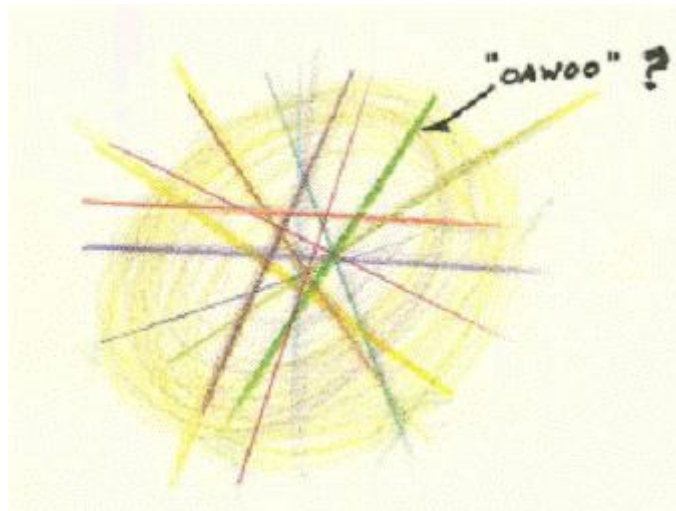


Letter D76: “We can reveal to you that the first “shock” suffered by the former mechanistic conceptions of the Cosmos was caused when our cosmophysicists came to ascertain the genuine nature of physical space.” (*emphasis mine*)

Throughout this whole work, let us not forget for a single moment that, in order to understand the IBOZOO UU, the very first thing is to discover the genuine nature of physical space.

This is how the Oomen present an IBOZOO UU to us

D59-3: Therefore: if we invite those who are lay in Mathematics to imagine the IBOZOO UU as a series of axes (indefinite straight lines, ideal ones)



we urge the MATHEMATICIANS to bear in mind that our concept of OAWOO, although it implies “DIRECTION”, could never be equated with real or ideal axes or straight lines.

Furthermore, they tell us that what we interpret as “reality” is ultimately nothing but a “construction” of our brain, and that “behind” that reality there is nothing but IBOZOO UU.

What we interpret as distance, time, particles, electric charge or gravitational field is nothing but the mental representation of information stored in the angular differences between the orientations of the various I.U.

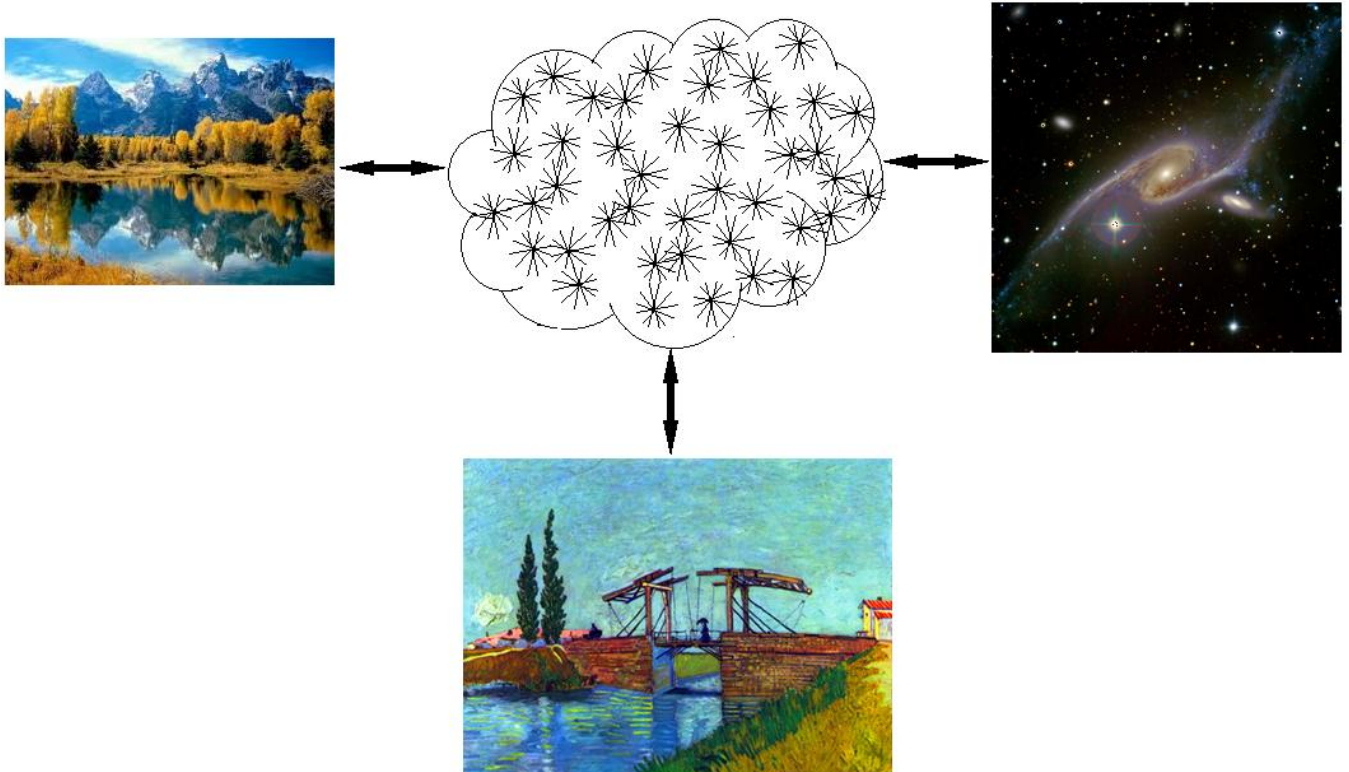
Where are these IBOZOO UU? The answer is that they are “nowhere”, since they are “prior” (not in the temporal sense) to space, and therefore it makes no sense to suppose that they are somewhere: geometric space is nothing but an idealization of our psyche, taking as its information base those “spatial images” produced by our brain but originating in something (the IU) that is NOT in space and is not space

