4-DIMENSIONAL FIELD OF LIGHT AND SHADOW

The model of a light source able to give the space characteristics of a photon directly in the observation reality, without instrumentation, has already been thought of and then refuted due to its complexity to realize. In this study, we see that a specific source allows its validation. This source of almost spherical shape and made of vertical bands diffusing its brightness in a room, we observe in a box equipped with a vertical slit bright and dark vertical fringes; and seeing that these fringes remain vertical when the position of the source is modified, we deduce the presence of a light and shadow field. In Euclidean, after placing a 3d coordinate system on the fringe screen, the physical analysis shows the need to add an additional dimension to the screen to correct a problem of incompatible spaces between fringes that are close. The geometry in space allows to transform this 3d coordinate system by adding this dimension to obtain a horizontal coordinate system with 4 dimensions and 8 parameters of the field in the box, as well as the characteristics of real space of a photon in this field. But that's not all. By transforming the horizontal coordinate system in reverse to return in 3d shape, the dimensions acquire a pivot property that makes the fourth dimension add itself orthogonally to all the others, which is also a novelty in Euclidean geometry. And finally, we obtain a property of discontinuity in direct propagation in space for light and shadow.

The bright and dark fringes

The source consists of a vertical band cover in the shape of a sectioned sphere of precise size equipped with a halogen bulb with one or two vertical filaments in its center and produces vertical light beams and shadow volumes. It is hung by its power cable in a room in which a box of about 60cm of edges with a vertical slit a few mm wide and a screen is placed at 7m in the direction of an angle so that the center of the screen, the slit and the angle are aligned. First, we observe in the box bright and dark fringes vertical and straight from the very top to the very bottom of the screen, the light beams and shadow volumes being sectioned vertically from the slit. Then it becomes very interesting if the source is pushed in any direction so as to impose large oscillatory movements on it avoiding a rotation movement on itself, because the fringes remain vertical and distinct and adopt a very weak horizontal movement on either side of a vertical axis positioned in the center of the screen, which makes the phenomenon quite impressive from an observational point of view. With a larger box, these fringes are just as impressive because even higher and still well vertical, distinct and straight, but the phenomenon makes that they have a lot of lateral travel at the left and right ends of the image when the source is oscillating, this is why the use of a box of about 60cm of edges allows to select a volume of the 3d space in which the horizontal movement is weak everywhere, which delimits a precise space and simplifies the analysis.

FIG. 1. The source is a spherical structure of diameter 29.5cm sectioned at the bottom made of 42 bands of average width 1.26cm opening on 42 slits of average width 0.95cm at mid-height. It can be equipped with a bulb with one or two vertical filaments positioned in its center.

FIG. 2. The box used measures approximately 60cmx60cmx60cm. One can also use a box with a little more depth between the slit and the screen and/or a higher height, but it is better to limit the width so that the horizontal movement of the fringes on the screen is observed weak everywhere. On the side, the vertical slit is of high length and in front of it there is a white screen.

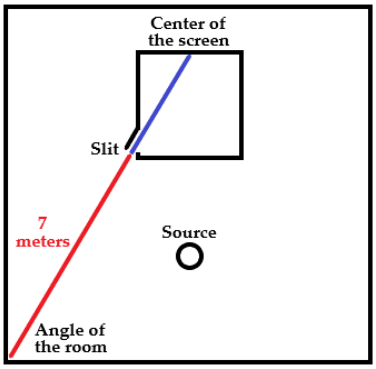

FIG. 3. Positioning, not to scale, of the box in top view. The center of the screen, the slit and the angle of the room are aligned, which has the effect of positioning a vertical axis at the center of the screen around which the fringes bounce when they are in movement. A minimum distance of 6.50m between the slit and the angle must be taken if one wishes a regular image.

