

II. *An Account of some Experiments of Light and Colours, formerly made by Sir Isaac Newton, and mention'd in his Opticks, lately repeated before the Royal Society by J. T. Desaguliers, F. R. S.*

**T**HE manner of separating the primitive Colours of Light to such a Degree, that if any one of the separated Lights be taken apart, its Colour shall be found unchangeable, was not published before Sir I. Newton's *Opticks* came abroad. For want of knowing how this was to be done, some Gentlemen of the English College at Liege, and Monsieur Mariotte in France, and some others took those for primitive Colours, which are made by immitting a Beam of the Sun's Light into a dark Room through a small round Hole, and refracting the Beam by a triangular Prism of Glass placed at the Hole. And by trying the Experiment in this manner, they found that the Colours thus made were capable of change, and thereupon reported that the Experiment did not succeed. And lately the Editor of the *Acta Eruditorum* for October 1713. pag. 447, desired that Sir I. Newton would remove this Difficulty. *Objectiones, inquit, quas Viri docti tum in Gallia tum in Anglia contra illam [de Coloribus] Theoriam fecere, felicissime diluit Vir perspicacissimus Newtonus, quemadmodum ex Transactionibus Anglicanis N. 84, 85, 88, 96, 97, 121, 123, 128 abunde constat. Unde multi optant ut mentem suam aperire dignerur. de difficultate ab ingeniosissimo Mariotto, rerum naturalium (dum viveret) scrutatore indefesso nec infelici, in Tractatu de Coloribus p. 207. & seq. contra eam mota. In distantia scilicet 25 circiter aut 30 pedum, charta exceptit radium solidum per exiguum foramen in cameram obscuram immissum,*

Y y y

&

& per Prisma vitreum trigonum transmissum, coloremque violaceum spatium majus quam trium linearum occupantem per crenam duarum linearum trajectum, alio Prismate exceptit admodum oblique opposito : quo facto quandam ejus partem in Rubrum & Flavum transmutari observavit. Similiter luminis rubri partem in cœruleum & violaceum transmutari expertus est. Hac verò transmutatione admissa corruere Theoriam Newtonianam, ex Actis A. 1706. p. 60. & seq. manifestum est. Assumpsit autem *Mariottus* distantiam 30 pedum, ne quis exciperet in minori distantia nondum factam esse plenariam radiorum heterogeneorum separationem. Nobis experimentum *Mariotti* tum demum videretur decisivum, si lumen cœruleum integrum in aliud mutatum fuisset. Thus far the Editor of the Acta. In answer to which it is to be observed that the Red and Yellow which came out of the Violet, and the Blew and Violet which came out of the Red, might proceed from the very bright Light of the Sky next encompassing the Sun, and that several sorts of Rays which come from several Parts of the Sun's Body are intermixt in all parts of the coloured Spectrum which falls upon a Paper at any Distance from the Prism. In this manner of trial, for making the Experiment succeed, the Light of the bright Clouds, immediately surrounding the Sun, should be intercepted by an opaque Skreen placed in the open Air without, at the distance of Ten or Twenty Foot from the Hole through which the Sun shines into the dark Room. And in the Skreen there should be a small Hole for the Sun to shine through. The Hole may be either round or oblong, and not above one eighth or one tenth Part of an Inch broad ; so that the Skreen may intercept not only the bright Light of the Clouds next encompassing the Sun's Body, but also the greatest Part of the Sun's Light. For thereby the Colours will become less mixed. The Beam of Light which passes through this Hole must afterwards pass through the other Hole into the dark Room, and the Prism must be placed parallel to the oblong Hole in the Skreen

*Screen, and the refracting Angle thereof be sixty Degrees or above. In this manner the Experiment may be tried with Success, but the Trial will be less troublesome if it be made in such a manner as is described in the fourth Proposition of the first Book of Sir I. Newton's Opticks.*

*Sir Isaac Newton therefore, upon reading what has been cited out of the Acta Eruditorum, desired Mr. Desaguliers to try the Experiment in the manner described in the said Proposition; and he tried it accordingly with Success before several Gentlemen of the Royal Society, and afterwards before Monsieur Monmort and others of the Royal Academy of Sciences; and still shews it to those who desire to see it. How this and other concomitant Experiments were tried and succeeded, is described as follows.*

