An introduction text.

An inventory

In almost all times and in almost all non-Western cultures one hears and reads accounts of people who claim that we not only have a biological body, but that we also have a set of subtle material bodies, which together make up the so-called aura. This is said to be located in a few thinner layers around the biological body.

Already among the ancient Greek thinkers, the existence or non-existence of a fine substance was one of the most important philosophical themes. Not to mention many non-Western cultures where even today a sense of it is not at all rare. Sensitives - in the paranormal sense of the word - claim to be able to experience this substance. For example, they are said to feel tingling in their hands and crown chakra while praying, something they say indicates a supply of extremely fine energy. Clairvoyants also claim to "see" this tenuous substance, and even today magicians maintain that they can manipulate it. They usually shun all publicity for fear of being ridiculed for it.

Also, in contemporary philosophy, the subject of "fine dust" is rarely discussed. Even if belief in the existence of the aura from a scientific point of view has long been abandoned, it still lives on - hidden or not - in occultisms of all kinds and in dynamically conceived religions. Such religions place emphasis on the psychic powers that, through this fine substance, are expressed. Thus, we read in the Bible, *Luke 9:28ff*, that Jesus went with some of the apostles on Mount Tabor to pray, and there he showed his aura. In doing so, his countenance took on a radiant light and his clothes became blindingly white. In *Luke 8:43*, Jesus asks who had touched him, for he had felt a power emanating from him. And in *Luke 6:19,* the evangelist mentions that even a whole crowd wanted to touch Jesus because a power emanated from Him that healed all. In *1 Cor. 15*, the apostle Paul writes that man is threefold articulated, consisting of a biological body, of an incorporeal spirit, but also of a fine material soul. And it is this latter, this energetic and "subtle" substance as it is still called in the old Catechism, that concerns us here. Its existence or non-existence indeed remains one of the great philosophical-religious questions of life.

Beginning a quest...

The theme of "fine dust" continued to fascinate us. We wondered how it is possible that on the one hand this fact is not unknown to everyone, while on the other hand it is not taken too seriously by many, to put it mildly. In order to shed some light on this, we informed ourselves extensively on the subject, after which - somewhat naively and overconfidently at first - we started experimenting with the concave mirror of our telescope. At the time, we had absolutely no idea how extensive and far from simple all this would become.

As mentioned, each person would be surrounded by an aura like an energy field, in different and increasingly rarefied layers. However, not all the layers would be of an optical nature, so it would be pointless to attempt to examine the most tenuous layers with optical instruments. But what about the first, the least tenuous layer immediately adjacent to the biological body? Surely that could be worthy of investigation? To our knowledge, hard science is not bursting with attempts in that direction. Shall we listen to those who are familiar with the paranormal? Perhaps there we will find some clues that can help us further.

Dion Fortune, an English occultist of the first half of the 20th century, mentions in her book *Spiritism* ([1]) that our aura "under certain light conditions could be seen even with ordinary sight." Phybe Payne, *Dormant Powers in Man* ([2]) seems to confirm this. She writes that the aura "under favorable illumination conditions is visible to the normal eye (...). It is most easily seen against a dark background. (...). It is perceived by many, who have hardly more than normal eyesight, as a grayish, flaky mass, radiating from the skin and specially visible around the head and hands."

Similar descriptions we find in Barbara Brennan, Light on the aura ([3]). We read, "Most people are able to see those rays from the fingertips after a few minutes. To see the aura you need "night eyes”. The eye then adapts to the darkness. You notice, for example, that you can see the aura of your hand better if you don't look directly at it, but focus your eyes on something right next to your hand, something a little further away. The light-sensitive cells in the retina of your eyes consist of rods and cones. The cones are for daytime, to see bright colors. The rods are much more sensitive to lower light intensities, that's what you look with at night, and that's what you use here." So much for Brennan.

In 1931, some ninety years ago - when lasers, desperately needed to accurately align parts of optical setups, were not available at all - Dion Fortune ([4]) wrote that "the discovery of the aura is probably only a matter of time." Let's hope her statement is more than a pious wish.

Remember from Fortune, Payne and Brennan the favorable exposure conditions and the "night eyes" and darkness.

First, let's turn to the first clue: favorable exposure. Because the mirror surface of our telescope can capture much more light than the eye, we see stars in our telescope that would otherwise simply remain invisible to humans. The eye has a pupil of about 6 mm diameter. However, the mirror of our telescope has a diameter of 155 mm, so it captures about six hundred times more ($pi*r^2$) light. We assume that with the use of our concave mirror, these favorable illumination conditions must have been met to some extent. Yet nowhere in our telescope does a trace of a possible fine-matter radiation show itself. So more is needed, but what? Inform ourselves further...