either—something like a computer program that “represents” on the screen, in “spatial” form, information that is nothing but bits.

Where are these IBOZOO UU? We ask again, and once more the answer is “nowhere”. Where are numbers? Well, just as numbers are nowhere, the IU are nowhere either.

And yet we say that the information contained in the angular differences between the various orientations of the IU “generates” “reality” in our brain.

Something like this is what I want to express in the following image:



But how does this happen? How can we be made of IBOZOO UU and not realize it, or not see them with our microscopes?

What kind of world can these bundles of axes represent? What information can the angular differences between them store?

Let us leave this question in suspense and abruptly change the scene.

TOPIC 1. Space

1.1. 1D / 2D

ONE-DIMENSIONAL UNIVERSE in a two-dimensional space

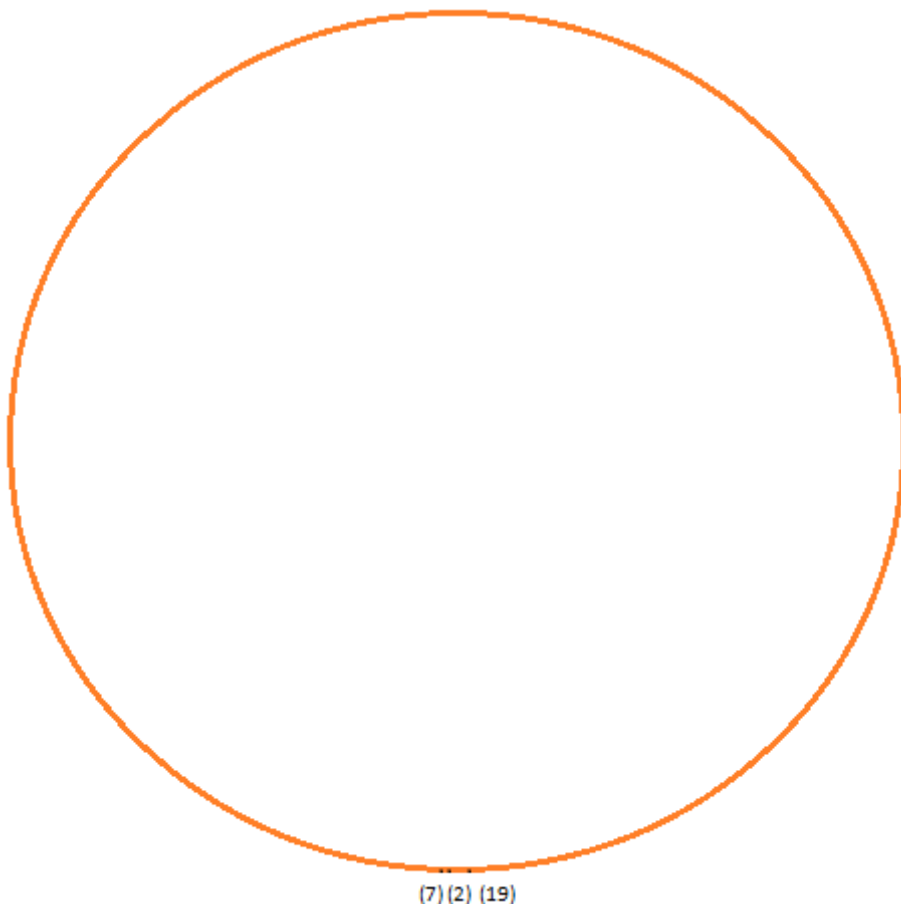
Let us imagine a linear world, different from ours, in which we believe we live in a space of three dimensions. Let us think of some beings who live in a one-dimensional space. They live on an indefinite line, which they imagine to be “straight”, a great “Euclidean” straight line (that is what they call it) extending to infinity.

