their very existence is therefore completely masked by irradiation.

[1] The present notice contains a more detailed description of the process than M. Janssen's original papers, and is published with his full approval and authority. With characteristic liberality M. Janssen writes:—"Quant au procédé lui-même, il est evident que toute personne un peu au courant de la photographie astronomique pourra l'appliquer et obtenir bientôt des photographies semblables à celles que nous obtenons. Je serai aussi très probablement devancé sur plusieurs points de la constitution du soleil que ces procédés peuvent révéler. L'inconvenient n'est que pour moi, et je crois qu'il vaut mieux dès aujourd'hui livrer la méthode au public scientifique. Les progrès de la science y gagneront certainement."

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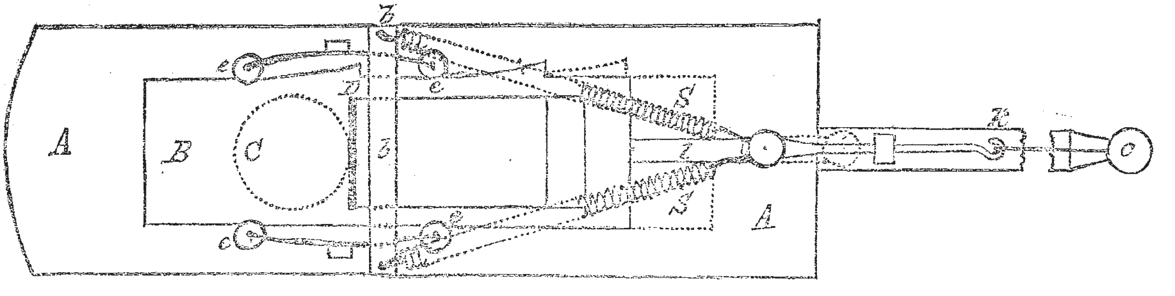
The simple and beautiful contrivance by which M. Janssen has succeeded in getting rid of irradiation, is to restrict the photographic action to one small sheaf of rays of the spectrum, viz., those which extend from the line G a short distance towards H. In a series of experimental photographs of the spectrum which M. Janssen took in my presence (with calc-spar prisms and a rock-crystal lens) and in which the time of exposure was varied successively from two-thirds of a second to three minutes, those obtained with the shortest exposure represented only that part of the spectrum immediately contiguous to G and extending a short distance towards H; and in this, the spectral lines were exhibited with extreme sharpness. With a more prolonged exposure the range of the image was greatly extended in both directions, accompanied by intensified action in the G–H region, which impaired the local definition.[1] Taking advantage of this fact, in the new process, the collodionised plate is exposed to the sun's action only so long as to allow of the action of the most actively photographic rays, and this is the cardinal condition of success. In practice, the duration of the exposure is restricted to between $\frac{1}{2000}$ and $\frac{1}{3000}$ of a second, in summer, being varied according to the season and to the time of day. The means by which this delicate adjustment is effected and verified will be described presently.

A second condition is, so to adjust the distance of the sensitised surface from the lens of the instrument, that it shall exactly coincide with the focus of the G rays. The necessity of this precaution will be readily understood when it is borne in mind that no lens is perfectly achromatic, and that, in virtue of the first condition, the rays in the vicinity of G alone produce the image. The remaining conditions are, the adoption of as large a plate as can be readily manipulated and some improvements in the process of preparing and developing the plates, whereby a very perfect surface is insured for the reception of the image, and a graduated development after exposure.[1]

The photoheliograph employed was constructed specially for the Meudon Observatory by M. Prazmouski of Paris. It has an object-glass of five inches diameter, and a reversing ocular, giving an erect image on the sensitized plate. The finding telescope casts an image on a disk of ground glass; by observing which, the operator can judge the exact instant for releasing the sliding screen, which causes the instantaneous exposure of the sensitised plate. At present, the position of the telescope is adjusted by means of winches worked by hand. The construction of the sliding screen, on the accurate adjustment and working of which the success of the operation mainly depends, will be understood on reference to the accompanying rough diagram (which, however, is not drawn to scale, and in which, to avoid confusion, some of the minor details are omitted). A A is an oblong brass plate which serves as a frame for the mechanism, and is introduced through a slit in the side of the telescope, exactly at the spot where the real image is formed by the object-glass. At the spot where the image falls, the plate is pierced with a circular aperture somewhat larger than