When studying car and aircraft models, for example, one tries to make thin air flows visible. This is called ‘flow visualization’. The question is how best to build models so that air resistance is reduced to a minimum. Some of these methods are based on light interference. Perhaps the latter can help us further. Let's get into it.

Interference of light.

The term may scare us somewhat, but we are confronted with the matter itself almost daily. Usually, however, we do so without thinking about it. Let us first explain the phenomenon.

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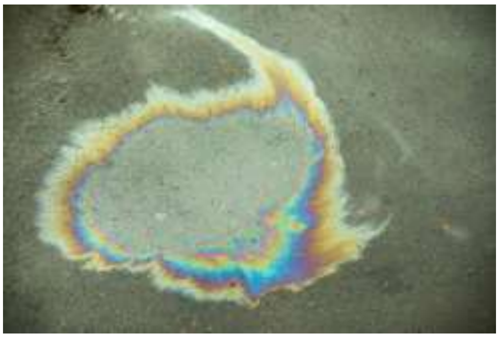
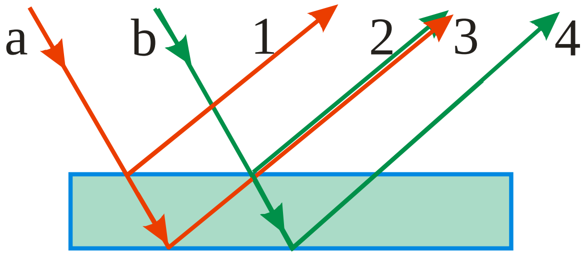


2

The interplay of colors in a soap bubble (1) or in a film of oil (2) on a pool of water, for example, are the result of optical interference, of the interplay of many rays of light. Or again: if we hold the screen of our cell phone (which is turned off) so that we see the sunlight or the light of a lamp reflected in it, we also notice a beautiful interplay of many beautiful colors. This screen is also covered with an extremely thin layer of a transparent fabric.

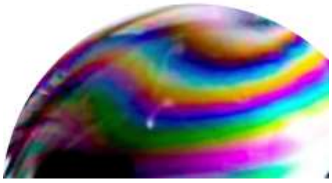
Why these many colors? The blue rectangle in the drawing below (3) represents a piece of the bubble, or a piece of a layer of oil on water or of a transparent substance on our cell phone. Let's incident light obliquely on it, and with light rays a and b.



3

The rays of light from a (in red color) and from b (in green color) that strike it can partly reflect on the top of the layer, but also on the bottom. Let's look at the path that the incident rays a and b can follow. Rays (a)1 and (b)3 reflect on the top side, rays (a)2 and (b)4 on the bottom side of the layer. It can be seen that the reflected rays 2 (green) and 3 (red) coincide with each other. However, ray a2 has traveled a longer path than ray b3. However, this minimal difference in path length leads to a noticeable difference in color. And this process repeats itself for the many rays of light incident on the layer, hence the beautiful color effects.

Look even more carefully at our bubble (4, 5). We observe in its so short and colorful life that the hues are constantly changing. These changes are caused by gravity.



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5

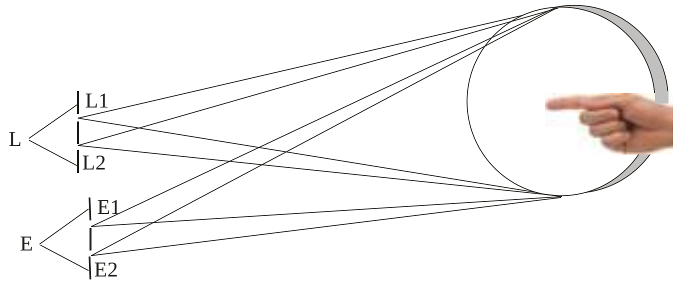
The water in the bubble is gradually drawn to the lowest point, sometimes showing some almost horizontal bands of color. Finally, too much water has accumulated at the bottom of the bubble and it has become so thin elsewhere that it bursts. Gone are our beautiful colors.

From this example we remember that minimal perturbations in layer thickness can lead to maximum color differences. And that can still be quite useful.

