erly winds that precede storms. Sometimes rapid alternations of sunshine and shade, by heating and cooling the wire, cause it to elongate and contract rapidly, and maintain an additional series of musical notes. Sometimes the length and tension of a wire stretched between two telephone supports is such that it can harmonically respond to several classes of waves transmitted from distant parts of the line. We thus obtain the very rich effects of the aeolian harp, which, as is well known, has often been said to ring out the finest notes before a storm, and whose action was also attributed to magnetism and other occult causes, until Chladni gave the correct explanation. — ED.]

An attempt to photograph the solar corona.

Mr. W. H. Pickering having called my attention to his letter entitled 'An attempt to photograph the solar corona,' printed in *Science* for April 3, may I ask you to insert the following lines in the next number of your journal.

The false coronal effects which Mr. Pickering describes are precisely those which might have been expected to result from his optical and instrumental methods. I have in my papers called special attention to the two principal sources of false effects which are present in the form of apparatus employed by Mr. Pickering; namely, the use of a lens, and the position of the drop-shutter which is said to have been 'attached to the lens.'

In some early attempts which I made with lenses, any true coronal effect which may possibly have been upon the plates was completely masked by very strong false coronal appearances and rays, similar to those obtained by Mr. Pickering. These were due, probably, in part to outstanding chromatic aberrations of the lenses, though corrected for photographic work, in part to reflections from the surfaces of the lenses, and in part to a diffraction annulus about the sun's image. It was on account of these, and some other probable sources of error when a lens is used, that I had recourse to reflection from a finely polished mirror of speculum metal. When the mirror was used, all these false effects disappeared.

It is scarcely necessary to remind your scientific readers that the only position in which the drop-shutter can be placed, when an object so bright as the sun is photographed, without introducing strong false coronal effects about the sun's image from diffraction, is in, or very near, the focal plane. 'Attached to the lens,' whether behind or in front of it, a strong diffraction effect is produced upon the plate at the beginning, and again towards the end, of the exposure. If Mr. Pickering will direct his apparatus to the sun, and observe the sun's image on the ground glass of the camera during the time that the drop-shutter is moved very slowly past the lens, he will be the spectator of a succession of fine diffraction effects, which in the aggregate, as far as they were bright enough, must have recorded themselves on his plates. In this way, with care and skill, the sources of other instrumental effects could, no doubt, be tracked out.

In one of my papers my words are, "The moving shutter, being placed very near the sensitive surface, and practically in the focal plane, could not give rise to effects of diffraction upon the plate." I may now add, that, even with the shutter near the plate, care has to be taken that no light is reflected from the edge of the moving plate of the shutter.

I state that with my apparatus, when the sky is free from clouds, but whitish from a strong scattering of the sun's light, "the sun is well defined upon a sensibly uniform surrounding of air-glare, but without any indication of the corona. It is only when the sky becomes clear and blue in color that coronal appearances present themselves with more or less distinctness." Any apparatus intended for photographing the corona must fulfil perfectly these conditions before any serious attempts are made to obtain the corona.

I stated, in a paper presented to the British association for the advancement of science in the summer of 1883, that I had discarded the use of colored glass (or cells of colored solutions) because of the danger of false appearances from imperfections in the surfaces or in the substance of the glass.

Mr. Pickering does not state that his sensitive plates were 'backed' with a solution of asphaltum, or other black medium, in optical contact with the glass, — an essential condition.

No tube, with suitable diaphragms inside, appears to have been used in front of the lens to prevent light falling upon the inside of the telescope tube or camera, and being thence reflected possibly upon the plate. The desirable precaution of using a metal disk, with a suitable surface, a little larger than the sun's image, and placed close in front of the sensitive plate, does not seem to have been taken.

Mr. Pickering says of the violet glass, "By its use, a negative image of the sun's disk was obtained; but without it, the plate gave a reversed image." I found no difficulty in obtaining a negative, or a reversed image, when violet glass was used, by a suitable change of the time of exposure; and therefore Mr. Pickering's time of exposure was in fault, if he wished a different result.

Mr. Pickering says, "Both bromide and chloride plates were provided; but, as with Mr. Huggins, the latter proved to give much the better coronal effects." And again, towards the end of the letter, he says that "chloride plates are more suitable than bromide ones for obtaining an atmospheric corona, just as Mr. Huggins has claimed that they are more suitable for taking a solar one: hence I think one must not rely too much on the ultra-violet sensitiveness of the chloride plate for the separation of the two." Passing by the use of the words 'atmospheric corona' for the false appearances which were due in great part, if not altogether, to diffraction and other instrumental effects, as I have already pointed out, and presuming that Mr. Pickering was not unfamiliar with the greater blackness of chloride plates, especially when developed with ferrous oxalate, he seems to infer some special suitability of the chloride plates to bring out the false effects upon his plates. It may be suggested that Mr. Pickering seems to have used the same length of exposure throughout, "giving an exposure which may be estimated at about a fifth of a second." Now, it is scarcely probable that the bromide and chloride plates possessed the same sensitiveness; and it may have been that the (probably) more sensitive bromide plates were thin from excessive exposure. It may even have occurred that his lens, if corrected for bromide plates, gave an outstanding aberration about H, or a little beyond. Anyway, until these and some other similar points are cleared, it does not seem to me that Mr. Pickering is justified in making the insinuation which seems to lie in the words which I have quoted.