the image, shown by the dotted circle C. But this is completely covered by the sliding screen B, excepting such portion as is momentarily uncovered by the transverse slit D, in its passage across the image. The width of the sl t D can be varied by means of a micrometer screw, which is omitted in the diagram. The sliding screen works between four small grooved wheels *e e*, fixed to curved springs, which press them against the edges of the screen-plate; and one of these edges is shaped in the manner shown in the diagram, so that the pressure is increased from the instant at which the slit D reaches the margin of the circular aperture C, neutralising the acceleration of the movement by the continued action of the springs, and rendering it uniform during the passage of the slit across the image.[2] Thus the image is allowed to fall on the sensitised plate, not as a whole, but in successive slices, and the width of the slit is so adjusted to the rate of motion, that each slice is exposed during from $\frac{1}{2000}$ to $\frac{1}{3000}$ of a second only. The motion of the screen is effected by three spiral springs, two of which S S, are shown in the diagram (the central spring being omitted). The fixed ends are attached to a bar *b b* screwed to the slide A A; the free ends to a stud on the bar *l* which projects from the proximal end of B, is bent twice at right-angles and terminates in the hook *k*. In setting the screen before operating, a loop of twine is passed over the hook, which is then drawn towards the clip *c*, extending the springs S S, and bringing the screen into the position shown by a dotted line on the diagram. The twine is made fast in the clip *c* and all is in readiness for the operation. At the critical moment, the retaining string is cut and the slit D is rapidly drawn by the tension of the springs across the field, till checked by a stop not shown in the diagram. The movement of the screen is generally horizontal, but a gravity compensation is attached which can be employed when the movement is vertical.

The rate of the movement and the uniformity of the motion are determined by attaching, by means of wax to any part of the sliding screen, a glass slip coated with lamp-black. A tuning fork with an attached bristle, being made to vibrate transversely to the movement of the screen, the latter is released as in the actual operation of photographing, and the length of the wave marked by the bristle on the carbonised surface, multiplied by the width of the slit D, and divided by the number of vibrations of the fork per second, gives the duration of the exposure; while the uniformity of the movement is tested by the equality of the wave-lengths, which correspond to the passage of the slit D across the circular aperture C. By this means, the uniformity of exposure can be regulated to $\frac{1}{10000}$ of a second.

In order to obtain the exact position of the sun's axis on the plate, the instant of the exposure is noted by the

[1] Owing probably to spherical aberration.

[2] This, M. Janssen suggests, may be otherwise effected by an arrangement which will arrest the action of the springs at the instant when the slit reaches the margin of C.

[1] In this part of the process, M. Janssen acknowledges the assistance of M. Arents, to whom the writer is also indebted for much information.

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chronometer, and the exact level of the slide containing the sensitized plate is observed with an accurate clinometer before removing it from the camera.

As M. Janssen has pointed out, the chemical preparation and development of the plate require very great care, in order to obtain the requisite sharpness of detail. The gun-cotton for the collodion is prepared at a high temperature (70° C.), and numerous precautions are taken to ensure that the collodion film shall be perfectly even, and free from the smallest speck of foreign matter. The image is developed gradually, beginning with a solution of ferrous sulphate, and after thorough washing, completing with a solution of pyrogallic acid, after which the image is strengthened with a mixture of pyrogallic and silver nitrate solutions.

In a favourable state of the atmosphere, the pictures thus obtained leave nothing to be desired in point of sharpness and definition of detail. But, as a matter of course, all states of the atmosphere do not permit of equal success, the process being subject to the same atmospheric contingencies as in all astronomical work with the telescope. The best results were obtained in the late autumn, and during this last spring.

The character of the photospheric surface as displayed in the new photographs, will be best described in a translation of M. Janssen's own words: "The photographs show that the solar surface is covered everywhere with a fine granulation. The forms, dimensions, and arrangement of the granular elements are very varied. Their size varies from some tenths of a second to three or four seconds. The shapes are circular or elliptical, and more or less elongated; but often these regular forms are more or less distorted. The granulation is exhibited everywhere; and, at first sight, it does not appear to present a different constitution towards the polar regions. But this is a point to be further investigated. The illuminating power of the granular elements, taken separately, varies much; they appear to be situated at different depths in the photospheric layer. The most luminous of them, those which more especially contribute to the luminosity of the photosphere, occupy but a small fraction of the surface of the sun.

