

THE NEW ASTRONOMY.

HOW WE FIND INVISIBLE STARS.

BY SIR ROBERT S. BALL.

ON one occasion, when I was giving a lecture on the subject with this title, I received an anonymous letter in which I was asked how it was possible that I could say anything about "Invisible Stars?"

If they were not visible, it did not seem that we could learn anything about them. Ought not, my correspondent asked, a lecture on "Invisible Stars" to be about as attractive as a concert of inaudible music, or as the fragrance of inodorous flowers?

It is not impossible that somewhat similar questions may occur to those who read this little paper. Let me therefore say at once that the "Invisible Stars" to which I refer are made known to us by the help of photography. For beautiful though our eyes may be, and exquisitely adapted as they are to subserve the purposes of our daily life, it is yet true that as optical instruments they are somewhat imperfect.

The human eye wants a certain delicacy possessed by the photographic plate. It certainly has not the patience, if I may use the expression, possessed by the film of sensitive material. Hence it is that, in our attempt to explore the heavens, photography renders us most extraordinary aid.

Not alone does the camera enable us to obtain pictures of celestial objects possessing unchallenged accuracy, but its assistance extends a great deal further. A photograph of the celestial regions exhibits multitudes of stars and other objects far too faint to be discernible by any eye, no matter how delicate may be its perceptive powers, and no matter how powerful may be the telescope to which the eye is applied.

Thus it is that we obtain on our photographs the representations of invisible stars.

To explain the matter a little more fully I will describe how the

astronomer sets at work when he wants to obtain pictures of these objects which his eye can never show him. He requires, in the first place, a telescope which is specially adapted to the purpose. It must be understood that the object-glass of an ordinary telescope, even though it be of the most perfect construction, will never answer.

The photographic objective must be prepared with an especial view to photographic purposes; for the light which takes photographs is, to a great extent, quite different in character from the light which acts on the nerves of vision. Provided with an object-glass carefully wrought for this purpose, the astronomer places a prepared plate at its focus, and exposes it to the sky.

Precautions have to be taken to insure that the telescope shall move properly, for as the stars appear, on account of the rotation of the earth, to traverse the vault of heaven, it is necessary to follow them with the instrument. Otherwise the star would present a trail on the plate, instead of a sharply marked point.

To keep the plate following the stars, an ordinary telescope is attached to that which carries the photographic apparatus. The eye of the observer is applied to the second instrument, by which he watches one carefully selected star, and thus guides the whole apparatus, so as to insure that the movement shall be perfectly uniform.

The plates which are employed for this purpose are the most sensitive that can be made. To illustrate the precautions that have to be taken I may mention that a plate has been known to be completely fogged over and destroyed by the accidental circumstance that while it was being placed in the instrument a carriage happened to be driving up the avenue, and a flash from the carriage-lamp fell on the plate.