Hence we see that the central point *b* will be very in­tensely illuminated by the blue radiating from *pb,* and the green intercepted from *bg.* It will be more faintly illumi­nated by the purple radiating from *vp,* and the yellow in­tercepted from *gy ;* and still more faintly by the violet from *wυ,* and the orange and red intercepted from yr. The whole colouring will be a white, tending a little to yellowness. The accurate proportion of these colourings may be com­puted from our knowledge of the position of the points o, *y, g,* &c*.* But this is of little moment. It is of more con­sequence to be able to determine the proportion of the total intensity of the light in *b* to its intensity in any other point I.

For this purpose draw rIR, I*w*W, meeting the lens in R and W. The point I receives none of the light which passes through the space RW ; for it is evident that *bl* : CR = *bA* : CE = 1 : 55, and that CR = CW ; and therefore, since all the light incident on EB passes through AD, all the light incident on RW passes through I*i* *(bi* be­ing made = *b*I*).* Draw *o*IO, *y*IY, *g*IG, I*p*P, I*v*V. It is plain that I receives red light from RO, orange from OY, yellow from YG, green from GE, a little blue from BP, purple from PV, and violet from VW. It therefore wants some of the green and of the blue.

That we may judge of the intensity of these colours at I, suppose the lens covered with paper pierced with a small hole at G. The green light only will pass through I ; the other colours will pass between I and *b,* or between I and A, according as they are more or less refrangible than the particular green at I. This particular colour converges to *g,* and therefore will illuminate a small spot round I, where it will be as much denser than it is at G as this spot is smaller than the hole at G. The natural density at G, therefore, will be to the increased density at I, as *g*I2 *to g*G2*, or* as *gb2* to *gC2,* or as *b*I2 to CG2. In like manner, the natural density of the purple coming to I through an equal hole at P will be to the increased density at I as *b*I2 to CP2. And thus it appears, that the intensity of the dif­ferently coloured illuminations of *any* point of the circle of dispersion, is inversely proportional to the square of the distance from the centre of the lens to the point of its sur­face through which the colouring light comes to this point of the circle of dispersion. This circumstance will give us a very easy, and, we think, an elegant solution of the question.

Bisect CE in F, and draw FL perpendicular to CE, making it equal to CF. Through the point L describe the hyperbola KLN of the second order, that is, having the ordinates EK, FL, RN, &c. inversely proportional to the squares of the abscissæ CE, CF, CR, &c. ; so that FL : RN = θp2 : ζjξa> or = CR2 : CF2, &c. It is evident that these ordinates are proportional to the densities of the se­verally coloured lights which go from them to any points whatever of the circle of dispersion.

Now the total density of the light at I depends both on the density of each particular colour and on the number of colours which fall on it. The ordinates of this hyperbola determine the first ; and the space ER measures the num­ber of colours which fall on I, because it receives light from the whole of ER, and of its equal BW. Therefore, if or­dinates be drawn from any point of ER, their sum will be as the whole light which goes to I ; that is, the total den­sity of the light at I will be proportional to the area NREK. Now it is known that CE ∙ EK is equal to the infinitely ex­tended area lying beyond EK; and CR ∙ RN is equal to the infinitely extended area lying beyond R N. Therefore the area NREK is equal to CR ∙ RN — CE ∙ EK. But RN

CF3 CF3

and EK are respectively equal to and Therefore

(CR CE∖ CR\* — OF®/

— CF1 ∙ ( — —— CF3 ∙ CE CR — CFs∙ ER

- C ∖CR CE∕ - CE ∙ CR -L CEτCR

CF3 ER CF’\_ CF3

^CE CR’ But because CF ,s ⅛ of CE> [je li"⅛⅛F CFl

= —g-, a constant quantity. Therefore the density of the light at I is proportional to ER/CR, orto AI/*b*I, because the points R and I are similarly situated in EC and *Ab.*

Farther, if the semi-aperture CE of the lens be called I, CF2/2 is = 1/8, and the density at I is = AI/8*b*I.

Here it is proper to observe, that since the point R has the same situation in the diameter EB that the point I has in the diameter AD of the circle of dispersion, the circle de­scribed on EB may be conceived as the magnified repre­sentation of the circle of dispersion. The point F, for in­stance, represents the point *f* in the circle of dispersion, which bisects the radius *bA.*; and *f* receives no light from any part of the lens which is hearer the centre than F, being illuminated only by the light which comes through EF, and its opposite BF'. The same may be said of every other point.

In like manner, the density of the light in *f,* the middle between *b* and A, is measured by EF/CF, which is = EF/EF, or 1. This makes the density at this point a proper standard of comparison. The density there is to the density at I as 1 to AI/*b*I, or as *b*I to AI ; and this is the simplest mode of comparison. The density half way from the centre of the circle of dispersion, is to the density at any point I as *b*Ito AI.

Lastly, through L describe the common rectangular hy­perbola ALη, meeting the ordinates of the former in *k*, L, and *n ;* and draw *kh* parallel to EC, cutting the ordinates in *g,f, r,* &c. Then CR : CE = EA : Rn, and CR : CE — CR = EA : Rn—EA, or CR : RE= EA : *rn,* and *b*I : IΛ = EA : *m.* And thus we have a very simple expression of the density in any point of the circle of dispersion. Let the point be anywhere, as at I. Divide the lens in R as AD is divided in I, and then *rn* is as the density in I.

These two measures were given by Newton ; the first in his treatise *de Mundi Systemate,* and the last in his Optics, but both without demonstration.

If the hyperbola *k*L*n* be made to revolve round the axis CQ, it will generate a solid spindle, which will measure the whole quantity of light which passes through different portions of the circle of dispersion. Thus the solid pro­duced by the revolution of L*kf* will measure all the light which occupies the outer part of the circle of dispersion lying without the middle of the radius. This space is 3/4ths of the whole circle ; but the quantity of light is but 1/4th of the whole.

A fully more simple expression of the whole quantity of light passing through different portions of the circle of chro­matic dispersion may now be obtained as follows :

It has been demonstrated, that the density of the light at I is as AI/*b*I, or as ER/CR. Suppose the figure to turn round the axis : the points I and R describe circumferences of cir­cles ; and the whole light passing through this circumference is as the circumference, or as the radius and as the density