spread over the whole of AD, muſt be much leſs than the denſity of the purple colouring, which radiates from p, and occupies only a part of AD round the circle *b.* These densities muſt be very nearly in the inverſe proportion of wb2 to pb2.

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 *wv,* 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, IwW, 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 *bI :* CR = *bA :* CE, = I : 55, and that CR = CW ; and there­fore, ſince all the light incident on EB passes through AB, all the light incident on RW passes through Ii *(bi* being made = bI). Draw oIO, yIY, gIG, IpP, IvV. 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 gI2, to gG2, or as *gb2* to *gC2,* or as *bI2* 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 *bI2* 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 = I/CF2 : I/CR2, 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 RN. Therefore the area NREK is equal to CR × RN — CE × EK. But RN and EK are respectively equal to

CF3/CR2 and CF3/CE2. Therefore the identity at I is proportional to CF3 × (CR/CR2 — CE/CE2), = CF3 × (I/CR — I/CE), = CF3 × (CE — CR)/(CE × CR) = CF3 × ER/(CF3 × CR), = CF3/CE × ER/CR. But becauſe CF is 1/2 of CE, CF3/CE is = CF3/2CF, = CF2/2, a conſtant quantity. Therefore the denſity of the light at I is proportional to ER/CR, or to AO/bI, 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/8bi.

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 nearer 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 I. This makes the denſity at this point a proper ſtandard of companion. The denſity there is to the denſity at I as I to AI/bI, or as *bI* 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 *bI* to IA.

Laſtly, through L deſcribe the common rectangular hy­perbola *kLn,* 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 = EZ : Rn, and CR : CE — CR = Ek : Rn — Ek, or CR : RE ≡ Ek : rn*,* and *b*I : I — Ek : *rn.* 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 kLn be made to revolve round the axis CQ, 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 Lkf 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 ſtill 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