Going a step further. We imagine for a moment that our hand is so thin that we can squeeze it all the way into the layer. Could the supposed thinness around our hand then change the color of this layer? Because yes, if there is indeed another thin band around the hand, an obstacle, then the light can encounter resistance from this, slowing it down a little compared to the light next to it. Possibly the color then changes at that place.

It is of course an absurd idea, our hand is not thin at all. But what if we turn things around? Suppose somehow we could make the layer so thick that it could contain our hand. Then the question suddenly becomes much more real: would the color of the layer change? And if that were indeed the case, then surely we have a serious indication of the existence of "something" around our hand?

After wading through a lot of information, after a lot of thinking and searching and some experimentation, we manage to formulate our task in a much more practical way. To do this, let's look at the following schematic representation (6).



6

We see some letters on the left, some lines representing diverging (widening) or converging (narrowing) light beams, a concave mirror, and just in front of it our hand.

The letter "L" stands for "light," there is our "point light source," an ordinary light bulb, not an LED bulb. That illuminates a little screen in which there are two holes. This splits the light from L through L1 and L2 into two distinct partial beams. Both beams diverge to illuminate our concave mirror. Just in front of that mirror we then hold our hand or finger. Both beams reflect on the mirror and go converging via E1 and E2 to E. This last letter stands for "Eye," for our eye, and thus refers to the observer's location.

We can now compare the space between L and the mirror, and between the mirror and E, to the blue rectangle, the layer of our bubble, or of the oil slick or of our cell phone, but now magnified many times. Put in technical terms, we now have roughly a design of a kind of interferometer: light from a point light source is split into two distinct sub-beams, each of which is confronted and possibly distorted by the same obstacle, and after reflection is brought back together in E, where they mix or interfere with each other.

Anyone familiar with the basic concepts of optics has already immediately noticed the analogy between our interferometer and Englishman Thomas Young's famous two-slit experiment. It was he who in 1805 by ingenious experiments with water waves and light beams came to the discovery of the interference phenomenon. Let us now look at this phenomenon in isolation, in order to go a little deeper into this two-slit experiment later. Let us first pay attention to waves in water, then to light waves.

Constructive and destructive interference

If one throws a stone into still water, the resulting waves will create a series of concentric and ever-expanding circles (7).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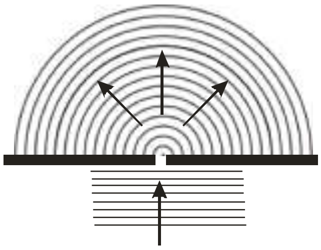
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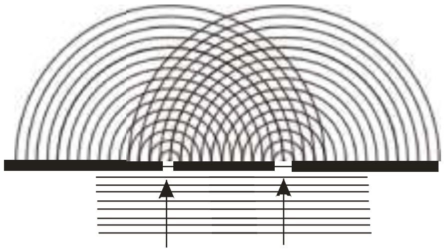
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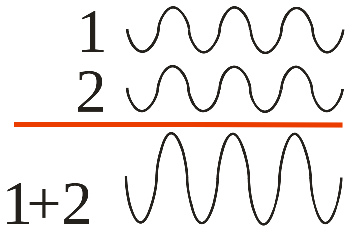
If parallel waves in flowing water squeeze through a narrow slit (8), then these waves will transform into concentric semicircles. If there are two crevices just next to each other, two sets of half circles will form, overlapping each other (9).

And somewhat analogously: if you throw two stones into the water at the same time and at a short distance from each other (10), you will see the waves caused by one stone "penetrate" the waves of the other.


10



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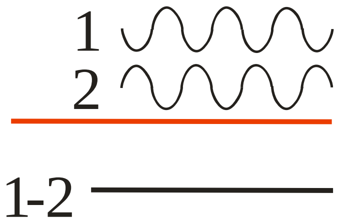


12

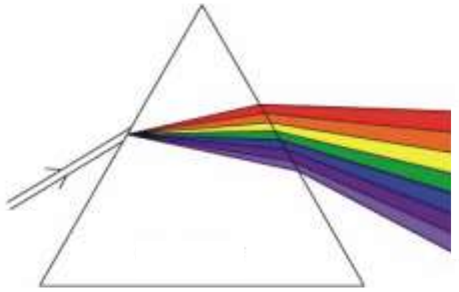
Now we look at these waves not from above, but in cross-section. In the drawing in the middle (11) we see wave 1 and wave 2 neatly under each other. Think that wave 1 was caused by the first stone, and wave 2 by the second stone. Both waves then approach each other and penetrate each other. The moment wave 1 reaches a peak, so does wave 2. And when wave 1 reaches a valley, so does wave 2. Below the red line we do the addition: here the crest is now twice as high, and the valley twice as deep. Where two wave tops merge, one has a higher top, where two wave valleys merge, one obtains a deeper valley.