"But the most remarkable result yet obtained, and which is exclusively due to the employment of the photographic method, is the discovery of the photospheric network (*réseau photosphérique*). An attentive examination of the photographs shows that the photosphere has not an uniform structure throughout, but is divided into a series of figures, more or less distant from one another, and exhibiting a special constitution. These figures generally have rounded contours, but also often rectilinear and sometimes polygonal. Their dimensions are very variable, and they sometimes attain to a minute or more in diameter. While, in the intervals between these figures, the grains are distinct and definitely bounded, although of very variable size; in their interior, the granules are half obliterated, drawn out and confused; most frequently, indeed, they have disappeared, giving place to trains of matter which replace the granulations. Everything indicates that, in these spaces, the photospheric substance is subject to violent movements which have confounded the granular elements. . . . This fact enlightens us as to the forms taken by solar activity, and shows that this activity is always very great in the photosphere, even though there be no spot visible on the surface. I will further draw attention to this very important fact, of which very distinct evidence is furnished by certain photographs, viz., that numerous very dark points appear in the regularly granulated tracts, indicating that the photospheric layer can have but a very small thickness."

In another paper, Mr. Janssen deduces some further conclusions of interest. He observes:—

"If the solar layer which forms the photosphere were in a state of repose and perfect equilibrium, it would result from the fact of its fluidity, that it would form a continuous envelope around the solar nucleus. The granular elements would be confounded together, and the lustre of the sun would be uniform in all its parts. But the ascending gaseous currents do not admit of this state of perfect equilibrium. They break up and divide the fluid layer, escaping at a great number of points. Hence results the formation of the granular elements, which are but so many fractions of the photospheric envelope, and which tend to take a spherical form, in virtue of the gravity of their constituent parts. . . . But even this state of equilibrium of the individual parts is but rarely realised; in numerous points, the currents drag along with them the granular elements, and these latter lose their spherical form, and eventually become no longer recognisable where the movements are most violent. . . . Moreover, in the regions of relative calm, the movements of the photospheric medium do not allow the granular elements to arrange themselves in an even layer, whence results the greater or less immersion of the grains beneath the surface, and consequently, owing to the great absorptive action of the medium, the great differences of their lustre shown in the photographic pictures. . . . We may further conclude, from the fact of the relative rarity of the most luminous grains in the photographs, that the illuminating power of the sun is due principally to that of a small number of points on his surface. In other words, if the solar surface were completely covered with granular elements of equal brilliancy with these, its illuminating power, according to a first approximate estimate, would be from ten to twenty times greater than it is." It will be interesting to ascertain, at the next epoch of sun-spot maximum, whether the brilliant granules occupy a relatively larger proportion of the solar disc than at the present time. The direct evidence which such an observation will afford on the important question of the periodic variation of solar radiative intensity, a question on which much diversity of opinion still exists, will be of the highest value.

H. F. BLANFORD

BIOLOGICAL NOTES

THE ANATOMY AND AFFINITIES OF THE AYE-AYE.—Dr. Alix having recently dissected a young male Aye-aye (*Chiromys Madagascariensis*), communicates, through Prof. Gervais, to the Academy of Sciences of Paris (*Comptes Rendus*, July 29, p. 219), some notes on certain points in its anatomy which bear upon the much-vexed question of the position of this curious animal in the mammalian series. It seems that his observations confirm in all points the opinion of all those eminent naturalists who, in accordance with De Blainville, and contrary to Gmelin and Cuvier, have held that the Aye-aye must be approximated to the lemurs and separated from the rodents, fresh facts being brought forward in support of this view. First, as regards its myology. The extensor communis hallucis, which in rodents is attached to the outer condyle of the femur, arises in the Aye-aye from the tibia. The biceps brachialis, which has only one head in the majority of rodents, has two in the Aye-aye. The supinator longus, which is generally absent in the rodents, has in the Aye-aye a good development. The common extensor of the digits, to those of the hand or foot, is composed of two distinct fascicles, of which one furnishes the tendons of the second and third digits, the other those of the fourth and fifth, from which it results that the Aye-aye, like the other Lemurina, possesses a paired digital system, and resembles in this feature the cloven-hoofed Pachyderms and the Ruminants, while the other mammals have, under all relations, an unpaired digital system. Dr. Alix has, moreover, verified the presence of a rotator muscle of the fibula, previously men-

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