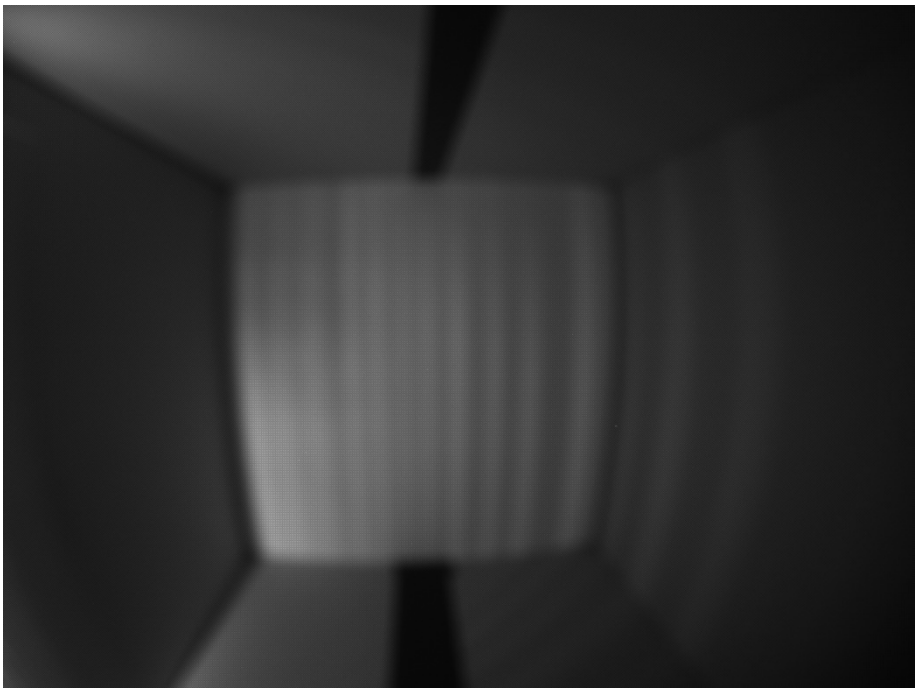

FIG. 4. Photo of the fringes made with an astronomy camera. In order to gain brightness, the slit is positioned only 5.50m from the angle of the room. The bulb used is one filament. With two filaments, the fringes have a little more relief and are a little less delimited.

FIG. 5. If the source is kept tilted, as if one does a freeze frame of the movement of oscillations, the astronomy camera films the vertical and straight fringes in the box and one observes them on the computer screen, in blue. The distance that separates the slit from the angle of the room is 5.50m.

The field

Given the slit width and thus the absence of diffraction, if the phenomenon was common, one could use the geometric optics to reconstruct the fringes from the drawings of reflections on the walls of the room facing the slit except that the “reverse return” from the image of the fringes imposes to observe on these walls bright and dark bands with a very small angle of inclination possible in verticality and in spite of everything we see very inclined bands or even absent depending if it is downright the beam of conical shape projected down from the source that lights them. The geometric optics seem to work individually in the room or in the box but as the reverse return does not work and the light beams and shadow volumes are sectioned vertically in the box as soon as the slit, a break in the latter prevents the drawing of light rays and shadow projections in straight lines. Considering this rupture and the regularity of the 2d horizontal movement of the light beams and volumes of shadow always in the box, we see that we have to deal with a field that involves space. We call it the “field of light and shadow”.

4 dimensions of real space to explain the phenomenon

In order to learn more about the space exploited by the field, we place in the supposed Galilean reference frame of the experiment room and in the Euclidean space, a right-handed 3d orthogonal coordinate system (x, y, z) of oriented Euclidean vector space of center O therefore with true dimensions of space with “x” in slit-screen distance, “y” the width positioned horizontally on the screen of the fringes and “z” the height ; and although the geometric optics cannot be used at the slit, we use the fact that the fringes observed are indeed the images of the cover with the bands of the source and therefore that each fringe on the screen has a beam of light or a volume of source shadow in the room which is for itself. Once this is done, we can see that when the inclination of the source varies, a fringe travels the vertical space crossed by its source beam or volume on its horizontal trajectory, this creating incompatible spaces between the trajectories of the near fringes that are superimposed on the screen. With a larger box, the greater lateral travel of the fringes involves a lot of superimposed trajectories and it might be necessary to add several “space dimensions” to eliminate all incompatible spaces thus created, but with the box used and according to the very weak horizontal movement of the fringes on the screen, all the trajectories of the bright fringes can be organized on a straight line without touching each other and it is the same for the trajectories of the dark fringes, which means geometrically on the screen that we have to add exactly one dimension of space if we want to eliminate incompatible spaces. And as this is valid for all the directions of pushes of the source, we are informed about the quality of the field which is excellent in every point of the room. To explain this phenomenon, 4 dimensions of real space are necessary.

