

XIII.—*On the Decomposition and Dispersion of Light within Solid and Fluid Bodies.* With a Plate. By Sir DAVID BREWSTER, K.H., D.C.L., F.R.S., and V.P.R.S. Edin.

(Read 2d February 1846.)

HAUY*, and other mineralogists, observed the two colours which are visible in several varieties of fluor-spar. He regarded the two tints as complementary, and explained them, as he did every other analogous phenomenon, by a reference to the colours of thin plates. In describing a species of dichroism noticed by Dr PROUT† in the purpurates of ammonia and potash, Sir JOHN HERSCHEL ascribes the green reflected light‡ “to some peculiar conformation of the green surfaces producing what may be best termed a *superficial colour*, or one analogous to the colour of thin plates, and striated or dotted surfaces.” And he adds—“A remarkable example of such superficial colour, differing from the transmitted tints, is met with in the green fluor of Alston Moor, which, on its surfaces, whether natural or artificial, exhibits, in certain lights, a *deep blue* tint, not to be removed by any polishing.”

Having, many years ago, found the same property in the Derbyshire fluor-spars, I was led to study it with particular attention; and, in 1838, I communicated the results of my observations to the British Association at Newcastle.§ In every specimen in which the colour in question exists, I found it to arise from *internal*, and not from *superficial* reflexion. In an extensive series of experiments on the absorption of light by the aqueous and alcoholic solutions of the colouring matter of plants, I found this property of internal dispersion in thirty or forty of these solutions. The most remarkable of these was the alcoholic solution of the colouring matter of the leaves of the common laurel. At first its colour is a bright green, afterwards changing into a fine olive colour; but in all its stages it disperses light of a *brilliant blood red colour*, which forms a striking contrast with the transmitted tint. After a long exposure to light, the transmitted tint almost wholly disappears, while the dispersed light retains its red colour.|| Another

* *Traité de Mineralogie*, tom. i., p. 512, 521.

† *Philosophical Transactions*, 1818, p. 424.

‡ *Treatise on Light*, art. 1076.

§ See Report of the Eighth Meeting, and Trans. of Sections, p. 10-12.

|| I shewed this experiment in 1836, at Lacock Abbey, to Mr FOX TALBOT, and several members of the British Association. At the meeting of the British Association at Manchester, in 1842, a friend handed to me, in the sectional meeting, a “solution of stramonium in ether,” which

very remarkable example of internal dispersion, pointed out to me by Mr SCHUNCK, is exhibited in an alkaline, or in an alcoholic solution of a resinous powder produced from *orcine* by contact with the oxygen of the air. Its colour by transmitted light is reddish brown, and the light which it disperses is of an exceedingly rich *green* colour.

Since these experiments were made, my attention has been called to two interesting papers by Sir JOHN HERSCHEL, in the last part of the Philosophical Transactions; the one *on a case of superficial colour presented by a homogeneous liquid internally colourless*, and the other *on the epipolic (or superficial) dispersion of light*; and as these papers contain results incompatible with those which I had previously published, I found it necessary to resume the investigation of the subject.

The two papers now referred to are chiefly occupied with a description of the phenomena of coloured dispersion, as exhibited in a diluted solution of *sulphate of quinine* in weak sulphuric acid. Owing to the solution being nearly colourless by transmitted light, the general phenomenon is very beautiful. The line of bright blue light dispersed by the stratum of fluid immediately beneath the surface of incidence, and about the 50th of an inch thick, *appears* to be confined to that stratum, and it is in this respect only that the phenomenon differs from that which is exhibited by fluor-spar and the vegetable solutions which I have mentioned.

1. *On the Internal Dispersion of Fluor-Spar.*

There are many varieties of fluor-spar in which no dispersion of the intromitted light takes place. It does not exist in the *yellow*, *red*, and bright *blue* varieties which I have examined. It occurs chiefly in the *green* fluor from Alston Moor, and in several *pink*, and *bluish-yellow* varieties from Derbyshire. In order to observe the phenomena of dispersion most distinctly, I transmit a condensed beam of the sun's light through the specimen, when partially covered with black wax or black velvet. In some specimens, the intromitted beam is partially dispersed in a fine blue tint from every part of the solid which it traverses; but in other specimens, which are composed of strata of different colours, parallel to the faces of the cube, a very different and a very instructive phenomenon is displayed. The intromitted beam A B C, Fig. 1, Plate V., is crossed with bands of dispersed light of different colours, and of different intensities. In one case, a *pink* light was dispersed from the stratum close to the surface of incidence; from the next stra-

