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ASTRONOMY AND ASTRO-PHYSICS.
DEPARTMENT OF ASTRO-PHYSICS.
GEORGE E. HALE, - EDITOR.

Kenwood Astro-Physical Observatory.

Chicago, April 7 1892

Professor P. Tacchini,
Osservatorio del Collegio Romano,
Rome.

My dear Sir:—

I received your letter of March 17 with much pleasure, and I thank you for your kind offer to publish some of my photographs of faculae and prominences in the Memorie. The photographs are hardly as sharp as I should like to have them for publication, but I hope very soon to send you some that may be suitable. As you suggest, I will have the plate made in Chicago, and then send it to you.

I have discovered some very remarkable forms of faculae, which seem to indicate some kind of "whirlpool" motion. The following rough sketches will serve to give you an idea of the general appearance of some of these, though the sketches are not

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very accurate.

If there is in reality a "whirlpool" motion, as these would indicate, it would not agree with M. Faye's theory, as he maintains that the ☉ motion is so closely confined to the umbra that even the penumbra usually shows no signs of it. In spite of his replies to your excellent papers in the Comptes rendus, I do not think that faculae not in the neighborhood of spots can be accounted for by assuming that the pores are more closely accumulated in such regions. I sometimes find immense areas of faculae (in one of the photographs which I will send you a group of faculae extends nearly across the whole disc of the Sun), and as there are often no large spots, and sometimes no

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spots at all, in these great regions, it does not seem possible that the ~~t~~ jores alone can produce such outbursts. At the same time I quite agree with you in supposing that the unequal velocities of the different regions of the photosphere must produce some "whirlpool" motion. Perhaps the faculae may precede spots; there seem to be many reasons to believe that they do. I hope shortly to take daily photographs of the Sun by the Janssen method on a scale of from 12 to 18 inches to the diameter, and there will be very carefully studied in connection with the photographs of faculae obtained every clear day with the spectroheliograph. I shall also study the question raised in your letter, as to disturbances on the disc being the cause of magnetic storms. In one of my photographs of the great February Sun-spot I found that the prominence (or facula?)

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observed near the spot through the C line, was shown on the plate. I cannot tell whether it was a bright prominence or a facula, as the H and K lines are reversed in both, and therefore both must be shown in photographs taken with the spectroheliograph. In many of my photographs the faculae are shown projecting a short distance above the limb, and sometimes the prominences are bright enough to be obtained with the short exposure used for the faculae. Usually, however, the image of the sun is covered by a diaphragm when the photographs of prominences are being made, as ordinary prominences around the limb require a shorter exposure than that needed for faculae. I have some plates, taken with intermediate exposures, which show spots, prominences and faculae, all on the same photograph.

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In photographing the spectra of spots, I have recently noticed several interesting facts. As is well known, the H and K lines are always reversed near spots, but I have also found that in all the plates I have so far made the bright lines extend entirely across the umbra, as well as the penumbra. This does not agree well with M. Faye's theory. In the penumbra the H + K lines are doubly reversed, as they are also very frequently in the faculae. In the umbra they are much narrower, and the double reversal is usually absent or very faint. Another peculiar fact is that H and K have always been straight in my photographs of spots and faculae, and showed no sign of distortion even when C was considerably distorted. In the prominences the distortions of H and K are usually, if not always, the same as those of C.

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Photography is proving to be most useful in investigating solar phenomena, and I hope to be able to learn very much more by its means. My present 12 inch objective is not particularly well suited for this work, as it is corrected for the visual rays, but I am now having constructed a 12 inch objective, corrected for photography. With this I should be able to obtain sharper photographs.

Very sincerely yours

George E. Hale