The drawing on the right (12) also represents two waves. However, where wave 1 reaches a crest, wave 2 goes through a valley, and vice versa. If they merge, they neutralize each other: in both cases the wave "fills" the valley. The water then remains at its original level at that place, almost as if nothing at all is happening. Indeed, if you effectively redo the experiment in still water, you will see the many concentric circles flowing into each other and notice the speeding wave crests and wave valleys. And in between, it seems somewhat unreal, the water constantly remains unmoved at its original height. It seems like all the water molecules in those "dead" places just remain indifferent to the whole dynamic thing. It is as if they seem to think somewhat pityingly: "All this time dancing up and down with the rest here? No thanks, it's really not for us.

Now let's pay attention to the waves of light. This is not so easy: light waves are simply invisible to us. And yet light also travels in waves, but these are incredibly small. Imagine, on average, about two thousands of them go into a single millimeter. That says a lot about the almost draconian precision with which such interferometers must be built.

Again, two wave crests that merge into each other become twice as high. And two wave valleys that reach each other form a valley twice as deep. In both cases, one has twice as much light. Where a wave top completely fills a wave valley, or a valley fills a top, they neutralize each other. In the case of water, it appears as if there is no movement at all in that place. In the case of light, the rather curious phenomenon shows itself that valley and wave cancel each other out. Light added to light then gives ... yes, darkness.

Notice the two important differences between water waves and light waves. As mentioned, light waves are invisible to us. We don't actually see waves crashing into our bubble, or on the oil layer, or on our cell phone. We do see the color effect when two waves mix. And that immediately brings us to a second difference. Water waves all have the same distance relative to each other. This also applies to light of a single color, such as the light from a laser. But with white light, it's a completely different story....



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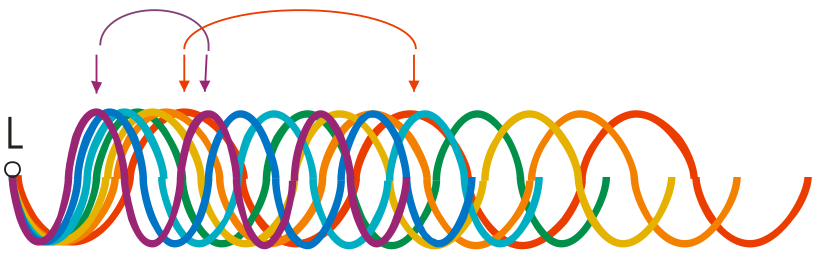
14

White light is indeed a collection of a number of colors. That shows us the refraction of light in a prism (13), or in the many raindrops that, illuminated by the sun, create a rainbow (14). And these colors, unlike the waves in water, each have a different wavelength. Illustrate this.

Starting from the white point light source L on the far left (15), the violet has the shortest wavelength. That length is indicated by the arrows and arc in violet. The red wave has the longest wavelength. That is indicated by the red arrows and the red arc. All other colors have wavelengths that lie between these two extremes. Recall that in one millimeter there go an average of two thousand waves, so that, after a few wavelengths from L, all the waves are so out of sync with each other that together they almost immediately form white light again.



15

And already getting started.

Build the setup we have in mind from our interferometer already on the optical bench. Bringing two points of light close together is a far from easy task. So we experiment patiently and learn from many failures how not to do it and what can be improved. Gradually we already achieve some result: some interference lines begin to show themselves for the observer.

In the first drawing on the left (16) we see that the two sub-beams begin to unite: the image of the mirror that we observe through the first sub-beam almost coincides with the image of the same mirror, but now observed through the second sub-beam. If we adjust so that both circular circumferences of our mirror practically coincide, then the whole surface fills with a single image. We see in the second drawing (17) a central line of destructive interference, with just left and right of it a luminous band. There the constructive interference shows itself. A little further away from the black line we see both left and right some widening lines in the colors of the rainbow. The third drawing (18) shows us a more precise adjustment: for this we had to bring our two point light sources even closer together.