In that straight one-dimensional “space” there are singularities which they call “mass”. We shall represent these masses by a black dot, and their magnitude by a number in brackets.



One fine day the scientists of that world begin to speculate about the “geometry” of their “space”. Owing to certain experimental results, some of them begin to find insufficient the intuitive conception that “straight” space extends indefinitely forwards and backwards.

At last one of their most brilliant scientists proposes something unimaginable. “Perhaps our world is curved.” “Perhaps we live in a one-dimensional space that curves within a more general two-dimensional space (which I shall call a ‘plane’).” “Something like this:”



“What happens to us,” the scientist adds, “is that, because the radius of curvature of our universe is so large, the ‘local’ geometry of our world seems to us to be Euclidean, to be straight.”

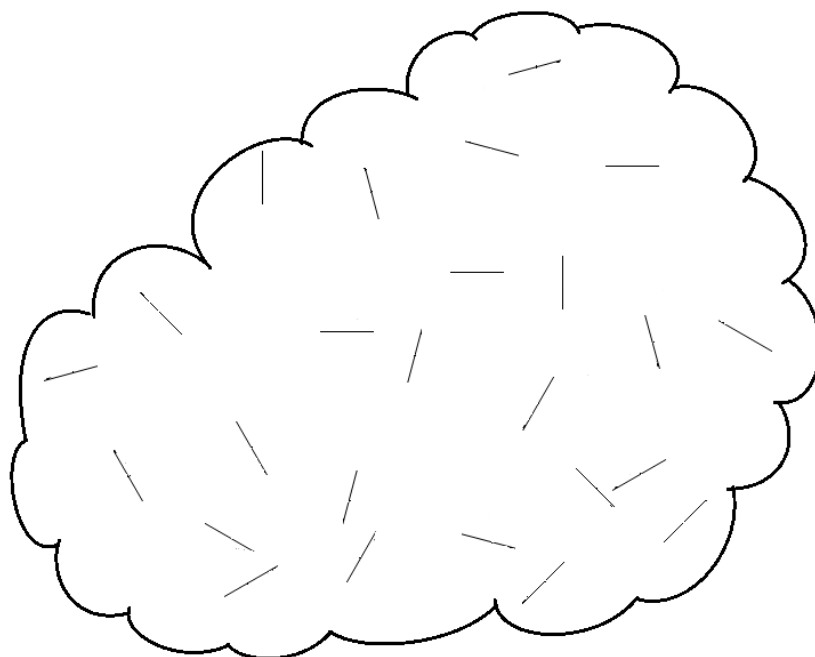
These beings, thanks to their space-probing instruments, had managed to see very far and had discovered that there were other inhabited “segments”. They had, for example, found the “HU Segment”, which lay 14.4 units of distance from their “T Segment”. And such was the history and scientific progress of these one-dimensional beings, until the inhabitants of the “HU Segment” arrived.

The intelligent beings of the one-dimensional world believed they lived in a straight one-dimensional space extending to infinity. Later they found out that their one-dimensional space was curved within a two-dimensional space. But that was not all.

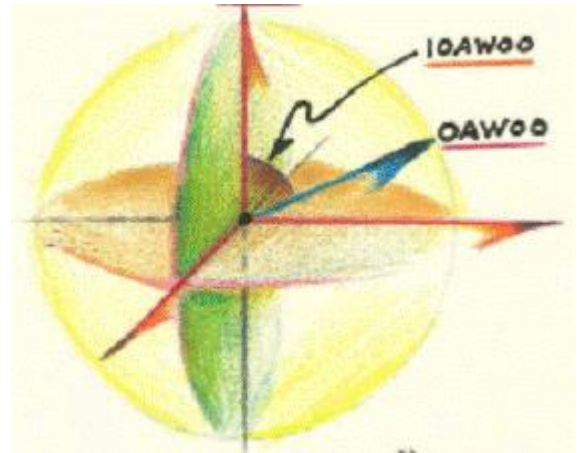
The **Great Revelation** that the inhabitants of the “HU Segment” bring to the inhabitants of the “T Segment” is not that their universe was curved—they already knew that. What the inhabitants of “S HU” bring them is that **their world, the world of their experience, made of space, DOES NOT EXIST.**

