Variation of Solar Radiation Received on the Earth's Surface.—In a paper published in No. 11 (1903) of the *Comptes rendus*, M. Henri Dufour discusses a series of observations, extending from October, 1896, to March, 1903, which show that the amounts of the solar radiation recorded during December, 1902, and January, February, and the first half of March, 1903, were considerably below the average amounts received during these months, respectively, for the last seven years.

The observations on which the above statement is based were made at two stations about 20 kilometres apart, and during the whole of the period each set of observations has been recorded by the same observer. The observers have used exactly similar instruments, the actinometers of M. Corva, one of which has been verified by the inventor himself and the other checked by it, and the observations exactly corroborate each other.

The figures obtained for December were so small as not to warrant any conclusive statement as to the decreased insolation, but the figures obtained during January, February and part of March corroborate them, and show that for these three months the insolation, per sq. cm., was 0·11, 0·15 and 0·19 (calories—gramme-degrees—minutes) less than the mean for the same months during the past six years.

M. Dufour seeks to explain this decrease by supposing that the atmosphere at the present time contains some matter which is absorbing an abnormal proportion of the solar radiation, and suggests that the volcanic dust thrown out by Mont Pelée may be the cause.

Annals of the Royal University Observatory of Vienna.—Vol. xiv. of these *Annals*, edited by Prof. Edmund Weiss, director of the observatory, contains the detailed results of the observations of minor planets and comets made with the 16·2-cm. Fraunhofer refractor during the period from August, 1895, to January, 1899, and with a 67-cm. Grubb refractor and a 38-cm. equatorial coudé during the years 1897 and 1898.

The tables include the details of the observations of the positions and magnitudes of twelve comets (1895 iii. to 1898 x. inclusive), the positions of twenty-nine NGC nebulæ and one new one, and the positions and magnitudes of many minor planets, including those of Eros observed during 1898.

Vol. xvii. of the same *Annals* contains a "dictionary" of B.D. stars, wherein references are given, opposite each star's B.D. number, to all the other catalogues containing details about the star in question.

A Variable, or Temporary, Star in Lyra.—Herr Seeliger, in a communication to the *Astronomische Nachrichten* (No. 3857), describes and gives a chart showing the position of a faint star (10, 1903, Lyræ) which appears on two plates obtained with the $4\frac{1}{2}$-inch telescope of the Munich Observatory by Herr E. Silbernagel on September 2 and 3, 1902. The star in question occupies the position $\alpha = 18h.\ 48m.\ 42s.$, $\delta = +32° 39'·0$ (1855), and is about 30s. preceding and 12'·0 south of the Ring Nebula; on the two plates mentioned above it was equal in magnitude to two twelfth magnitude stars between which it is situated, but on plates taken on June 28 and December 10, 1902, on which these two stars are plainly visible, it does not appear. Neither is it shown on any one of thirteen plates, showing thirteenth magnitude stars, obtained with a 6-inch telescope on various dates between July, 1895, and July, 1902, nor does it appear on two plates taken with a 16-inch objective on July 10, 1901, and July 19, 1902, although these plates show stars of magnitudes 15 and $13\frac{1}{2}$ respectively.

Prof. Max Wolf obtained two photographs of this region, one on January 14 and the other on February 6, 1903; the first showed images of stars of the thirteenth magnitude, and the second, which had 2h. 10m. exposure, showed much fainter objects, but on neither plate does the star 10, 1903, Lyræ appear.

In an editorial note appended to Herr Seeliger's notice is a communication from Prof. Hartwig, in which he states that he observed the star 10, 1903, Lyræ on the morning of March 8 (May 7, 16·25h., M.T. Bamberg) with a 10-inch refractor, and found it to be of about the fourteenth magnitude, 0·2m. brighter than its nearest neighbour.

THE FORMATION OF DEFINITE FIGURES BY THE DEPOSITION OF DUST.

It was hardly to be expected that a fine dust when separating out from the air could easily be made to deposit in perfectly sharp, clear, and constant figures, but this is easily done by simply raising the plate, on which the deposit is to take place, a few degrees above that of the surrounding air, and in five to six minutes, in place of a uniform deposit, which would naturally be expected, a perfectly definite figure is formed; the dust will be heaped up in certain places, and in others the plate will be without a trace of deposit upon it. That a plate, bombarded on every side by a thick dust, should be able to compel by means of a very small amount of heat added to it the falling particles to arrange themselves in such definite forms is undoubtedly remarkable.