dispersed a *bright green* light. I described the phenomenon to the meeting, and it is noticed in the Transactions of the Sections, p. 14. Upon making the solution myself, I cannot obtain the same tints, either from the stalk or the dried leaves of the plant. The solution of the leaves disperses a brilliant red tint, like that mentioned in the text. The solution put into my hands must, therefore, have been one of the seeds of stramonium, or of some other substance possessing internal dispersion in a high degree.

tum there was *no dispersion* at all; this was followed by a narrow stratum, which dispersed a *bright whitish light*; then succeeded a stratum of non-dispersing fluor, and alternately dispersing and non-dispersing strata, scattering the fine blue light which has already been mentioned.

These results, which I have shewn to different persons, are incompatible with those obtained by Sir JOHN HERSCHEL with the very same variety of *fluor-spar*. He regards the blue dispersed light as *strictly* an *epipolic* or *superficial* tint,—so superficial, indeed, “that it might be referred to a peculiar texture of the surface, the result of crystallization, were it not that it appears equally on a surface artificially cut and polished.”* Were I to hazard a conjecture respecting the cause of this difference in our results, I would ascribe it to the different degrees of light in which the observations were made. While I used a condensed beam of the sun’s light, Sir JOHN HERSCHEL seems to have employed chiefly the ordinary light of day. In studying the phenomena in the solution of quinine, he “exposed it to strong day-light or sunshine;” and in another experiment, which pre-eminently required a powerful illumination, he “directed a sunbeam downwards on the surface, by total reflection from the base of a prism,” which was in reality inferior to the ordinary sun’s light. In the case of fluor-spar, however, he states that the epipolic colour is seen in perfection when “exposed to daylight at a window.” In such a feeble light I could not have seen the phenomena I have described, and it is owing chiefly to the intensity of the light which I employed, that I have been enabled to place it beyond a doubt that the blue light dispersed by fluor-spar is reflected from every part of the interior of the crystal, and is not produced by any action either strictly or partially superficial, or solely by any stratum near the surface.

Sir JOHN HERSCHEL mentions, that the green fluor-spar of Alston Moor is the only solid in which he has observed an epipolic tint. It is the only mineral in which I have found an internal dispersion, excepting, of course, the minerals which exhibit the analogous phenomena of opalescence and chatoyance; but I have found several glasses which possess it, one in particular of a *yellow* colour, which disperses a *brilliant green* light, and another of a *bright pink* colour, which also disperses a *green* light, and a third of an *orange* colour, which disperses rays of a *whitish green* colour. In these cases, the glass has a decided colour of its own; but I have found many specimens, both of colourless plate and colourless flint glass, which disperse a beautiful green light.

2. *On the Internal Dispersion of the Solution of Sulphate of Quinine.*

Sir JOHN HERSCHEL describes the epipolic dispersion of this solution as “occupying a very narrow parallelogram, having a breadth of about a 50th of

* Philosophical Transactions, 1845, p. 143.

an inch, of a vivid and nearly uniform blue colour over its whole breadth;”* but upon “directing a sunbeam downwards on the surface, by total reflection from the base of a prism, a feeble blue gleam was observed to extend downwards below this vivid line to nearly half an inch from the surface, thus leaving it doubtful whether some small amount of dispersion may not be effected in the interior of the medium at appreciable depths.” By using condensed solar light, this doubt is immediately removed, and the phenomenon ranks itself as one of internal dispersion, differing only in the law of its intensity from those which I have already described. In the one the dispersible rays are thrown *gradually*, in the other *quickly*, from the intromitted beam,—a phenomenon to a great extent identical with what takes place in the analogous phenomena of absorption.