What exists (with another meaning of “to exist”, when it refers to what they call ‘Reality’)—what exists, I say, are only **some pre-geometric entities, the Precursor Elements (IBOZOO UU / EP), which are oriented along an axis in a two-dimensional “space”.**

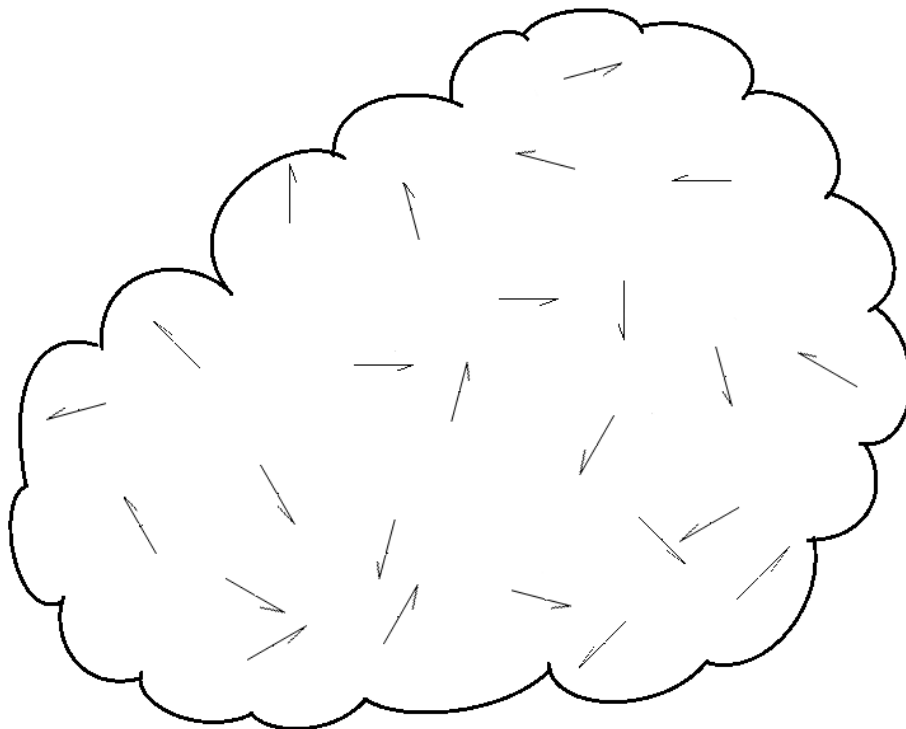
These entities or Precursor Elements (EP) are not located in space. They are prior to space and time (forgive me for using a two-dimensional “space” only to deny afterwards that the EP exist in space. We shall return to this again and again).



[As we advance through letter D59-2](#) we see that the Oomen point out that these “orientations”, OAWOO, which characterize the IBOZOO UU, have a “sense” as well as a “direction” (we use terms belonging to our spatial perception, but always bearing in mind that these “orientations” are the only thing that characterizes these Precursor Elements, EP, of Reality)



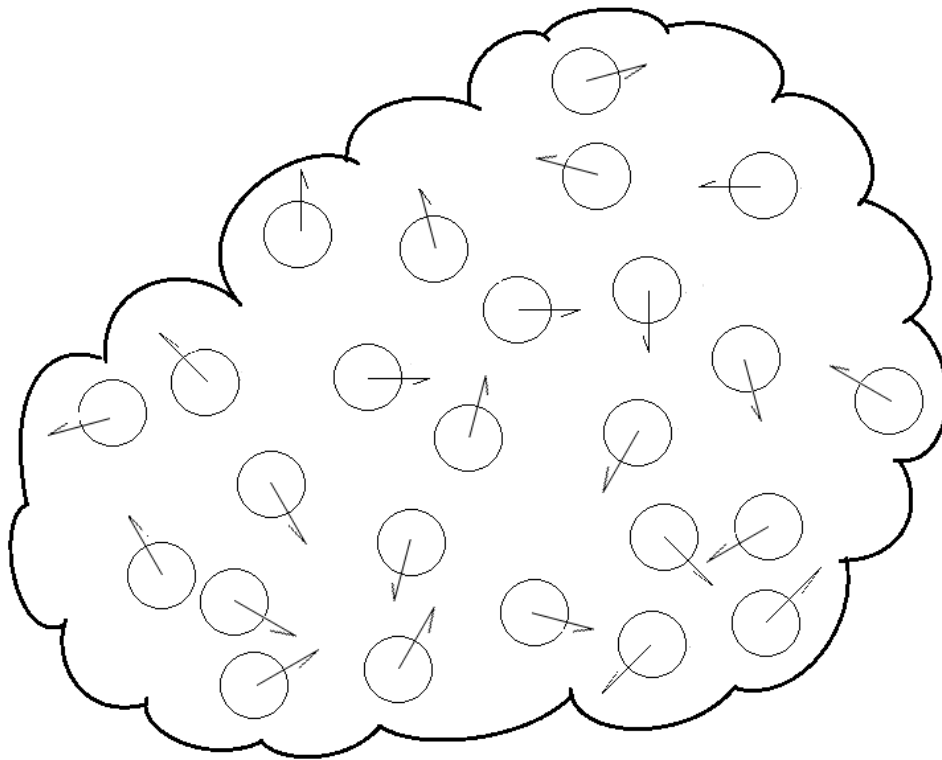
How do we indicate this characteristic that we call sense? Using graphic resources typical of our culture, the matter is easy: we add an “arrowhead”, thus indicating the sense in which that OAWOO, that particular “orientation”, points. Something like this:



The travellers from the HU Segment showed them the previous didactic image and then, to make it clear, went on to say: “Let us draw these oriented axes inside a circle, to stress that all of them are coplanar, that they rotate in a two-dimensional plane and are not projections of three-dimensional vectors onto the plane of the paper.”

(Here again we are saying that these oriented segments lie in a plane, in a “2D space”. When we speak of “space” here, I suggest to those versed in mathematics that they think of a Hilbert space. What is a space of functions? [Where](#) are the functions? And

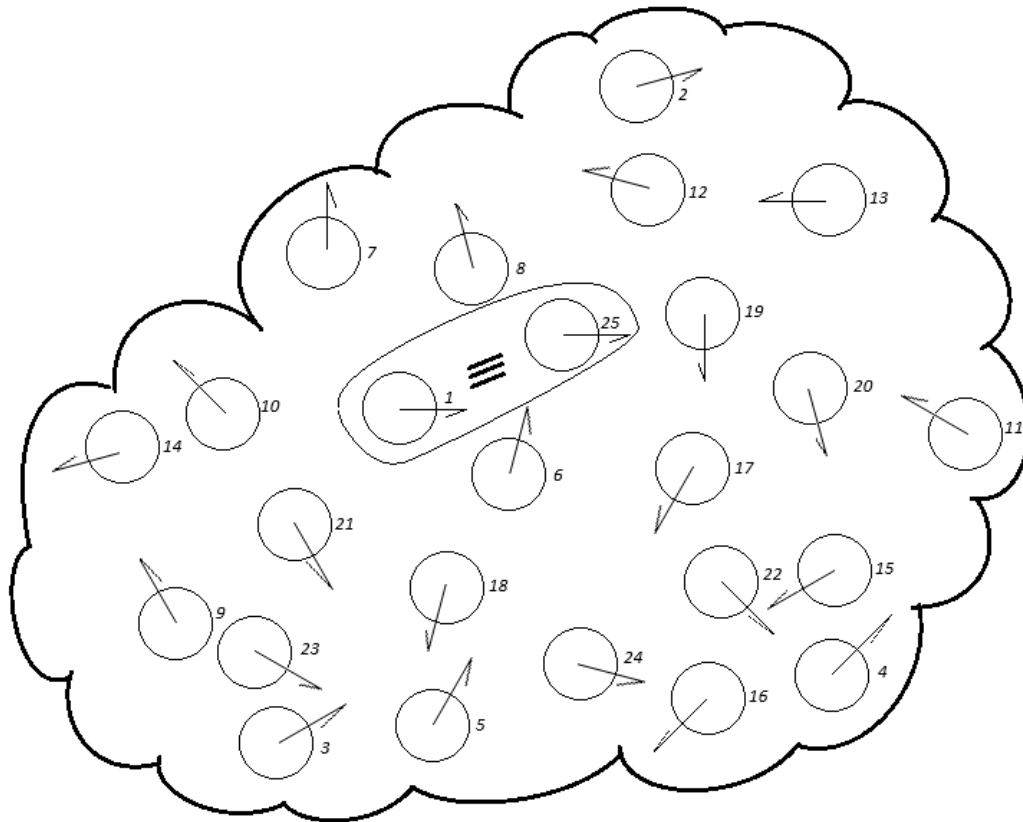
yet we can define orthogonality between them, an angle between functions... We shall come back to this.)



And they added: “The ‘Euclidean straight line’ space in which you believe you live DOES NOT EXIST. This does not mean that the one-dimensional space of your experience is not a straight line but an immense circumference—you already know that. No, what we are saying is that physical space DOES NOT EXIST; it is an illusion of your mind, forged from an (almost) infinite number of oriented elements (they have sense as well as direction) which we call IBOZOO UU” or Precursor Elements (EP). And then they went on: “These ‘axes’ are not straight lines in space, since ‘physical space’ does not exist beforehand. Although we represent them didactically as vectors, they are only ‘orientations’ of some with respect to others. Nothing more.”