## EXPERIMENT I.

Having sew'd together end-wise two Pieces of Ribbon four Inches long each, the one blew and the other red, whose common Breadth was  $\frac{3}{4}$  of an Inch; I caus'd it to be held in such manner, that the Light which fell from the Clouds thro' the Window was so reflected, that the Angle made by the Rays of Light, which came in at the Middle of the Window, with the Plane of the Ribbon produced, was equal to the Angle made by a Line drawn from the Ribbon to my Eye and the said Plain of the Ribbon. My Eye was plac'd as far behind the Ribbon as the Window was before it, the Distance from which to me was about 12 Feet. Then looking thro' a Prism at the Ribbon, it appear'd broken afunder in the Place where the blew and red Half join'd. If the Prism was held with the refracting Angle downwards (or laid with one of its Planes flat upon the Nose) the blew Half of the Ribbon appear'd to be carried down lower than the red, as at *B, R* in *Fig. 1.* but if the refracting Angle of the Prism was turn'd up-

Y y y 2

wards

wards (as when the Prism has one of its Planes laid flat to the Forehead) then the blew Half of the Ribbon was lifted up, as at  $\text{C } \rho$ .

The Prism was of white Glass, having every Angle of 60 Degrees: but when instead of it, one of a greenish sort of Glass, such as Object Glasses of Telescopes are made of, was used, having the refracting Angle which I look'd thro' of about 48 Degrees; the same Phænomenon was more distinct, this Glass having no Veins, but the Red and Blue were nearer to a streight Line: in such manner that if *A* represent the Ribbon seen through the first Prism, *B* will represent the Ribbon seen thro' the second Prism. *Fig. 2.* If the refracting Angle of the last Prism had been as great as that of the first, the Light being transmitted thro' too great a Body of greenish Glass, the Phænomenon would not have succeeded so well.

The blue Ribbon being somewhat too pale, and the red a little dull; I repeated the Experiment with a Skeen of blue, and one of red Worsted join'd together in the Middle as the Ribbons were before; and, the Colours of both being very intense, the Experiment succeeded better with both Prisms. All that were present trying the Experiment found it to succeed, and that every Circumstance answer'd to the Account given in *Prop. 1. Theor. 1. Book 1.* of Sir Isaac Newton's *Optics*, as far as the Directions there given were followed. So that it appear'd that the Blue being carried lower than the Red in the first case, and lifted higher in the second, was owing to the greater Refraction of the blue Ray: for tho' each Part of the Ribbon or Worsted reflected all manner of Rays, yet the Phænomenon was very apparent; as also that the blue Ribbon or Worsted reflected the blue Rays more copiously than the red Rays, and that the red Ribbon or Worsted reflected the red Rays more than the blue ones, because the Red of the blue Half seen thro' the Prism was less intense than

than that of the red Half, and the Blue or Purple of the red Half seen thro' the Prism was less intense than that of the blue Half.

*N. B.* If the Ribbon or Worsted is laid upon any enlightened Body, the Phænomenon will not succeed so well; the Colours of the Body seen thro' the Prism mixing with those of the Ribbon or Worsted. Even a black Body will not do, if Light falls upon it; but there must be a black Cloath behind, in such manner that no Light falling upon it can be reflected so as to disturb the Phænomenon. And if a short-sighted Person looks through the Prism, a concave Lens between his Eye and the Prism will render the Phænomenon more distinct than it wou'd otherwise be.

## EXPERIMENT II.

Some Days after, the Sun shining, I made two Holes *H, h*, in the Window Shut *S s*, of a darkned Room; thro' which letting the Sun's Beams pass, by means of two Prisms *A, B*, (one near each Hole) I open'd the Rays coming from the Sun into the two colour'd *Spectra*  $\alpha, \beta$ , where the following Colours were very distinct, *viz.* Red, Orange, Yellow, Green, Blue, Purple and Violet. Now the Reason of their being more distinct than ordinary, was, that the Prisms which I made use of were made of the greenish Glass mentioned before; which is very free from those Veins by which the Colours are too much thrown into one another, by the best white Prisms of the common sort.