If the dispersing action of the solution were rigorously confined to a stratum the fiftieth of an inch thick, it would have followed, of necessity, that “an epipolized beam of light (meaning thereby, a beam which has been once transmitted through a quiniferous solution, and undergone its dispersing action) is incapable of further undergoing epipolic dispersion;” but as the dispersing action is not thus limited, that conclusion must be incorrect. Sir JOHN HERSCHEL, indeed, has deduced this result from direct experiment with a plate of glass immersed vertically in a quiniferous solution. In this case he could perceive no trace of colour either at the ingress or egress of the epipolized beam which was incident upon the plate. Sir JOHN does not mention the distance of the plate from the epipolising stratum. If the distance was small, we are confident, from direct experiment, that the blue tint would have been seen; but if the distance was considerable, then the beam, incident upon the glass, must have been previously shorn of all its dispersible rays.

In examining the blue rays themselves, Sir JOHN found that they consisted of a “small per-centage of rays, extending over a great range of refrangibility.” They formed, however, a continuous spectrum deprived of the less refrangible red, nearly of the whole orange, and all the yellow; a rich and broad band of fine green light, slightly fringed with red, passed into a copious indigo and violet without the intermediate blue.

The comparatively feeble light of the dispersed blue rays renders it difficult to ascertain their susceptibility of being a second time dispersed. Sir JOHN HERSCHEL could not obtain any indication of this susceptibility; but we have no doubt that with condensed light their second dispersion will be discovered: and we are led to this opinion by the fact, that Sir JOHN believed that the epipolic dispersion takes place in all directions, and therefore expected to discover a second dispersion under circumstances in which, according to my experiments, it could not be found.

* The best method of seeing this experiment, is to take the solution into the open air, where the whole light of a blue sky can fall upon its surface. I have in this way seen the blue line perfectly luminous at that stage of a December twilight when there was not light enough to read by. I consider, therefore, the light of the sky as peculiarly susceptible of this species of dispersion.

Fig. 1.

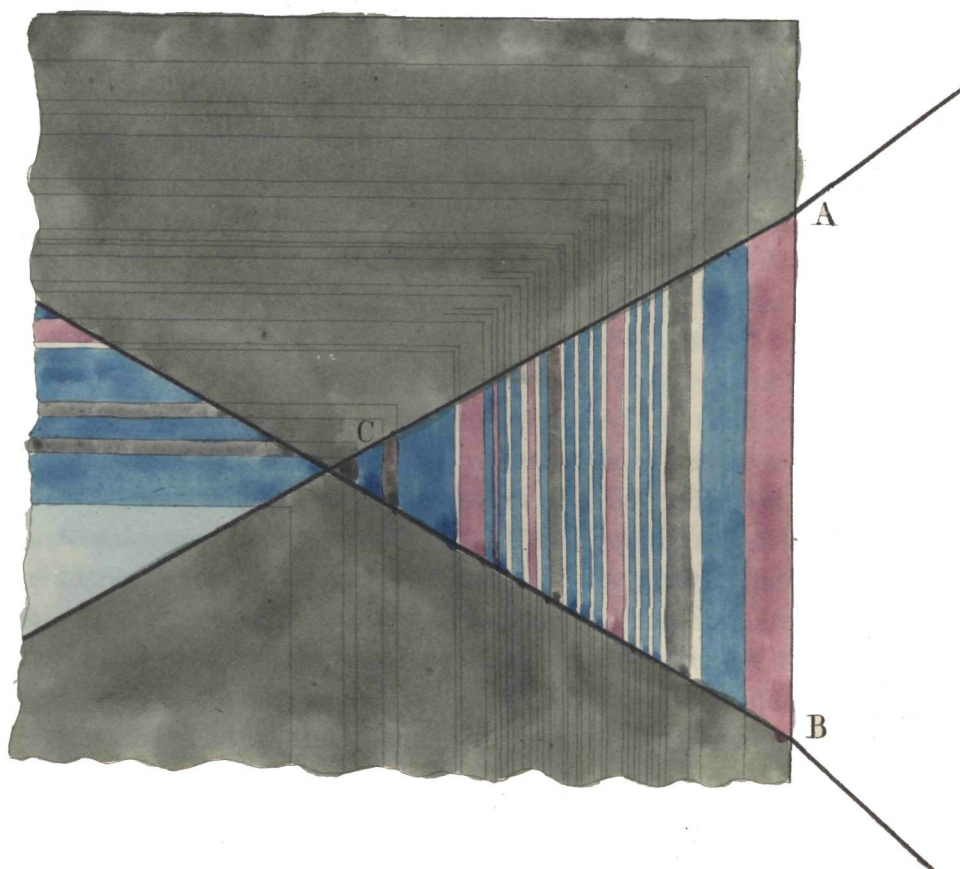
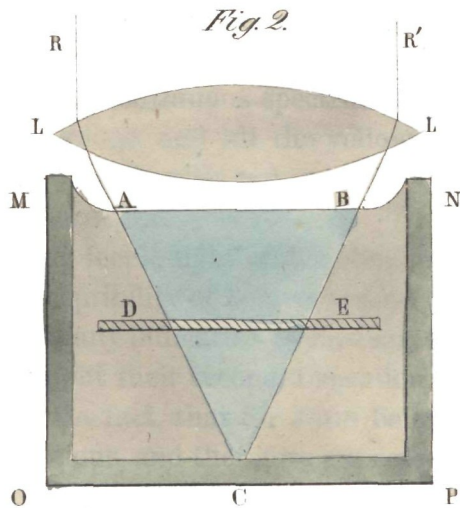