Since these explanations did not clear the matter up, the HU told them the following: “Let us place side by side this Cloud of Precursor Elements (NEP) and the curved linear universe in which you believe you live. We shall see that the information contained in the NEP completely and unambiguously defines the information of your space. We mean that an ‘Interpretative Algorithm’, that is, a set of rules, could faithfully reproduce your Universe from the information encoded in the angular differences between the elements of that NEP.”

“First let us number some of these EP, to highlight the fact that we can order them by increasing angle starting from one that we take as reference and call ‘1’ (we do this only in our mind, since they are nowhere and therefore cannot be ordered)”:



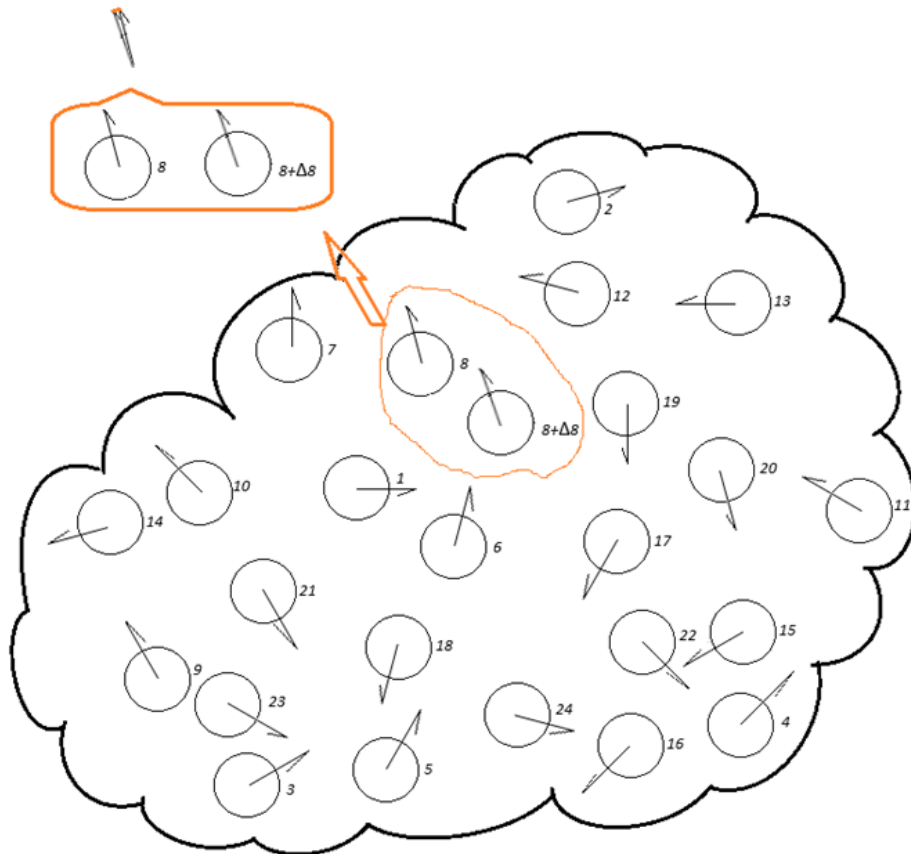
We see that, after a complete turn, at IU / EP ‘25’ we return to the starting point ‘1’. Now, and this is important, these two EP are one and the same EP. I shall therefore eliminate EP 25.

“How do these EP account for the reality of our Universe?” the 1D-beings of T kept asking. The gentlemen from HU went on: “We have said that there is an (almost) infinite number of Precursor Elements, EP (or IU), and that the only thing that distinguishes them is their orientation; that is, their respective orientations form different angles with one another. We can search, and we shall find that for each element there is always another whose angle of separation between their orientations is (almost) infinitely close, for let us not forget that the EP constitute a [countably infinite set of elements](#) ([REFERENCE](#)). However, being countable is not enough by itself for that ‘nearest neighbour’ to exist: the rational numbers are countable too, and yet between any two of them there is always room for another. What the Oomen suggest to us is something stronger: that between the orientations of the EP there is a minimum angular increment, a quantum of angle, $\Delta\alpha$, below which no difference is possible. It is the existence of this quantum, and not countability, that makes the step

from one EP to another never continuous but discrete, though extraordinarily small. Well then, a pair formed by two EP whose orientations differ by exactly that minimum quantum we shall call a pair of 'connected' elements. Let us now draw a few connected elements and, in addition, place side by side our Precursor Cloud, NEP, and our physical linear world.