16

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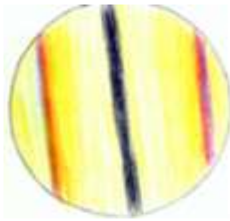
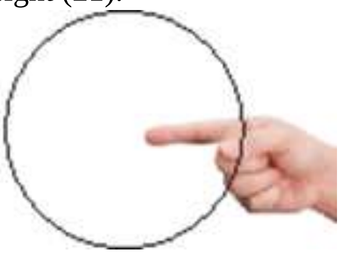


18

In the setup, as aligned in the drawing on the right (18), if we hold the hand just in front of the mirror we do indeed get it in focus, but there is no sign of any movement of the lines themselves or of any disturbance and color shift. Further searching, then...

One more thing: we tried to capture these images digitally. However, our point light source has a diameter of only 0.3 mm, the diameter of an acupuncture needle, and is very dim. In some attempts to take pictures anyway, the images are so small that when digitally enlarged they show only a collection of overly blurred pixels. In this text, therefore, we prefer to stick to a reality representation in drawings.

Next, we build a kind of reversal interferometer. Here one half of the image mixes or interferes with the mirror image of the other half. Then we bring the finger just in front of the mirror, as shown in the image on the left (19). An image will form in front of the observer as shown schematically in the center (20). We see the rather surprising result in the drawing on the right (21).



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21

Notice this last image. The heat from the finger warms the air around it and causes it to rise. Possibly the evaporation emanating from the finger itself also plays a role. It is curious that the turbulence is clearly bounded. With e.g. a smoking cigarette, this boundary between "here is still smoke" and "there is no more" can hardly be drawn, it seems like an unlimited cloud. In the drawing it is as if the evaporation is bounded and somewhat 'trapped'. Curious are the two 'lines' above each finger that each in their own way delimit the evaporation. Possibly they are two light waves pushed upward by the heat given off. The bright dynamics of the image prevent calm viewing. Colorful heat bubbles regularly escape, somewhat analogous to soap bubbles that rise when blowing bubbles. If one gently moves the finger back and forth, what shows itself above the finger follows, with some delay. It is almost like the flame of a burning match that one gently moves back and forth. Of a possible fine substance around the finger, however, there is no immediate appearance. Yet all this remains an unusually dynamic and captivating spectacle. One can keep looking at it fascinated for some time....

Continuing our quest, we then experiment with an arrangement in which two distinct interferences combine. So not two beams of light mixing with each other as before. But two separate interferences that we let flow into each other. What shows up we see in the following figure (22).

22

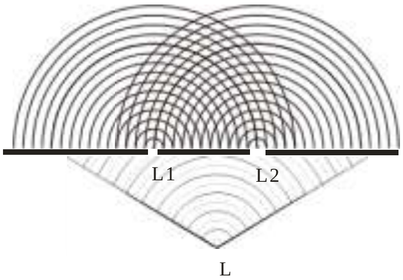
23

If we compare drawing 22 with drawing 18, we see that the colors of both interferences blend. In drawing 23, some vertical, broad interference bands form, which are crossed by interference bands that strike obliquely from top left to bottom right. Again, both sub-beams "blend" with each other and form a nice and symmetrical color pattern. If we now bring the hand in front of the mirror, we see that this does not affect the composition of the colors. It remains a beautiful color pattern, but it really does not take us any further on our search....

Fascinating as it may be, still, apparently none of our setups so far meet our expectations. So we inform ourselves further and immerse ourselves in Young's experiment already cited. Possibly that will provide some new insights and clues.

Youngs' two-slit experiment.

Let us first give a brief description. Let us recall drawing 9. This showed us the semicircular waves caused by two narrow slits. We replace the parallel waves just in front of the slits by a single source L (24). And then we look at the drawing on the right (25). One immediately sees the analogy between the two images. However, we also emphasize the difference: on the left we are talking about water waves, on the right we are talking about light waves.



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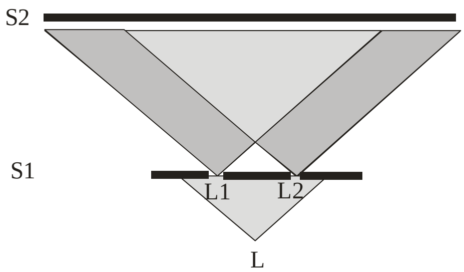
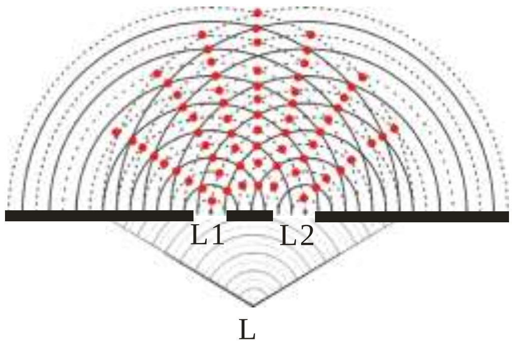


25

The paper or digital screen represents all this in a flat plane. But in reality it involves a dynamic event in space. So it is not parts of circles, but parts of a series of concentric spheres that keep expanding and whose waves from one light source continually penetrate into another.