The foremention'd colour'd *Spectra* being thrown into the Room, to the Distance of about 20 Feet from the Window where the Sun's Light came in, I caus'd a Piece of white Paper  $\pi$ ,  $\frac{3}{4}$  Inch broad and 5 Inches long, to be held within the refracted Rays, (at the Distance of 10 Feet from the Windows,) which produc'd these Colours in such manner, that by turning the Prisms round their

AXES

Axes, I cou'd make the red Ray of the *Spectrum*, made by the one Prism fall upon one half of the Paper, and the purple Ray of the *Spectrum* made by the other Prism fall upon the other Half; for the *Spectra* were both vertical, the Lines which terminated the long Sides of them towards each other just touching, as appears in *Fig. 3.* Then at the Distance of 9 Foot, looking thro' the Prism *C* at the Paper thus colour'd, the red Half appear'd very much separated from the Purple, the one seeming lifted up from the other; the Red or the Purple appearing the highest, according as the refracting Angle of the Prism was either held upwards or downwards. The Phænomenon is much more distinct this way than any other; for the Paper-not only seems divided into two, when it is coloured by a red and a purple Ray, but also by a Red and Blue, (*Fig. 4.*) by a red and a green Ray. (*Fig. 5.*) or indeed by any two Colours that are different, how near soever their Places in the *Spectra* be to each other. The Halves of the Paper appear, when view'd thro' the Prism, to be farther from each other, when the Paper is ting'd with such Colours as are farther from each other in the Series of Colours in the *Spectrum*: and nearest, tho' still divided, when neighbouring Colours fall upon the Paper, as Yellow and Green, or a light and a deep Green. But the Paper appears no way divided, when colour'd with the Red of the two *Spectra*, (*Fig. 6.*) if those Reds are equally intense: and so of the other Colours.

### EXPERIMENT III.

I held a Lens of about 3 Foot Radius at the Distance of Six Feet from the oblong Paper (on which a red and purple Ray falling, made it look half Red and half Purple) and I projected the Image of the said colour'd Paper at the Distance of about Six Foot on the other Side of the Lens,

on

on a white Sheet of Paper ; where it was observeable, that when the red Half was distinctly painted on the white Paper (which was known by the Edges of the Image being regularly terminated) then the blue Half of the Image was confus'd : but if the white Paper was brought about two inches nearer to the Lens, the Image of the blue Half became distinct, and that of the red Half confus'd.

I try'd the Experiment with a Paper colour'd half red and half blue the red with Carminè and the blew with Smalt, making the Candle to enlighten the Paper (the Room being otherwise dark) and the Experiment succeeded in the same manner. The Experiment thus made is the same that Sir *Isaac Newton* gives an Account of, *Book 1. Part. 1. Theor. 1. of his Optics.* Only it is to be observ'd that when the oblong Paper is coloured with red and blue from the Prisms, the focal place, where the red part of the Image is distinct, is more distant from the place where the blue part of the Image is distinct, than when the Paper is colour'd with the Painter's Powders, and much more vivid.

The 7th Figure shews the Projection of the Paper ring'd with the Rays ; and *Fig. 8.* the Projection of it when painted : where a black Thread is wrapp'd round the red and the blue part, that the Distinctness of the Image of the Thread may shew when the red or when the blue part of the Image of the Paper is most distinct.

*N. B.* When the Candle enlightens the painted Paper, set an opaque Body as *B* between the Candle and Lens ; lest the Image of the Candle being also projected should disturb the Experiment.

#### EXPERIMENT IV.

Having made an Hole of  $\frac{1}{4}$  Inch Diameter in the Window-Shut of the darkned Room, I suffer'd a Sun-Beam to come

come into the Room, which I intercepted with a Prism at the Distance of 5 Inches from the Hole; and after its Refraction in passing thro' the Prism, I receiv'd it upon a Sheet of white Paper, where it was colour'd, making an oblong Image of the Sun or *Spectrum* of about 9 Inches in length and 2 in breadth, which Breadth was nearly equal to the Diameter of the round Image of the Sun received upon a Paper at the same Distance from the Hole, which here was 18 Foot. Or if the Sun be too high, a Looking-Glass being put in the room of the Prism will throw a white round *Spectrum* upon the Paper, which held at the said Distance of 18 Foot, will have its Diameter equal to the Breadth of the colour'd *Spectrum*.