In conclusion, I cannot refrain from expressing great surprise that Mr. Pickering should have mentioned my name in connection with experiments carried out in complete disregard of the conditions to which I had called attention, as essential in a matter

of such extreme delicacy as photographing the corona, and in which no little skill and special experience are necessary on the part of the *photographer* as well as on the part of the physicist.

Mr. Pickering has no doubt received authority from Dr. O. Lohse to say that "he (Dr. Lohse) considers that the halo on his plate is wholly atmospheric, and not coronal;" but Dr. Lohse's published statement reads differently. Dr. O. Lohse's words are, "Es gelang aber dieselben (die schwierigkeiten) zu überwinden und resultate zu erhalten welche zu einer fortsetzung der — hier freilich selten möglichen und mit grösserem vortheil in möglicht hoher lage anzustellenden — experimenten ermuthigen." — *Vierteljahrsschrift der Astronomischen gesellschaft*, xv. 134.

I have not seen Dr. Lohse's plates, and can therefore express no opinion as to the nature of the appearances upon them. William Huggins.

THE PRESERVATION OF NIAGARA.

Nearly seven years ago Lord Dufferin, then governor-general of Canada, suggested to Gov. Robinson of New York that the governments of the province of Ontario and the state of New York should purchase such lands about Niagara Falls as would be required to give free access to the principal points of view, and serve to restore and preserve the natural scenery of the great cataract, beside securing to visitors freedom from those vexatious annoyances which now abound. Subsequently the governor-general called the attention of the government of Ontario to the matter, and recommended co-operation with the state of New York in accomplishing this purpose.

Later, in January, 1879, Gov. Robinson, in his annual message to the legislature of New York, presented this matter, and recommended the appointment of a commission to investigate the question, to confer with the Canadian authorities, to consider what measures were necessary, and to report the results to a succeeding legislature.

By resolution the commissioners of the state survey were charged with the investigation. This commission included some of the most distinguished men of the state, — Ex-Gov. Horatio Seymour, Vice-President of the United States W. A. Wheeler, Lieut.-Gov. Dorsheimer, President Barnard of Columbia college, and others.

With breadth of view worthy of such men, they state in their report, that, "under this resolution, it became the duty of the commissioners to ascertain how far the private holding of land about Niagara Falls has worked to public disadvantage through defacements of the scenery; to estimate the tendency to greater injury; and, lastly, to consider whether the proposed action by the state is necessary to arrest the process of destruction, and restore to the scenery its natural character." In pursuance of these objects, the commissioners instructed Mr. James T. Gardiner, director of the state survey, to make an examination of the premises, and prepare for their consideration a project. He was assisted in this work by Mr. Frederick Law Olmsted, the distinguished landscape-architect.

The examination showed that the destruction of the natural scenery which forms the framework of the falls was rapidly progressing: unsightly structures and mills were taking the place of the beautiful woods that once overhung the rapids; the fine piece of primeval forest remaining on Goat Island was in jeopardy from projects looking to making a showground of the island; and every point from which the falls could be seen on the American side was fenced in, and a fee charged for admission. It was found, that, owing to the topography of the main shore, it was practicable to restore its natural aspect by clearing away the buildings from a narrow strip of land 100 to 800 feet broad and a mile long, and planting it with trees which would screen out from view the buildings of the village. When these trees should be grown, and the mills removed from Bath Island, and trees planted there, the falls and rapids would be again seen in the setting of natural foliage which formed so important an element in their original beauty. Every point from which the falls could be seen would also become free of access by the plan proposed. A map was made showing just what lands should be taken to carry out these purposes. The commissioners adopted the plan of Mr. Gardiner and Mr. Olmsted, and recommended to the legislature of 1880 the passage of an act to provide for acquiring title to the necessary lands by the exercise of the right of eminent domain, leaving it to a future legislature to consummate the purchase by appropriating the amount for the payment of the awards, if the sum should seem a reasonable price for the property. Such an act passed the assembly, but was defeated in the senate, although the movement was supported by petitions signed by the most distinguished men of this and other countries. The report of the state survey, with its complete descriptions, illustrations, and maps, then became the basis of a systematic effort on the part of a few determined friends of the falls to educate and arouse public opinion to save the scenery of Niagara. Early in 1883 this