Passage in 4d

The additional dimension which is positioned coincident with “y” and in the same orientation is called dimension “a”, the table of the passage in 4d allows the understanding by approaching it by the phase 1, and there are therefore two cases of separation of the incompatible spaces, the first in which the trajectories of the dark fringes taken by the SM Shadow Movement parameter are positioned in “a” and the second in which the trajectories of the bright fringes taken by the LM Light Movement parameter are positioned in “a”. We use the usual technique of adding a dimension in the horizontal plane in geometry in space while doing these cases at phase 4, thinking first be able to leave the two parameters of a color in (y, x) and “transfer” the two parameters of the other color in (a, z) for each case to flow directly from the starting situation. After adding the dimension “a” orthogonally to “y” in the horizontal plane, we obtain two 4d/4p coordinate systems that are valid and without incompatible spaces but observationally incomplete because each one only has light or shadow propagation in “x”, and as it is more interesting in physics to have a single observationally complete case with both LP and SP in “x” in order to be able to compare it to an observable photon, we merge these two coordinate systems at phase 6 to obtain a single coordinate system with 4 dimensions and 8 parameters 4d/8p of the horizontal field, which is geometrically possible because one is allowed to reorganize the geometry links between parameters at phase 7, in order to remain geometrically linked by case when one is at 8 parameters, which protects the original dimensions. We use the property of a dimension “x” “y” “z” or “a” of the 4d reference frame allowing it to assign itself a coincident parameter, and we obtain color links organized by left or right side, the color parameter of one dimension joining the parameter of the other color of the coincident dimension.

Link per case = Link 4d L or S

Except that when we go from phase 3 to phase 7 because phase 7 is the same as phase 4 but merged, we are obliged either to copy the original parameters or to involve external parameters directly in (a, z) in order to retrieve the links of the dimensions of the 4d reference frame and obtain the 4d L or S links, which makes that it was not possible to transfer the parameters from phase 3 to phase 4. But the technique is still valid. First, whether we transfer (3 to 4) or copy (3 to 7 and 3 to 4), we are obliged to do it with the original parameters LP LM SP SM and to put the number 1 or 2 of the case only once the parameters are positioned in (a, z) because otherwise the initial conditions are changed, and since 4d L or S links are established with parameters already numbered, they are valid for both situations, transfer or copy, and only the provenance of the parameters is changed. Moreover, the 4d reference frame which is the valid fringe observability reference without incompatible spaces, complete with the parameters of (a, z), shows us that in the starting reality we cannot observe the fringes because the parameters of (a, z) are not present, which means that there are necessarily these parameters in the background in this starting reality since we observe the fringes, and that when we went from phase 3 to phase 4, the parameters of (a, z) could not be copies of the parameters of (y, x) but parameters that come from an external contribution, even if these copies are structurally correct in the technique. There are therefore no incompatible spaces in the starting reality since they are already eliminated in the background by the two “4d sub-realities”, and the parameters of (a, z) work as copies but come directly from the 4d space. In short, the technique imposed by physics involves additional parameters of 4d space, on which their own movement of the fringes contributes to the elimination of incompatible spaces.

And what about the addition of the dimension “a” in the coordinate system? So far, the dimensions use known properties, but we now see that they assign themselves a new property in the 4d coordinate system in 3d shape of phase 8. Indeed, the 4d L or S links being established at phase 7 between parameters that are already in planes and that have the properties of these planes, when the 2d (a, z) is raised, the orthogonality of the planes applies to the linked parameters which then have a pivot property the one with

respect to the other. Then, we transfer this pivot property to the dimensions via the dimension planes that are coincident with the parameter planes, and finally, it is the dimension that gives the direction of the pivot, because it is it that gives the link and marks the position before and after pivot:

Pivot "a" with respect to "y" = π/2
Pivot "y" with respect to "a" = π/2

What is confirmed by the dimensions: one 4d L or S link uniting geometrically at phase 7 two parameters which are in horizontal planes in the same dimension, when the 2d (a, z) is raised, the dimension "a" keeps the property of its horizontal plane linked to its vertical plane and the dimension "y" keeps the property of its vertical plane linked to its horizontal plane, which makes that we directly obtain the pivot of "a" or "y" defined by the orthogonality of the planes, as well as the direction. The pivot is therefore a fundamental property of the dimensions "a" and "y" in the 4d coordinate system in 3d shape, and since these two pivots are each defined by the orthogonality of dimension planes, we can gather these two orthogonalities into a single orthogonality of the planes. Moreover, the 4d L or S links being the only geometry links between "a" and "y", these dimensions are fundamentally orthogonal between them in the 4d coordinate system and see each other only orthogonal from the center O. Regarding the dimensions "z" and "x", although their fundamental properties are also those of orthogonal planes since their links are established in the same way at phase 7, it is a simple orthogonality between dimensions that unites them in the 4d coordinate system in 3d shape because we use "z" to raise the 2d (a, z). And as with the pivots, this orthogonality can be subdivided into two orthogonalities with directions. Thus, in the 4d coordinate system with dimensions of phase 9, we count the right angle number 1 of the 2d (y, x), the right angle number 2 of the 2d (a, z), the right angle number 3 between the dimensions "x" and "z", and the right angle number 4 of the orthogonality of the planes (y, x) and (a, z) between "y" and "a" i.e:

"x" orthogonal to "y" orthogonal to "a" orthogonal to "z" orthogonal to "x"

One of the peculiarities of this coordinate system being, because of the orthogonality between "y" and "a", that we cannot give the orthogonalities between "x" and "a" and between "y" and "z" unless we switch to 3d. Which returns to 3d and allows to confirm the addition of the dimension orthogonally to the three others when we switch to 4d. Indeed, we use 3d to obtain the position of the axes, with in particular "y" and "a" coincident, and the 4d in which "y" and "a" are fundamentally orthogonal, to give all the orthogonalities necessary:

"x" orthogonal to "a" and "y" orthogonal to "z" in 3d; "x" orthogonal to "y", "x" orthogonal to "z" and "z" orthogonal to "a" in 3d and 4d; and finally we place ourselves in 4d with "y" orthogonal to "a".

Which confirms the addition of the dimension "a" orthogonally to the three others in the 3d coordinate system, in Euclidean space. The coordinate system of 3d Euclidean vector space is transformed into a 4d coordinate system formed by two orthogonal planes, which makes it compatible with the scalar product and therefore valid as a Euclidean vector space, all in the Euclidean space. We are well talking here about a fourth dimension of space and not "dimension 4", the latter not being concretely added in a 3d coordinate system and representing just a Euclidean solution to go from a 3D volume to a 4D object. And we also do not talk about the time axis «t», usually used as an additional dimension of 3d space in physics. Time flows normally in the room in which we observe this fourth dimension of space "a". Finally, we quickly see the pseudo 3d at phase 11 which is not as good as the 4d reference frame but which is better than the 3d of start because the links between parameters in the dimensions "x" and "y" are directly ready to welcome

the additional parameters of (a, z). The pseudo 3d is interesting in that it allows to easily see this hidden dimension “a” of the observed space.