The Colours of the *Spectrum* were these; Red, Orange, Yellow, Green, Blue, Purple and Violet, tho' the Violet was so faint in this as to be scarce perceivable. See *Fig. 9.*

*N. B.* The Axis of the Prism in this, and all the other Experiments hereafter mention'd must be perpendicular to the Ray that falls on it; and the Plane into which the Ray enters must be held in such a Position, that the Angle which such a Ray makes with that Plane when it enters, may be equal to the Angle made by the middle Line of those Rays which emerge after Refraction, on the other Side of the refracting Angle of the Prism, with the Plane out of which they emerge. That is  $\angle BDG = \angle AEH$

If the Plane *AC*, on which the Sun-Beam falls, be turned nearer to a perpendicular to the Sun Beam than before, the *Spectrum* will be much longer: if it be more inclin'd to the said Beam, the *Spectrum* will be shorter, and in both Cases less distinct. See the *Spectrum DE* and the *Spectrum de* in *Fig. 10.* and *11.* where *H, h*, represents the Hole in the Window Shut in each Case; *AC, ac* the Plane of the Prism on which the Rays enter; *BC, bc* that out of which they emerge; *P, p* the perpendicular, and *C, c* the refracting Angle. If



If the Plane  $AC$  be still more oblique to  $HE$ , all the Light will be reflected, and there will be no colour'd Image or *Spectrum* made by Refraction at all. *Fig. 12.*

But if it be held so as to be more nearly perpendicular to the Sun Beam than in *Fig. 10.* the whole Beam will indeed enter the Prism; but meeting with  $BC$  the lower Surface of the Prism, or rather the Surface of the Air contiguous to it, some of the Light will by the Plane  $BC$  be reflected to  $de$ , passing almost perpendicularly thro'  $AE$ ; and the rest will emerge thro'  $BC$ , and by Refraction make the imperfect *Spectrum*  $DE$ . See *Fig. 10.*

If the Sun-Beam enter  $AC$  perpendicularly and in the middle of it, the Light will be all reflected as in *Fig. 13.* some of it by the Plane  $BC$  to  $R$ , and the rest by the Plane  $AB$  to  $\rho$ . But if the Beam fall nearer to  $A$  (still perpendicularly) it will all be reflected by the Plane  $AB$ ; if nearer to  $B$ , it will be all reflected by the Plane  $BC$ .

In order therefore to have the colour'd *Spectrum* as it ought to be, care must be taken that the emerging coloured Light may make the same Angle with the Plane  $BC$ , as the immerging Light does with the Plane  $AC$ ; that is, the Angle  $AEH$  must be equal to  $BDG$ , as was said before, *Fig. 9.* which may also be seen on the enlightened Dust in the Air. But the best way is to turn the Prism on its Axis, and at the same time look at the colour'd *Spectrum*, which will rise and fall and become longer or shorter as you turn the Prism; and between the Ascent and Descent of the Image, it will appear stationary: there stop the Prism, and the Reflection will be such as is required for all the Experiments hereafter mention'd.

In order to have the Prism move freely on its Axis, and stop any where, I fix'd each End of it into a triangular Collar of Tin, from the End of which came a Wire, which was the Axis of the Prism produc'd; and so I laid it on two wooden Pillars, with a Notch on the Top to receive

the Wires, and fix'd it to a small Board just broad enough to stand fast. See *Fig. 14.*

### EXPERIMENT V.

I took the Prism *CD*, and thro' it look'd at the colour'd *Spectrum RP*, which appear'd then round and white as at *S* just as if it had been the Sun's Light received on a Paper from the Hole *H*, and seen with the naked Eye. In this case the Prism *CD* must be held *in directum* with *AB*, and the refracting Angles in the two Prisms must be equal. This *Spectrum* appearing white but just in one Point, is not so readily found; but the best way is to look thro' the same Prism *AB* which makes the *Spectrum*, which may easily be done if it be pretty long, and then *KI* will be seen white and round, and as at *S*, as if coming directly from *H*. See *Fig. 15.*

### EXPERIMENT VI.

I held a broad *Lens LL*, ground to a Radius of  $2\frac{1}{2}$  Feet, in such manner that the whole colour'd *Spectrum* fell upon it; and after Refraction all the Colours appear'd to converge. if receiv'd on a Paper at *pp*; but when the Paper was held in the Focus at *F* in the position  $\pi F \pi$ , the *Spectrum* was round and perfectly white by the Union of all the colour'd Rays. If the Paper was held at  $\Pi \Pi$ , the Colours appear'd to diverge from each other, but then the Red was uppermost, which before us'd to be the lowest, and so on in an inverted Order.