Let us proceed step by step.

First let us pick an EP / IU at random and its 'connected' partner (the one angularly closest to it). Let us choose, for example, EP 8 and EP $8+\Delta\alpha$. Let us extract both from the NEP cloud (all this is a thought experiment) and make their origins coincide. We see that together they determine an 'angular quantum', yes, but this is an 'oriented angular quantum'. Let us reflect on this.

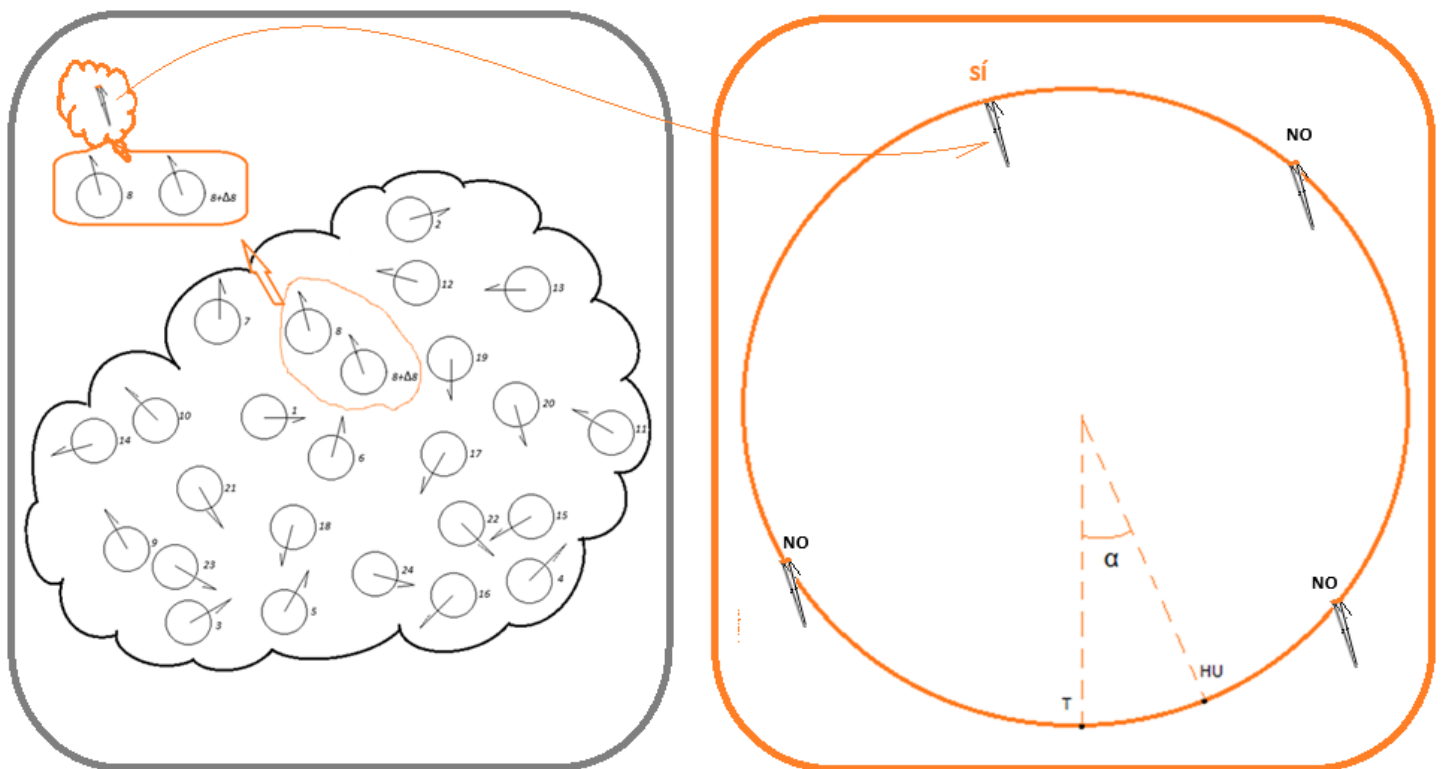


Does this angular quantum have any singularity? The Oomen have insisted to us several times that the IU taken individually ([REFERENCE](#)) mean nothing. The information carried by the cloud of IU, the NEP, does not lie in each EP but in the angular differences between their OAWOO (which, for want of a better term, I shall go on calling 'axes' or 'vectors' despite their spatial connotations).