Illustrate Young's experiment. A monochromatic light source L at the bottom (25) - a light source that generates light of one wavelength and therefore of one color, e.g., a red laser - illuminates a screen S1. This screen is represented in top view by a black broken line. In this screen there are two very small openings L1 and L2, each of which in itself forms a new point light source. The distance between L1 and L2 is e.g. one millimeter. They illuminate the screen S2, also represented in top view, which is e.g. five meters away.

Shown below in the drawing on the left (26), we again reproduce the previous drawing on the left (24), but with the following clarifications. We have represented each wave valley with a dotted line, and each wave top with a solid line. Where a wave top of L1 meets a wave top of L2, they reinforce each other. Where a wave valley of L1 meets a wave valley of L2, they also reinforce each other. In addition, wherever two peaks or two valleys meet, we have added a red dot. There the light will be twice as intense. We see that well-defined patterns begin to emerge.



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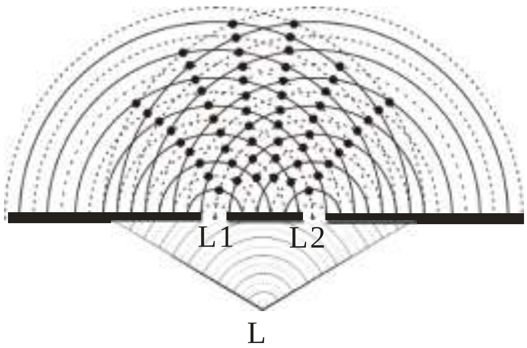
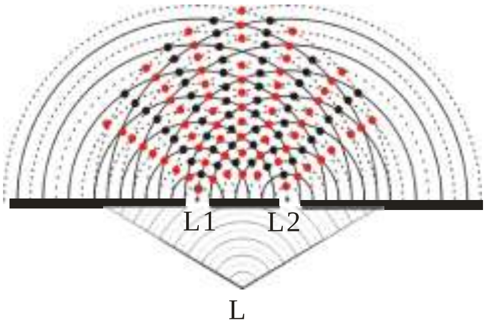


27

Drawing 27 is analogous to drawing 26. However, with this difference: we now pay attention to the places where a crest coincides with a valley. Where a wave top of L1 fills a wave valley of L2, or a wave valley of L1 absorbs a wave top of L2, they neutralize each other. Wherever a crest coincides with a valley, we have applied a black dot. There will be no light there, but darkness. We see that there are well-defined patterns here as well.

We bring the two drawings (26, 27) together. We get what is shown below on the left (28). If we also add the screen S2, on which this light is projected, we get the drawing on the right in top view (29).



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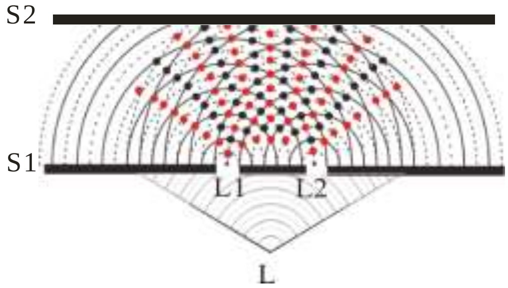
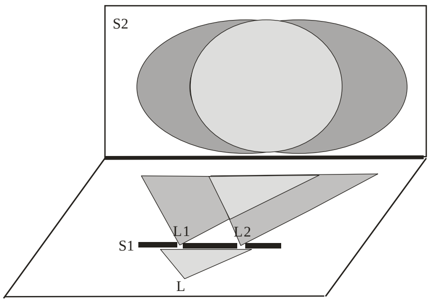


29

Resume drawing 25 on the left below, but such that we now see the screen S2 not in top view, but in front view (30). Perhaps it is to be expected that each point light source, both L1 and L2, projects a circle of light onto this screen. And that in the common part of the screen, where both light from L1 and L2 falls, the light there will be twice as intense. But ... our light source has hardly any surface of significance. It does not give us a wide beam of light. No, we are working with a "point light source" of only 0.3 mm diameter. And that fact makes for a completely different story. We're about to find out. If we set the screen in S2 so that we can also see it in front view (31), and think that our point light sources consist of light of one color, namely red.