Fig. 2.



Sir JOHN has clearly shewn, that the light is dispersed outwards as well as laterally; but as he was conversant only with the phenomena of a narrow blue line, and had not seen the blue cone of rays dispersed from the cone of condensed light, he could not be aware of the changes which take place in its colour while the eye passes from the azimuth of 90° to that of 100° .

These changes are very decided, and will be understood from fig. 2 (Plate V.), in which M N O P is a horizontal section of the vessel containing the solution; R R' a beam of solar light, incident upon an achromatic lens L L, and condensed into the luminous cone A C B. Now, the blue colour produced by the first stratum, next to the side A B, is exceedingly strong, and that which occupies the rest of the cone A C B comparatively faint. When we view the bright blue stratum in the direction N M, or in the azimuth of 90° , the tint is very brilliant, because the eye receives all the blue rays dispersed by the whole length A B of the stratum; whereas, when we view it in the direction R' C, in the azimuth of 0° , we only see the tint corresponding to the thickness of the stratum. The tint, however, is, in reality, a maximum in the azimuth of 0° , and gradually diminishes till it ceases in the azimuth of 180° , or in the direction C R'.

If we now immerse in the fluid a plate of colourless glass, whose section is D E, so as to receive the beam A B E D, we shall find that there is no peculiar dispersion, as Sir JOHN HERSCHEL observed, either at its surface of incidence or emergence. Hence he concluded that the epipolised beam A B E D "is incapable of undergoing farther epipolic dispersion;" and that having thus "lost a property which it originally possessed, it could not, therefore, be considered *qualitatively* as the same light."

Now, in using a condensed beam of light, as we have done, we find that the whole cone A B C, even when *two* inches long, and with a December sun, disperses the blue light, and the stratum behind the glass plate D E nearly as much as the stratum before it. In fluor-spar, and in the other fluids I have mentioned, this is still more strikingly the case,* and hence neither of the conclusions drawn by Sir JOHN HERSCHEL are admissible.

The following appear to me to be the deductions which the experiments actually authorize:—

1. A beam of light which has suffered dispersion by the action of a solid or fluid body, (that is an *epipolised* beam) is capable of further undergoing epipolic

* In one of these experiments a piece of green fluor, from Alston Moor, when immersed in the quiniferous solution, dispersed a fine *violet blue* light, at the distance of *three-fourths* of an inch from its surface. In another experiment, a beam of light that had been dispersed in the solution of quinine, again suffered dispersion at *two inches* distance from the surface of a piece of Derbyshire fluor.

A beam of light that has passed through the Esculine solution disperses blue light, but not copiously, when transmitted through the quinine solution; but the beam that has passed through quinine is copiously dispersed when transmitted through Esculine.

dispersion, provided the thickness of the medium is not so great as to have dispersed all the dispersible rays.

2. When such a medium is thus rendered incapable of dispersing more light, it is not because it has lost a property which it originally possessed, but because it is deprived of all the dispersible rays which it contained.

It is no doubt an interesting fact, that a small number of differently coloured rays, constituting blue light by their mixture, should possess this property of being dispersed, while other rays of the same refrangibility are either less dispersible, or apparently indispersible, by the same medium; but the fact will appear less surprising and anomalous when we advert to certain phenomena of absorption in which the same property is displayed.

