of cloud on a scale of 0 to 10, and the chance in percentages of its occurrence are as follows:

August 8th, 8 P. M.		August 9th, 8 A. M.	
Amount of Cloud.	Chance.	Amount of Cloud.	Chance.
10	45.5	10	45.5
8	13.7	9	9.1
7	4.6	8	4.6
5	4.5	7	9.1
3	9.1	6	4.5
2	4.5	4	4.6
0	18.2	3	4.5
		2	9.1
		0	9.1
	100.1		100.1

"In Vadsö there is a telegraph station, and time signals are to be had from the observatory in Christiania. The latitude and longitude have been determined with all possible accuracy. Sydvaranger lies on the south side of the Varangerfjord and Elvenes is the name of the posting station. Vardo, lying on the north side, is not to ber ecommended, having too often fog or clouded sky. In the interior of Finmarken the sun is lower than at Varangerfjord."

Although the astronomical conditions of low altitude of sun and short totality are not good, yet the meteorological conditions just noted compare favorably with those of stations in Japan, where the eclipse occurs later in the day and totality lasts longer. As a basis of comparison for the chance of clear weather, it may be stated that here at Blue Hill, Mass., near the coast, at 8 A. M. in August the average frequency of cloudy weather (sky 8 to 10 tenths covered) is 50.0 per cent. and the average frequency of clear weather (sky 0 to 2 tenths covered) is 32.3 per cent.

A. LAWRENCE ROTCH.

BLUE HILL METEOROLOGICAL OBSERVATORY, February 20, 1896.

THE RÖNTGEN RAYS.

The following fact regarding the X-rays of Röntgen may be of interest:

I have found that it is possible to obtain a photographic image by these rays using a 'pin-hole camera,' having the aperture pierced in a piece of sheet lead backed with aluminum. The Crookes tube was illuminated by discharges from a Thomson high-frequency coil. The photographs taken in this way show very distinctly the two electrodes, while the glass bulb, which appeared to be brightly illuminated to the eye, is scarcely perceptible. It would appear from this that nearly, if not all, the so-called X-rays proceed directly from the electrodes of the tube and not from the glass where this is acted on by the cathode-rays. It likewise affords further illustration of the rectilinear motion of the X-rays. Experiments are in progress with a broken current and also to study the effect of a magnetic field.

Previous observation had shown that the photographic effects were produced equally whether the cathode rays impinged upon the glass or upon other phosphorescent material (*e. g.*, arragonite) within the tube. It has also been noticed in experiments in this laboratory that the appearance of the tube to the eye affords no criterion of its efficiency in producing the X-rays; tubes showing but little fluorescence of the glass composing them often giving admirable photographic effects, which in some cases are obtainable even from a low-vacuum Geissler tube. But the rays producing photographic effects always appear to produce strong flourescent effects on platino-cyanide of barium, so that the fluorescence of this affords an indication of the photographic efficiency of the radiations emitted from the tube.

RALPH R. LAWRENCE.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON, February 26, 1896.

RÖNTGEN RAYS PRESENT IN SUNLIGHT.

IN the course of a series of experiments on the so-called Röntgen or X-rays, the undersigned have secured evidence of the presence of these rays in sunlight, and have been able to reproduce many of the phenomena ascribed to the X-rays, without the use of vacuum tubes or any other source of light or energy than direct sunlight.

Dr. Egbert was led on February 22d to place in a photographer's printing frame, an ordinary sensitive plate (Seed's No. 26), upon which was superimposed a positive lantern slide, and on this a shield of aluminium; which was then exposed to the direct rays of the sun for two hours, and the plate developed, when it was found that the aluminium shield had been transparent

to some agent which had produced a photographic effect; although the sensitive plate was completely in the dark within the printing frame and thoroughly protected from light rays as generally understood. Apparently, however, the plate had been over-exposed, and it seemed that better results might be obtained by shorter exposures. Therefore other plates of the same kind were exposed by us for gradually decreasing periods, under negatives and positives, and shields, respectively of aluminium, hard rubber, black cardboard and double thicknesses of opaque needle paper.

Positives were obtained in each case resembling those obtained by the photographer with ordinary methods, in some cases the exposures being as brief as ten minutes.

Shadowgraphs ('skotographs,' or 'skiagraphs') were also produced by the method employed by Prof. Röntgen, except that the source of energy was the direct sunlight in place of the rays from a vacuum tube, *i. e.*, coins placed upon the aluminium shield produced shadow prints on the sensitive plate.

It is obvious that these experiments prove the presence in sunlight of the peculiar rays described by Prof. Röntgen, or of others possessing the same properties, namely, the power of penetrating substances opaque to ordinary light rays.

Prof. Röntgen states, in the second clause of his article (as translated and printed in SCIENCE of February 14th, p. 227,) 'that some agent is capable of penetrating black cardboard, which is quite opaque to ultra-violet light, sunlight or arc-light.' If this statement refers to sunlight *in toto*, including the visible and invisible rays, it is evidently contravened by our experiments, which demonstrate beyond a doubt the existence of an 'agent' in sunlight, which accomplishes the work of the 'X-rays.'

Prof. Röntgen refers to the possibility that the effect is due to a fluorescence produced in the material of the sensitive plate. One of our experiments seemed to point to the correctness of this hypothesis. Fixed photographic prints on albumin paper placed between the aluminium shield and the sensitive plate gave corresponding negative effects; but the space covered by these prints was evidently more intensely acted upon by the rays than other parts of the plate covered only by the aluminium. Should fluorescence be produced by these rays in silver emulsions, it would perhaps explain the phenomena. Prof. Röntgen further states that silver in 'thin' layers allows the rays to pass; but we have shown that some of the rays are partially stopped by the exceedingly thin film of silver in the ordinary photographic negative.

It is obvious that the discovery of these rays in sunlight opens up an entirely new field for experiment and is of the highest practical importance to all photographers.

We hope to supplement this preliminary statement by a presentation of the results of our attempts to solve a number of interesting problems that have been suggested.

CHARLES S. DOLLEY,
SENECA EGBERT.

[Results somewhat similar to those given by Drs. Dolley and Egbert have been announced by M. Gustav Le Bon, Prof. S. P. Thompson and others. The conditions, are, however, so complex that it is difficult to eliminate sources of energy other than the Röntgen rays. Careful experiments at Columbia College have not detected any penetration of thin ($\frac{1}{100}$ inch) sheets of aluminium by sunlight, though ebonite and wood of considerable thickness are penetrated by ordinary light. Ed].

RÖNTGEN RAYS FROM THE ELECTRIC ARC.

PROF. S. P. THOMPSON is reported * to have discovered the Röntgen rays in the radiations emitted by the electric arc, and to have succeeded in getting excellent shadow pictures with them. The present writer had carried out the following experiments before seeing the report of S. P. Thompson's work, and had reached conclusions opposite to those reported of Prof. Thompson.

Very rapid (Carbutt's 'Eclipse 27') and medium (Carbutt's 'Orthochromatic 23') plates, placed in ordinary holders, were laid in deep lead trays and masked with two to five thicknesses of black cardboard, including the card-

* London, *Electrician*, January 24, 1896. Digest in the *Electrical World* February 15th.