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A LABORATORY FOR PHOTOGRAPHIC RESEARCH.

BY ROMYN HITCHCOCK.

THE discussion upon the respective merits of ordinary and color-sensitive plates for photographing stars, which has been raised by the French astronomers, is only a single example out of a great number which might be mentioned to show how much experimental work has yet to be done before our photographic processes will fully meet the demands of scientific investigation. Modern photography has experienced very rapid development. It has been such a fascinating subject for experimentation that a great host of workers, many of them skilful and indefatigable, have contributed a countless array of facts, but intermingled with these are so many observations of a different character that the extensive literature of the subject is very confusing. What, for instance, are we to understand concerning the remarkable phenomena observed by several of the early investigators who found that certain rays of the spectrum produced chemical changes which were reversed by certain other rays? It has seemed to me that this subject would well repay investigation with the improved appliances and better knowledge of the present time. The latest application of the phenomenon that has come to my notice has been at the astro-physical observatory at Washington, in an attempt to photograph the invisible infra-red spectrum by means of a phosphorescent plate. The rays of the spectrum destroy the phosphorescence, leaving luminous bands representing the spectrum lines. It is not probable that any such method will prove of much practical value, but none the less is the investigation of the phenomenon to be advocated for the information to which it may lead concerning the nature of radiant energy.

The fact that Professor Langley has resorted to such a device to photograph the invisible part of the spectrum brings clearly before us the supposed limitations of photography in this direction. The limits of the photographed spectrum have within a few years been greatly extended into the red, and even beyond it perhaps, by special sensitizing agents or by peculiar methods of preparing plates. But the theory of the subject has not been worked out, and in this there is a very important field for research. The inducements to carry out such investigations must come from those who most need the results. In other words, here as in other cases the photographic investigator would like to know that his results will be intelligently applied, else he becomes discouraged and enters upon some other field. If the physical observer would encourage research in photography to meet his requirements, and if the astronomer would have plates perfectly adapted to his purpose, let them cease to place their reliance upon color-sensitive plates, or on any other plates prepared for the public demand, and put their photographic work in the hands of an experienced photographic chemist — not a mere operator picked up in a gallery or among amateur experimenters — but one who can apply the latest discoveries to the work in hand. It is because investigators who are not trained photographers, familiar with the processes and discoveries of the time, have undertaken to do the most difficult kind of photographic work themselves, that the results are so frequently inferior to what they might be. It is certainly a fact that the best photographic knowledge we possess is not generally applied to scientific work.

It is upon such grounds as these that I have long advocated the establishment of a photographic laboratory for research in connection with one of our great institutions. Such a laboratory would not only lead to important discoveries and improved methods, but it would give an impetus to the study of photography as a science involving chemistry and physics, in preparation for work in various branches of science. The problems presented in the observatory and in the spectroscopic laboratory could then be systematically studied, as they cannot be by the workers in these different fields. For example, the astronomer desires plates for photographic star-maps, which shall be uniform in character and rapidity, unaffected by temperature or moisture, free from granularity and without the tendency to "halation" by long exposures. More than this, an effort should be made to produce a plate which will reproduce fairly well the relative actinic magnitudes, if I may coin the expression, if not the visible magnitudes of stars. That such plates can be produced scarcely admits of a doubt, but to establish the fact requires some, perhaps a great deal of experimenting. But having once accomplished the result, it would be a boon to astronomy sufficient in itself to justify the existence and liberal endowment of such a laboratory. The mere discovery of a means to produce plates of absolutely uniform sensitiveness, measured in units of time and also spectrographically, would be of incalculable benefit to physical investigation. As regards the granularity of the image, it has been clearly demonstrated that this is greatly influenced by the development, particularly with certain plates more than others.

Now as regards plates for other special purposes, to mention a case in point, I refer once more to Professor Langley's desire to photograph the part of the spectrum which he has so ingeniously mapped with the bolometer. No one has questioned the accuracy of the indications of that instrument, but it would certainly be of interest to see a photographic reproduction of at least a portion of that invisible spectrum, to compare it with the bolometric curves. It would enable us to interpret the latter with much more confidence when it becomes desirable to reduce the curves to spectrum lines.

As already stated, considerable work has been done abroad in extending the photographic action of the red rays of the spectrum. Schumann, for example, has photographed the spectrum, showing line *A* distinctly and for some distance beyond.

But when we consider the enormous extension of the invisible spectrum beyond the blue, recently photographed by Mr. Schumann,[1] on plates especially prepared for the purpose, we have an indication of the possibilities of scientific research in photography. There is really no reason to suppose that we have reached the photographic limit in the less refrangible end of the spectrum.

The interesting phenomenon of the sun's corona has led to many attempts to photograph it on the rare occasions offered by total solar eclipses. But so little have the photographic conditions been considered in this connection, that, as I have elsewhere remarked, the government photographic expedition was sent to Japan without a photographer, and the expedition to Africa went with commercial color-sensitized plates. Now, it would be interesting to learn the reason for the selection of those particular plates for the corona. While I am not prepared to say that they

[1] Hitchcock, R. The latest advances in spectrum photography, *Science*, Feb. 26, 1892.