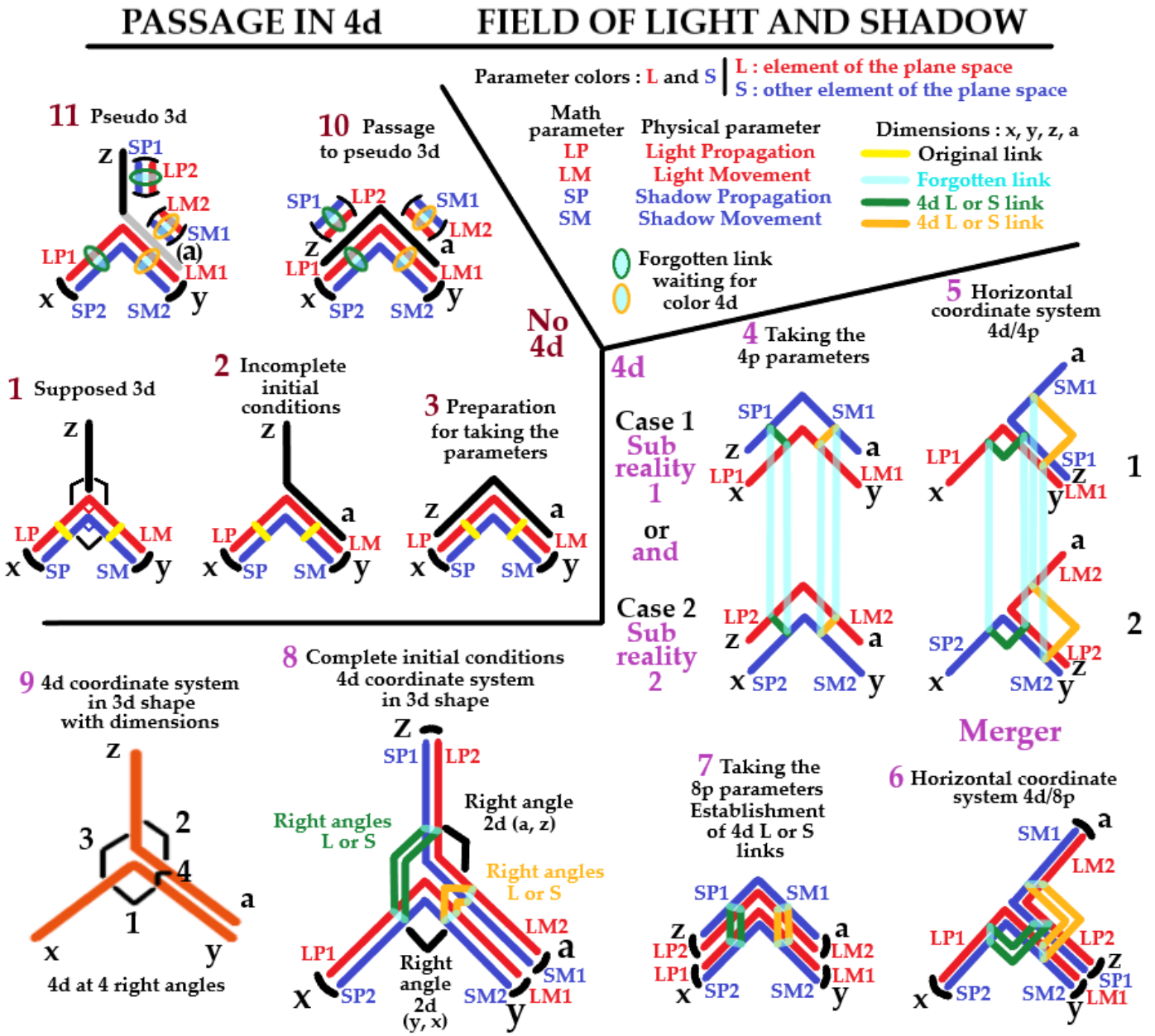

FIG. 6. Passage in 4d

Field and photon

In physics, we obtain the characteristics of the field in the box or “horizontal field” and of a photon in the box: two 4d/4p coordinate systems each observationally incomplete with only LP or SP in “x” are merged into a 4d/8p coordinate system observationally complete of the horizontal field with LP and SP in “x”, which gives the characteristics of a photon $E=hC/\lambda$ at a point of space of the horizontal field i.e 4 dimensions and 8 parameters 4d/8p, and this photon is constructed with two 4d/4p sub-parts each formed by a 2d Light and a 2d Shadow; which is also a first since the characteristics in dimensions of real space of a photon are obtained from a simple visual observation in reality.

