

All being ready, the exposure is given, not for the small fraction of a second, which would completely suffice for the production of the picture under ordinary circumstances, but for many minutes, or even hours.

It is quite true that the very large stars would record their impression in a few seconds, but to obtain the fainter stars much longer exposures are demanded. It seems as if the little waves of light which come from the star and strike on the plate cannot succeed in engraving their impression until they have been allowed to operate for a time which has to be longer just in proportion as the star is fainter.

It thus follows that the longer a plate is exposed the more numerous will be the stars which can be counted upon it after the development has been completed. It is not unusual to find at least ten thousand stars on a single plate, provided an exposure of four hours has been given.

Indeed, in some cases it has been deemed advantageous to make still longer exposures. I have seen a beautiful plate representing the Cloud of Magellan, in the Southern Hemisphere, which had been submitted to starlight for no less than seven hours.

Many remarkable discoveries have been made by the examination of these photographs. The larger stars thereon depicted are no doubt those visible to the unaided eye; the intermediate stars, which may be counted in thousands, are objects which might be perceived in a telescope of considerable power; but the smaller points, which are barely discernible on the background of the plate, are the invisible stars. They could never be perceived were it not for the peculiar assistance which photography gives us.

Many of the most noteworthy achievements in this delicate and interesting branch of astronomy are due to Professor Pickering of Harvard College Observatory.

The examination of these plates reveals in the most startling manner the extraordinary profusion in which stars are scattered over the

sky. Remember that each plate can contain a representation of but a small part of the heavens. Not fewer than ten thousand photographs would be necessary, if we desired to form a map representing the entire surface of the celestial sphere.

If on each such plate there be on an average ten thousand stars—and this is a low estimate—it is obvious that not less than a hundred million stars must be spread over the surface of the sky. When we realize that every one of these stars is an independent source of light, and that dark objects in the stellar regions are not visible at all, we obtain some notion of the extraordinary abundance with which matter is strewn through the universe.

It must be remembered that each star, even the tiniest that is just depicted on the plate, is in itself a sun often comparable with, and often far surpassing, our own sun. It is the distance at which it is placed that makes it look so insignificant.

There are other departments of astronomy in which photographs are also very instructive, in revealing the existence of invisible objects. Take for instance, that well-known group of stars known as the Pleiades.

This charming little cluster has been looked at by every student of the skies for thousands of years. It has been most carefully scrutinized by those employing good telescopes. And yet it possesses a something which had never been noticed until Mr. Isaac Roberts took a photograph of the cluster with an exposure of four hours.

He then found that the well-known group of stars was surrounded, or, indeed, I might say bathed, in a widely extended fire-mist, or mass of glowing nebula. The light from this is of such a kind that it does not appeal to any nerves that are in our eyes, but it does produce an impression on the photographic plate.

Consequently, we are able, time after time, to reproduce on our pictures the ghostlike outlines of this cloud of fire, which can never be perceived by any human eye.

It is quite plain that this nebula can be no mere effect of some error