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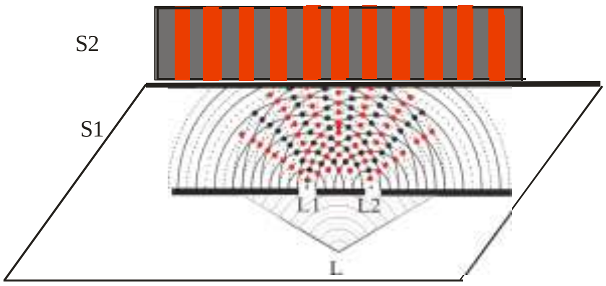
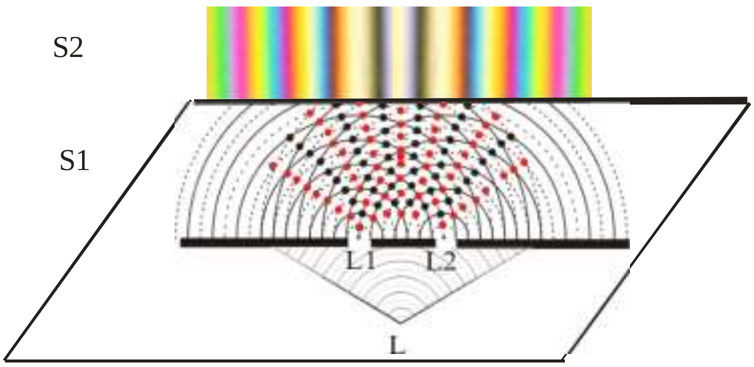


31

Some red lines or strips show up on the screen S2, where we had put our red points in drawing 26. The many points of the so-small light waves together indeed form a line or strip. In those places the light waves interact constructively. We further see that these lines are interspersed with darker strips. These are formed by the lines of the dark points from drawing 26, the places where the waves destructively interact. Also, the analogy between drawing 29 and drawing 31 becomes clear to us.

However, if we are working with white light, then things become a little more difficult. The red light source is now replaced by a white one. But this one contains in itself all the colors of the rainbow. And these, with their difference in wavelength, are not at all inclined to line up neatly. This is what we see on the projection screen (32) as well. The black lines in the middle, lines of destructive interference, are marked off quite clearly, but with the following lines the colors get out of step quite quickly. Gradually they overlap more and more and form white light again. However, the latter is outside the screen here.



32

After all the previous, such a line spectrum does seem somewhat familiar to us. Indeed, we have encountered it before. The setup on the optical bench (16, 17, 18) already gave something similar. Only there we had only one black line. Whereas here we have two next to each other. The reason lies in the fact that in our setup the light reflects on a mirror and therefore undergoes an additional phase jump. This is in contrast to Young's arrangement where the light is not reflected. However, explaining this further would take us needlessly too far in this text.

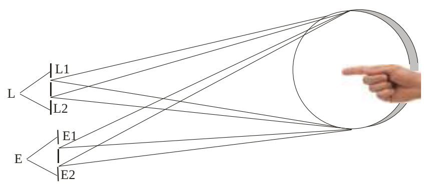
Our focus is on an arrangement where the colors are changed when the hand is brought just before the mirror. And we have not yet achieved that. Think further. Perhaps the disturbance our hand might cause here is too small to force an interference line to swerve a bit. If that were so, then further experimentation with monochromatic light makes no sense. The lines or strips would then simply remain in their same place, as shown on screen S2 in drawing 31.

But what about white light? Suppose we can bring our two point light sources incredibly close together, much closer than, say, the one millimeter that separated L1 from L2 in Young's experiment. Suppose we could bring them really insanely close together ... then a single interference line would fill the entire field of view. Stronger, and even further thought, the mirror surface would then contain only a single color of the rainbow.

With an average of two thousand light waves in one mm, and then directly adjust to a part of it? Precision work e.g. down to one twenty-thousandth of a mm? That is, we would almost say, "miles" away from an amateur's capabilities.

Is this the end of our story? No, because we came up with an indirect way to bring two points of light incredibly close together after all. Clarifying all this here would again take us too far. In the following text we did explain it in detail.