The active agents in bringing about these results are, no doubt, the currents of air set up round and on the plates, but that their flow should be so regular, so persistent, and so powerful, is more than could have been anticipated. The figures, although very easily formed, are in many cases very complicated, and, notwithstanding the deposit giving a clear and constant record, still at present it remains an unsolved problem how these complicated effects are brought about. Diminished atmospheric pressure does not affect the figures formed.

The material of the plate on which the dust is to settle is not a matter of consequence; it may be of metal, glass, ebonite, india-rubber, or cardboard, and the same figure will be formed, but obviously on some materials the dust will be more visible than on others. A glass plate is probably the best substance on which to receive the deposit, and the best dust to use is that produced by burning magnesium ribbon, for it is brilliantly white, and is readily obtained in any quantity. A glass receiver, or a box of any kind without a lid, will serve as a receptacle for the dust. Light the magnesium and invert the receiver over it, and if sufficient magnesium be used, a dense atmosphere of dust is formed. The plate on which the figure is to form should be raised about an inch above the table on a small support, and then the receiver, filled with the dust, placed over it and left there for six or seven minutes. The plate, previous to placing it in the dust must be warmed; if it be glass, pass it over the flame of a lamp until the moisture, at first condensed on the under side, disappears; other materials may be treated much in the same kind of way, or heated in an air bath. The essential point in order to obtain a good figure is that the plate should be a few degrees, 10° or 15° C., above that of the dust atmosphere. If it be of nearly the same temperature, then the figure is but faint, and the same happens if it be some 100° to 120° above the temperature of the surrounding air, and if of still higher temperature, no deposit of dust takes place.

Suppose now the experiment is made with a square glass plate, treating it as above described; on removing the plate from the dust receiver, most of the dust having subsided, the plate will be found not covered all over with a fine deposit, but a clear and most delicately drawn cross, consisting of four rays, each starting from a corner of the plate and reaching to the centre, is seen. Under the above conditions, the figure is absolutely constant; it may be dense or faint, and it may be slightly distorted by conditions now well known and described, but on a plate of this shape it is always a cross that is formed. The figure starts from the four corners, but vary the form of the plate and you vary the form of the figure deposited on it. The corners being the agents which principally, if not entirely, determine the figure, and in this simplest case a square, it is not difficult to imagine that even the slight heating of the plate is sufficient to start currents of air, which, flowing round the edges of the plate, carry the dust with them, and allow it only to fall where a comparatively still atmosphere exists. In other cases, the flow of the currents seems very difficult to follow, still with such definite and easily produced pictures it may be possible to follow the changes they undergo.

On the square plate, the action of each corner is evident, and this action of corners is still more clearly shown if a plate in the form of an octagon be used (Fig. 1). With a triangular plate, a figure of three limbs is produced, and so on with other shapes, the corners always determine the general figure, and if there be no corners, if the plate be a circle, no deposit forms. It does not appear as if the composition of the dust used to produce these figures is a matter of importance, the dust from ashes, from ammonium chloride, the fine spores of a fungus, all produce the same figures, but the magnesia produced by burning magnesium is, as before mentioned, more brilliant in colour, and more readily produced than any other dust. There is, however, one essential character necessary in whatever dust is used, namely, that it be very fine.

To obtain these figures perfectly regular in form, care has to be taken that the atmosphere surrounding the plate shall be fairly uniform in temperature. If the reservoir of dust be a glass vessel, and an ordinary Bunsen burner be at a distance of one to two feet from the plate and outside the receiver it is sufficient to spoil the symmetry of the cross by either making one limb of it much thicker than the others or by pushing it more or less on one side. Again, by placing a hot body under the plate while the dust is depositing, curious modifications of the deposit are produced, but require the photographic pictures to show exactly what has taken place. At first this extra heating causes an increase of deposit, but when the temperature rises beyond a certain point, it gradually diminishes the amount of deposit, and if the plate rest on a metal support which is at a temperature of about 150° C., no deposit takes place. In fact, for each different way that the heat is applied a different form of deposit is produced. For instance, if the plate be *not* heated, but is placed on a small metal cylinder which is heated, a remarkable deposit is formed; so again when a hot or cold metal cylinder is placed on the top of the plate instead of below it, curious and complicated figures are formed. When the plate is not exactly horizontal, the figures formed on it are no longer symmetrical, but have the appearance of sliding down the plate. Very remarkable effects are produced on these dust deposits by proximity to the plate of different-sized bodies; for instance, stick up a piece of glass against the plate, and then expose it to the dust. The glass screens the plate from the currents of air formed, and a deposit takes place according to the size of the obstruction. Fig. 2 shows what happens when an ordinary pin is placed with its point on a level with a square plate, and at a distance of 3 mm. from it. The cross is still formed, but the pin has caused a realm of calm from the centre towards the edge of the plate. Again, Fig. 3 shows strikingly the delicacy of this kind of action; the fine deposit ending in a fine point was produced by sticking a human hair vertically against the side of the plate and exposing it to the dust atmosphere.