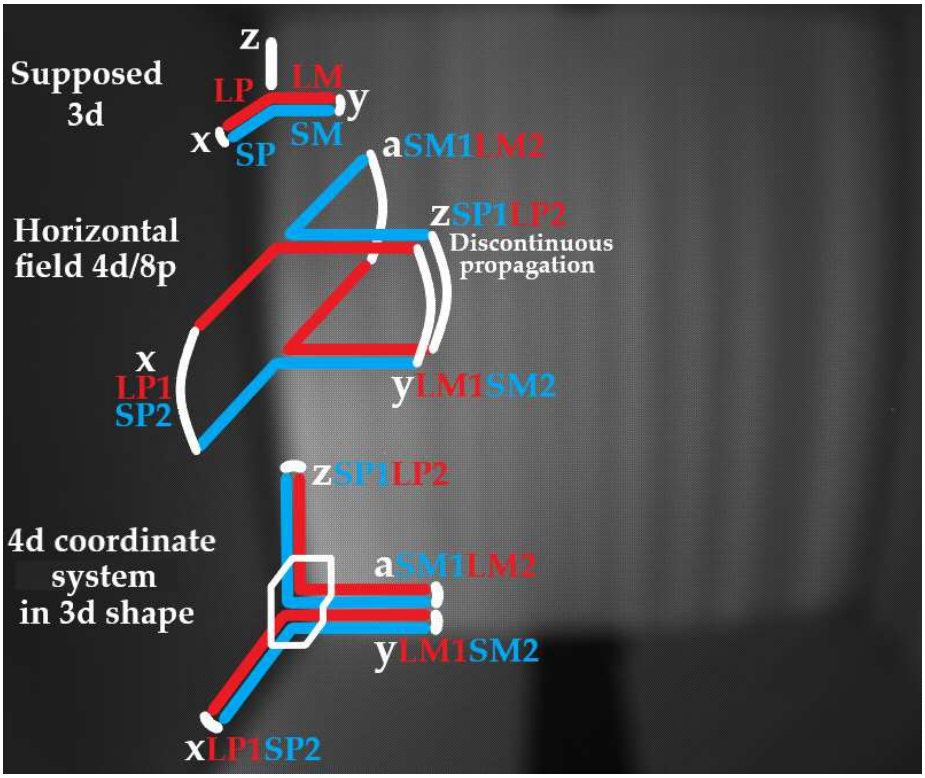

FIG. 7. The supposed 3d, the horizontal field 4d/8p and the 4d coordinate system in 3d shape are in position on the fringe image. The slit is located in the extension of "x". In the horizontal field, we see the discontinuous propagation zSP1LP2 positioned on the screen.

Discontinuous propagation

Finally, after having noticed beforehand, from the drawing of the bright and dark fringes, that zSP1 positioned on the screen in the 4d/4p 1 coordinate system is a discontinuous propagation of shadow because of its orthogonality with LP1 in "x" and that zLP2 positioned on the screen in the 4d/4p 2 coordinate system is a discontinuous propagation of light because of its orthogonality with SP2 in "x", we obtain a discontinuity property in direct propagation in space for the light and the shadow by joining zSP1 and zLP2 in a single dimension of the observable 4d/8p field, that is zSP1LP2 which is therefore a "double discontinuous propagation of light and shadow observed on the screen". And this interesting property will be useful to create pieces of light and shadow stopped or suspended in space as holograms using the field of light and shadow and its geometry.

The experience is just beginning

By using a smaller box in which we let in a little brightness of the field, positioned on an eye or equipped with a camera, we see the light propagate in the darkness of the box in the form of small luminous discs, and among the few special observations already made, we can note the "hole in reality" which is the transformation of one of these discs into the image of an area of the 3d space located in the field viewed from a position different from the observation position, i.e a shortcut of space directly observable, which can be useful for example to observe an area hidden by 3d relief. But the light and shadow field will also demonstrate a great compatibility with the observer's thinking, its discovery marking the beginning of new physics, more natural.

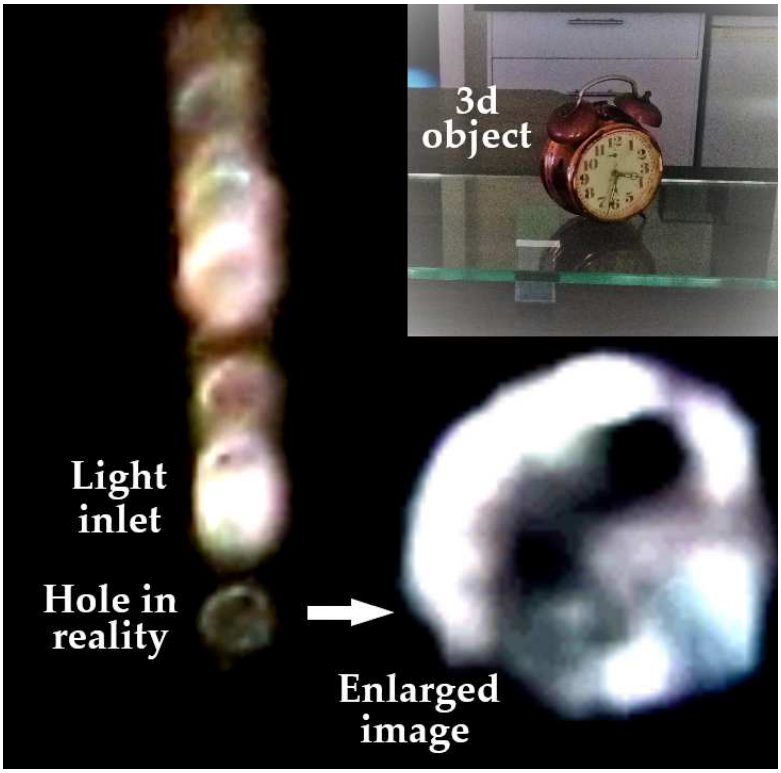

FIG. 8. Image of a “hole in reality” obtained using a camera equipped with a small, drilled box placed on the lens, the source being equipped with a bulb with one vertical filament. The brightness of the field that comes inside the box reconstitutes the image of a 3d object located in the field.

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