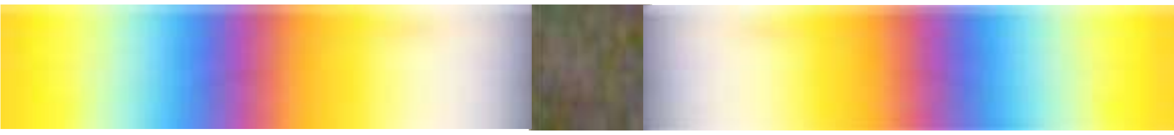
Recall below on the left (33) the arrangement on the optical bench, and on the right (34) we give a piece from the interference band as shown in Figure 32. Here, however, as already explained, with a single black line, and furthermore, brightly magnified.



33

34

Now gradually bring our light points L1 and L2 exceptionally close together, this band will become even wider (35).



35

Eventually it becomes so wide that it exceeds the diameter of our mirror many times over. We can then adjust the mirror so that its entire surface is optionally filled with a single interference color each time. We see this suggested below (36).

36

If we adjust to a background color and bring the hand into the light path just in front of the mirror, we see, depending on the color chosen, what is drawn and colored below (37, 38, 39). We no longer notice violent turbulence as shown, for example, by the inverted interferometer (21). No the image is now quite static. We can continue to watch quietly.

37

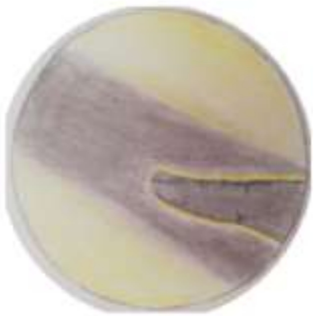
38

39

And what if we tune to the central black strip, the strip of destructive interference. Remind the reader of the findings of Fortune, Payne and Brennan. In addition to the importance of favorable lighting conditions, they also stressed the importance of "night eyes" and darkness.

So do we also set the arrangement up for destructive interference, and bring the finger into the "light path," or should we say, into the "dark path”. Would then the supposed thin matter around the finger be an obstacle for the light and slow it down somewhat? Possibly then at that place the so sensitive destructive interference is disturbed or even nullified. Indeed, possibly the interference then changes from destructive to constructive. But in that case a thin and luminous band might show itself next to the hand. We do not then really see the tenuous substance per se, as Payne, Fortune and Brennan described it. What we do notice is the effect that that substance has on the passage of light. In other words, that band will then have to be the color of the light of the light source employed. And in our case that is yellow-white.

Do we adjust our setup more and more destructively. And yes, after meticulous adjustment, this succeeds. With an almost held breath, we extremely carefully bring the finger to just in front of the mirror. Tensely we watch what gradually reveals itself... (40, 41, 42).

40 41 42

And these last images, it seems to us, nevertheless speak for themselves. Moving the finger gently back and forth, this yellow band also seems to follow here with some delay.

With this, our story also seems to be quietly coming to an end. It was a journey of several years, during which we felt that the limits of what is possible for an ordinary tinkerer were reached or even exceeded more than once. Nevertheless, it was an incredibly fascinating and surprising journey. Actually, it's a bit of a shame that it's all finished now... Well, let's enjoy the result, "a thing of beauty is a joy forever".

In conclusion

We conclude all the search for the existence or non-existence of a fine substance with a tentative hypothesis: perhaps it exists. Further research, carried out with a great deal more accuracy than our attempts, may be able to verify, and supplement, or possibly falsify it. We have conducted some experiments that point toward the existence of a fine substance, which makes its occurrence somewhat more probable. But we have not provided the convincing proof, the evidence to enforce that universally and in a hard-scientific manner. Rather, so far that conviction is merely individual or private.

Still, let us remain particularly humble. After all, what does an amateur, with a self-sharpened mirror of only 155 mm diameter and some other optical material, have to say to the so vast optical science? At most, our tinkering may have brought the topic of "fine dust" and what is related to it a little more into focus.

Possibly, though, all this could be a spur to further research at a higher, professional level. The question remains: what would transpire if larger telescopes, with mirrors of, say, 2 meters in diameter, and with an accuracy incomparably better than ours, were to literally put the whole of man in the spotlight. Will other, possibly unprecedented perspectives about us humans - literally - then come to light? And if so, will such might enrich our view of ourselves and of life, scientifically, philosophically and religiously? Surely these remain extremely fascinating and intriguing questions.

August 2022

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