FIG. 1.

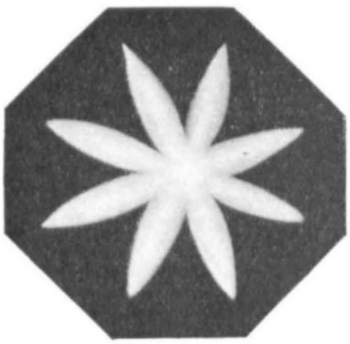
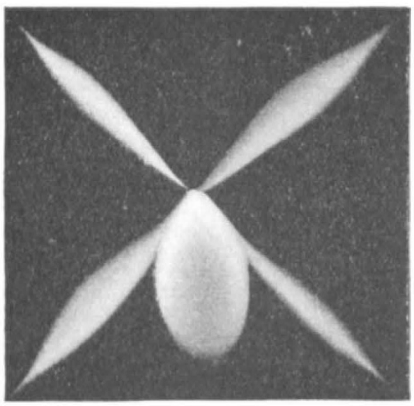


FIG. 2.



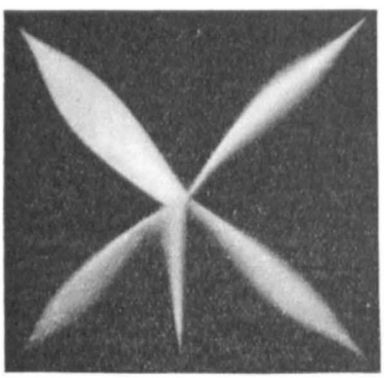


FIG. 3.

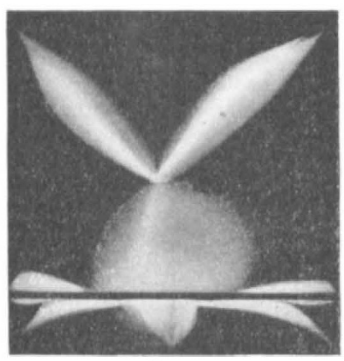


FIG. 4.

It is then unnecessary for this pin or post to be in contact with the plate; it may be at a distance of some 8 to 10 mm. from the plate. It may be above the level of the plate, on a level with it, or even below its level, and still influences the deposit of dust. In all cases, as the pin recedes from the plate, so does the deposit recede from the edge, getting smaller and smaller, until at last it disappears at the centre. It is difficult to realise that a pin held so that its point is at 6 mm. below the level of the plate and 2 mm. away from it should be able to induce on the plate a definite and decided deposit, but such is the case. In using glass plates for the figures to deposit on, care must be taken that the edges are quite smooth, for if not, the small pieces forming the rough edge of a cut piece of glass are sufficient to cause spikes of deposit to shoot out from the centre on other parts of the figure.

There still remains another way of studying the formation of these singular figures and influencing their formation, by offering obstructions to the free deposition of the dust; for instance, if a strip of glass be placed across a square plate, and the strip be not more than 1 mm. high, the deposit takes no notice of it, and the cross forms as if the strip was not there; but increase the height of the strip, make it 4 or 5 mm. high, and the figure becomes much altered, and the form of the deposit is much changed. Again, if the obstruction to the free flowing of the currents be produced by hanging a strip of glass or a point above the plate to receive the deposit, an interesting series of figures is formed, but these cannot be discussed without the illustrations. Fig. 4 may, however, serve to give some idea of the kind of changes which are produced. This represents a square glass plate with a strip of glass some 25 mm. high, and longer than the plate, placed across it, and a pin pressed against it at the middle of the lower side. The influence of the four corners of the plate, of the pin and of the strip are all clearly indicated; also it will be seen that the right hand ray at the top of the picture has two points, the smaller one is produced by some splinter of glass which was very near to the corner. In the full paper to be printed in the *Phil. Transactions*, there are some fifty pictures showing the formation of different figures.

If the fine powder from burning magnesium is used on a glass plate, it is, when first deposited, easily removed by the slightest touch, but if allowed to remain on the glass for some time, say a fortnight, it becomes comparatively fixed there, and may even be lightly rubbed without being removed.

If mercury in a square vessel be used in place of a solid plate, the same figure of a cross forms upon it. If water be used, entirely different figures form, the sinking of the powder gradually through the water producing other changes.

W. J. RUSSELL.