I try'd the same Experiment with a *Lens* of one Foot Radius, with one of 9 Inches, and with another of 7, and the Success was the same. See the 16th Figure, where the *R, O, T, G, B, P, V*, express the Colours.

*N. B.*

*N. B.* Care must be taken that the very end of the Red, and the Extremity of the Violet be taken in by the *Lens*; otherwise the *Spectrum* will not be perfectly white at the *Glass's* Focus.

There is no fix'd Distance of the Prism from the Lens, but it ought to be brought so near the Prism that the two Ends of the *Spectrum* may fall nearer the Axis of the Lens than the Edges of the Lens; because there the Refraction is not so regular.

Behind the Lens *L*, which made the Colours converge into White at the distinct Base or Focus *F*, I plac'd the Lens *l*, which made the White be at *f* the distinct Base of the two Glasses combin'd; and the Experiment succeeded as before. Fig. 17.

When the Paper was held in the Focus of the Lens, so as to receive the white Image of the colour'd *Spectrum* projected by the Lens; if with a Card I intercepted the red Ray, the White appear'd ting'd with Purple, and if I intercepted the Violet or purple Ray, or both, the White appear'd ting'd with Red; and if the Red was intercepted at the same time, the *Spectrum* appear'd to be a Mixture of Yellow, Green and Blue. If any single Colour was suffer'd to fall upon the Lens, the rest being intercepted, that Colour wou'd continue the same; only it wou'd be more intense in the Focus of the Lens.

## EXPERIMENT VII.

I took a Board (*Fig. 18.*) *q b s* which stood reclining on a Prop *t*, having an Hole of a Quarter of an Inch Diameter at *b*, and behind it a Prism *B* supported on two Props, as above-mention'd, so as to turn easily about its Axis; and having set this Board on the Ground with the Prism behind it at *B*; by turning the Prism *AC* about its Axis, I first made the red Ray of the colour'd *Spectrum*

Z z z 2

pass

pass thro' the Hole *h*, and fall obliquely upon the second Prism *B*. This Ray after its Refraction in passing thro' the second Prism, was carried up to the Ceiling of the Room at the place mark'd *R*: then I made the purple Ray fall upon the Board, and pass thro' the Hole *h*, as the Red had done before; and after Refraction thro' the Prism *B* it was carried up to the Ceiling at *P*. And the green Ray being afterwards made to pass the second Prism in the same manner, went up to *G*: and so of all the intermediate Rays, which were by this second Refraction thrown to the intermediate places on the Ceiling between *R* and *P*.

Care is to be taken that the second Prism be plac'd oblique to the Rays which come thro' the Hole *h*, least they be reflected, as they wou'd be, if the Board being in the Position *Q S*, and the second Prism in the Position *L N M*, the Ray from the first Prism be  $\rho h$ ; for then it will be reflected upwards to  $\sigma$  instead of being refracted (*Fig. 19.*). Neither must the Plane of Immersion be too oblique, least the Incident Ray be reflected downwards by it, as the Ray *R h* is by the Prism *B* thrown to *E*, in *Fig. 20.* Several have confess'd to me that they at first us'd to fail in this Experiment, for want of setting the second Prism in a due Inclination.

Tho' the Colours by the second Refraction on the Ceiling appear'd unchang'd, when seen by the naked Eye, yet if view'd thro' a Prism, they afforded new Colours (except some part of the Red, and some part of the Violet) which was owing to their not being fully separated; for which reason I made the following Experiment, to prove that if the Colours be well separated, they are truly homogeneous and unchangeable.

*N. B.* When the Prisms are good, and no Clouds are near the Sun, the Extremity of the Red or Violet will afford unmix'd Colours in this Experiment; otherwise not.