The difference between the *absorption* and the *internal dispersion* of light is simply this. In the one case the portion of light withdrawn from the intromitted beam is *extinguished* and *invisible*, and in the other *dispersed* and *visible*; and we may compare the two classes of phenomena by *supposing* that the light extinguished by absorption is rendered visible as if by dispersion. Now it is a remarkable fact, that almost the whole of the blue light absorbed by the mineral called *native orpiment* is extinguished during the passage of the light through the first stratum, whose thickness is less than the fiftieth of an inch; and hence it is that the thinnest slice of this substance has nearly as deep a yellow colour as the thickest. Were the absorbed blue rays to become visible by dispersion, we should actually see a more striking example of epipolism, or dispersion confined to the first stratum, than in the quiniferous solution. Even the condensation of the beam would not in this case give us a blue cone of light.

The analysis of the blue line indeed would indicate a difference between the two phenomena. It would shew that the blue light was derived chiefly from the *violet*, *indigo*, and *blue* spaces, and but partially from the *green*, *yellow*, *orange*, and *red*, having appropriated the whole of the more refrangible rays, and but a very small portion of the less refrangible ones; whereas the blue light from the quiniferous solution is derived almost in equal proportions from all the coloured spaces excepting the least refrangible, red. The limitation of the rays capable of absorption, like the limitation of the dispersible rays in the quiniferous solution, is shewn in the action of various bodies on the spectrum. Such bodies change the colour of certain spaces in the spectrum, without continuing to absorb the residual rays; that is, when the absorbable rays are removed by a certain thickness of the body, an additional thickness operates very feebly, as in the quiniferous solution, in altering the colour of the residual beam.

I have pointed out these analogies between the phenomena of absorption and dispersion to meet the case of the bright blue line in the quiniferous solutions. The dispersion of fluor-spar, and of the glasses and vegetable solutions already described, is of a different character. In fluor-spar the dispersion effected

by the first stratum is by no means very abundant, and the intromitted beam, even after passing through one or more undispersing strata, is dispersed nearly as copiously as before. In the glasses and in the vegetable solutions there are no peculiarities which require explanation, excepting those which arise from the absorption of the dispersed beam in passing through the coloured medium.

When the phenomena of internal dispersion are exhibited in coloured fluids and solids, the influence of absorption upon the dispersed light is very interesting. Previous to its dispersion the light has the same colour as the transmitted light, were it to emerge at that point of its path, and when viewed at an azimuth above 90° , a portion of the dispersed light has that colour. The quantity of light possessing this colour increases between the azimuth of 90° and 180° . In order to see this effect disembarassed from another influence, we must make the intromitted beam parallel to the surface of the fluid or solid, so as just to graze it. In this way the dispersed light is not changed in its passage to the eye after dispersion. When the beam passes through the coloured medium without this precaution, it again suffers absorption proportional to the thickness of the coloured substance through which it has passed, and sometimes disappears altogether. This effect is finely seen in the darker solutions, which disperse a brilliant *red*, or a brilliant *green* light; the colour of the former becoming *yellowish green* and *whitish*, while that of the latter becomes *whitish yellow*.

3. *On the Polarisation of Dispersed Light.*

As the dispersed light is turned from its path by reflection, and is reflected at angles proper for polarising it, its partial polarisation at least might have been anticipated. Sir JOHN HERSCHEL viewed it through a tourmaline, and states that no signs of polarisation were perceived in it; but his method of obtaining the blue line from light diverging from a large area of the sky, and therefore reflected at various angles far above and far below the polarising angle, rendered it impracticable to detect its state of polarisation. The method which I adopted, of using a narrow cylindrical beam of strong light, affording a bright dispersed beam more than an inch in length, enabled me to discover its polarisation, and to investigate its peculiarities.

Upon examining the blue beam in the quiniferous solution with an analysing rhomb of calcareous spar, I found that a considerable part of it, consisting chiefly of the less refrangible portion of its rays, was polarised in the plane of reflection, while the more refrangible of its rays, constituting an intensely blue beam, had a different state of polarisation.