## EXPERIMENT VIII.

Having made a Hole in the Window-Shut 2 Inches wide (*Fig. 21.*) I applied to it a Tin Plate, which sliding up and down hid all this Hole in the Wood, and only transmitted a small Beam thro' its own Hole *H*, whose Diameter was  $= \frac{1}{16}$  Inch. This Beam, by means of the Looking Glass *L*, plac'd on the Board of the Window *XW*, I reflected horizontally to the other end of the Room. But to correct the Irregularity of the Reflection of the Looking-Glass, I made use of the Frame of Past-Board *Pp*, which had an Hole in it *h* of  $\frac{1}{16}$  Inch likewise: and placing it at *Pp* I suffer'd some of the reflected Beams to pass thro' it, so as to fall upon the Lens *FE* (convex on both Sides, and ground to a Radius of  $4\frac{1}{2}$  Feet) at the Distance of 9 Feet, so that the Image of the Hole *h* was projected to *f* on the other Side of the Glass, at the Distance of 9 Feet more. Just behind the Lens, which by a Screw in the Stand *S* might be rais'd or let down, so as always to receive the Beam along its Axis, I plac'd a Prism *A* (upright on one of its Ends and easily moveable about its Axis, by reason of its Wire turning freely in an Hole in the solid piece of Wood *T*, which stood on another Stand behind the Lens) as near as I cou'd to the Lens *EF*, so that the Image of *h* instead of being round, white, and projected to *f*, was cast sidewise on a white Paper stretch'd on a Frame, and appear'd colour'd, and 30 or 40 times its Breadth, as at *MN*. The Colours in this Case were very vivid and well separated. only the Violet had some pale Light darting from its End, upon account of some Veins in the Prism *A*, and the Light not coming directly from the Sun, but reflected; which ought not to have been, if the Sun had been low enough to have thrown the Rays a good way into the Room without the Help of a Looking Glass.

To shew that the Colours in this *Spectrum* were simple and homogeneal Lights, I made the following Experiments.

### EXPERIMENT IX.

Having made an Hole  $h$  in the Paper which receiv'd the colour'd *Spectrum*, I suffer'd the red Light to pass; which being refracted by a second Prism, fell upon another Paper at  $T$ , where it appear'd still Red whether seen with the naked Eye or Prisms of different refracting Angles. To the Eye which saw it thro' the Prism  $V$ , it appear'd indeed lower as at  $t$ , but red, round and unchang'd. I made the Experiment upon all the Colours, which by this means appear'd to be simple and homogeneal. See *Fig.* 22. Where the same Letters denote the Lens, Prism and first Paper.

Thro' the same Lens and Prism the *Spectrum* was made to fall on a Book; then thro' the Prism  $F$  it appear'd unchang'd; and the Letters in the Book which cross'd the *Spectrum*, were as distinct as when seen with the naked Eye. See *Fig.* 23.

*N B.* The Axis of the Prism  $F$  ought to be perpendicular to the long Axis of the *Spectrum's*  $m$  thrown on the Book, which will appear as at  $\sigma\mu$ ; and the Prism in the Position represented at  $F$ , with its flat Side towards the Nose: for that is the most convenient Position for looking at the *Spectrum* in these Experiments.

I suffer'd the purple Ray only to pass thro' the Hole  $h$  and fall upon a Book at  $P$ , the Letters of which appear'd at  $\pi$ , and were as distinct thro' the Prism  $Q$  as when seen with the naked Eye: and I had the same Success with all the other Rays. See *Fig.* 24.

But if a Sun-Beam as  $r$  comes thro' the Hole  $H$  directly upon the Book at  $W$ , an Eye looking at it thro' a Prism  
at

at *X* will see this Beam at *T* oblong and colour'd, and the Letters on which it falls, confus'd. See *Fig. 24.*

*N. B.* The Lens ought to be very good, without Veins or Blebs, and ground to no less a Radius than I mention'd in the Experiment; tho' a Radius of a Foot or two longer is not amiss. The Prism ought to be of the same Glass as the Object-Glasses of Telescopes, the white Glass, of which Prisms are usually made, being commonly full of Veins. And the Room in these last Experiments ought to be very dark.

A few Days after, having got very good Prisms made for the purpose of the above mention'd Glass, I made all the Experiments over again before several Members of the *Royal Society* with better Success; and had the *Spectrums* very regularly terminated, without any pale Light darting from the Ends of it.

*For a further Account of Experiments to this purpose, see Sir Isaac Newton's Opticks. B. 1. Part. 1. to which I might have refer'd the Reader altogether; but that I was willing to be particular in mentioning such things as ought to be avoided in making the Experiments above-mention'd; some Gentlemen abroad having complained that they had not found the Experiments answer, for want of sufficient Directions in Sir Isaac Newton's Opticks; tho' I had no other Directions than what I found there.*

---