This insulation of the bluer rays greatly increased the beauty of the phenomenon, and promised to throw some light upon its cause. I was therefore anxious to ascertain their state of polarisation, which was not indicated by the analysing rhomb. With this view I transmitted through the solution a strong beam of polarised

light, and was surprised to find that the blue beam which it yielded by dispersion, retained the same intensity in every position of the analysing prism, and therefore possesses a *quaquaversus* polarisation, such as that which light receives when transmitted through a congeries of minute doubly refracting crystals having their axes in all possible directions.

In making the same experiment with other dispersing fluids and solids, I found some in which the whole beam was completely polarised in the plane of reflection, and others in which it exhibited solely a *quaquaversus* polarisation; but as these experiments indicate new processes in the decomposition and polarisation of light, which require a more extended analysis, I shall resume the subject in a separate communication, contenting myself at present with a general account of the more important facts, and the results to which they lead.

Having transmitted a condensed beam of light through an alcoholic solution of the leaves of the Common Laurel, or of Tea, either green or black, I found that the *bright red beam* which it dispersed, possessed, like the *blue* one in the quiniferous solution, a *quaquaversus* polarisation, a small portion of the light being polarised in the plane of reflection. The *green* beam dispersed by the preparation of *orcine*, has the same properties, the white portion of it disappearing and reappearing during the revolution of the analysing rhomb. In the aqueous solution of *esculine*,* the dispersed pencil consists of two finely-contrasted pencils, the one *whitish* and polarised in the plane of reflection, and the other a *very deep blue*, having *quaquaversus* polarisation. The *white* pencil is more intense than the *blue* one, which is the very reverse of what takes place in the solution of quinine. The alcoholic solution of the seeds of the *Colchicum autumnale* gives a bright and copious *green* beam of dispersed light, which consists of two pencils, one whitish and polarised in the plane of reflection, and the other bright green, with a *quaquaversus* polarisation. The same property is possessed by a solution of *guaiacum* in alcohol, which disperses, by the stratum chiefly near its surface, a beautiful *violet* light; and also by an alcoholic solution of *sulphate* of *strychnine*, which disperses a green light, *after it has stood for some days*. The same property is possessed by almost all the oils, in some of which the dispersed light is exceedingly beautiful, varying from a pale green to a blue tint.

The polarisation of the dispersed beam in one plane, namely, in the plane of reflection, is exhibited in several fluids and solids. It is very marked in the bile of the ox, which disperses an olive-green light; in a solution of gum-myrrh in alcohol, diluted with water, which disperses a bright white beam; and in an orange-coloured glass, which disperses a pale greenish beam.

In many fluid solutions, the beam with a *quaquaversus* polarisation is very intense, when compared with the faint pencil which is polarised in the plane of

* In the alcoholic solution of Esculine, the *faint-blue* approaches to *violet*. The polarisation is like that in quinine.

reflection; but in a specimen of *yellow Bohemian glass*, which gives a copious and brilliant *green* beam by dispersion, the whole of the beam possesses a *quaquaverrus* polarisation.

When we view the dispersed beam in different azimuths, some very interesting phenomena present themselves to our notice. In general, the colour of the dispersed light suffers a considerable change, passing, between the azimuths of 90° and 180° , from the colour of the dispersed beam to the colour of the transmitted beam. This effect is finely seen in the alcoholic solution of tea, where the brilliant *red* light passes into an *olive* tint; but it is still more remarkable in a mixture of *Prussian blue* and water. The dispersed beam is polarised in the plane of reflection. It is *bluish* in the azimuth of 90° : *pinkish* about the azimuth of 100° ; *greenish* in that of 120° ; *bluish* in azimuth 150° ; and again *pinkish* in azimuth 170° . These three last tints may be all seen at the same time.

Such are the general phenomena of internal dispersion, a subject which promises to throw some light on the constitution of those solid and fluid bodies by which it is produced. The *apparently superficial dispersion* in the quinine solution to which Sir JOHN HERSCHEL has given the name of *epipolism*, is obviously a single case of the general phenomenon in which the ordinates of the curve of dispersion diminish rapidly after the light has entered the stratum nearest the surface; while the *real epipolism* which he ascribes to fluor-spar, so far from being an action of the surface, is much less so than that of the quiniferous solution, and entirely similar in its character to that which is produced by the fluids and solids which I have examined.

The phenomenon of internal dispersion, when considered merely as a case of reflection and polarisation, possesses much novelty and interest. If the exciting beam, as we may call it, is cylindrical, we have before us an experiment, in which the phenomena of *cylindrical reflection*, and *cylindrical polarisation*, are at once exhibited to us. The innumerable reflecting surfaces, receiving the intromitted beam at all possible angles, reflect the incident light in all possible directions, so that the eye, wherever it is placed, sees the beam as if it were self-luminous; and while the eye is made to revolve in a circle round the cylindrical beam, it receives a pencil of polarised light—polarised in a plane passing through the eye and the axis of the cylinder; or, what is the same thing, a thousand spectators viewing this beam in the same azimuth, but in directions differently inclined to the horizon, would all see exactly the same phenomena of reflection and polarisation!

4. *On the Causes of the Internal Decomposition and Dispersion of Light.*

In imperfectly crystallized minerals, such as particular specimens of *adularia*, *chrysoberyl*, *opal*, and *sapphire*, the white and coloured opalescence, and the asterial radiations, have been shewn to arise from minute vacuities, or from open spaces with crystallized sides, or from narrow pipes, or linear spaces parallel to

the edges of the primitive or secondary forms of the mineral. In tabasheer, where the vacuities contain air, which we can expel and send back at pleasure, a fine blue light is dispersed, depending, no doubt, on the size of the vacuities. In a very remarkable specimen of calcareous spar, crowded with hemitrope veins, I have observed a copious internal dispersion produced by the reflection of light at the different surfaces, which, though in optical contact, have different degrees of extraordinary refraction.

All these phenomena, however, are essentially different from those which form the subject of this paper, with the exception of the phenomena of fluor-spar, in so far, at least, as they are the result of imperfect crystallization. The *epipolism* which Sir JOHN HERSCHEL ascribes to this mineral, or its *internal dispersion*, according to my experiments, does not belong to the species, but only to particular varieties, and not even to the variety, but merely to particular parts of it. It is therefore the result of inequal or imperfect crystallization. The nucleus is perfect, a coating supervenes, having a different tint by transmitted light, and dispersing a fine blue light, and so on through a succession of strata, dispersing differently coloured lights, and separated by non-dispersing spaces. An extraneous element, therefore, depending on the state of the solution, has been successively introduced into the crystal, and if it had the same refractive and dispersive power as the fluor-spar, it could not reflect any portion of the intromitted beam : But if there is any difference in the mean refraction, or in the dispersive power, or if the difference consists merely in the unequal length of certain portions of the two spectra, then, in all these cases, light will be dispersed by the extraneous element. If, for example, we place a film of oil of cassia between two prisms of flint glass, the light reflected from the film will be *blue*. The index of refraction for certain of the *red* rays is the same in the glass and in the oil, and consequently none of these rays enter into the reflected pencil, which must therefore be *blue*, whatever be the inclination of the incident rays. If we now suppose this film of oil to be solidified, and disseminated in infinitely small atoms throught flint glass, or a fluid that has the same action as the glass upon light, we should have the phenomenon of a blue dispersion.*

A beam of blue light thus produced should be polarised at the polarising angle, and partially polarised at other angles ; and if this is not its character, we must look for some cause by which it has been counteracted. We have already seen that, in the Bohemian yellow glass, none of the light is polarised by reflection, and that in the quiniferous solution only a part of it is so polarised, the whole pencil in the one case, and the residual pencil in the other, having a *quaquaversus* polarisation. This effect cannot be the result of an opposite polarisation

* In the experiment with *Prussian blue*, which is a very splendid one, the particles are mechanically suspended in the water ; so that we have here an ocular demonstration that the particles are the cause of the dispersion and the *quaquaversus* polarisation.

by the refraction of the dispersed light at the surfaces of the reflecting particles, because such an action would only reduce the amount of polarisation by reflection ; and I have found by direct experiment, namely, by making the blue light pass through different thicknesses of the fluid, that such an effect is not produced. Unless, therefore, we suppose that this *quaquaversus* polarisation is a new property of light, produced by a peculiar action of certain solid and fluid bodies, we are driven to the conclusion, no less remarkable, that it is produced by an infinite number of doubly refracting crystals, having their axes of double refraction lying in every possible direction, and therefore reflecting from their posterior surfaces a pencil of light with *quaquaversus* polarisation.

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