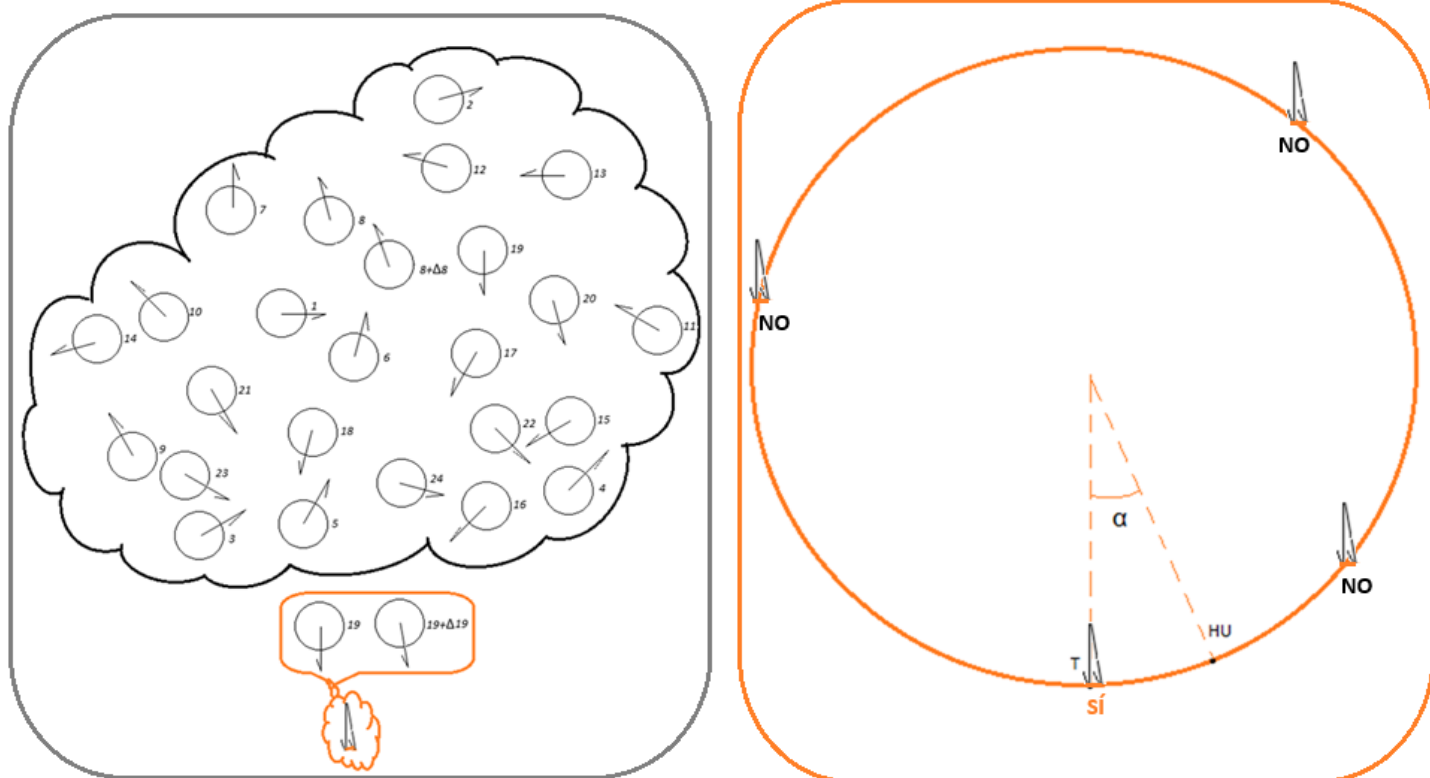
In order to understand the IU / EP we are carrying out an experiment of gradual approach, and it has its limitations; but if we set aside the obvious objections to this

reduction, let us try to answer the previous question. Does this angular quantum have any singularity? The first thing we see is that this angular difference, this mini-arc, this 'angular quantum', is oriented. What do we mean by saying that it is oriented? Let us take the image above again and place it beside the 'real one-dimensional World' of our little friends, the 1D-beings.

Now let us carry out the mental exercise of trying to put that small oriented angular arc into correspondence with some part of our little friends' Universe. We see, to our surprise, that this arc CAN indeed be put into correspondence with a micro-segment of the one-dimensional 'Real Universe'. What is more, it can be put into correspondence with that micro-segment and ONLY with it. It is a one-to-one relationship.



We begin to glimpse an affinity between the two. The little beings then ask themselves: will there be a set of EP / IU that represents our segment-world? Will there be a set of EP that is uniquely associated with the segment of the HU?



Of course there will! We can see it in the figure above. And not only for the little ‘T-Segment’ world, but also for the HU micro-segment. For all the elementary segments that make up the spatial reality of that one-dimensional universe there is a connected pair of EP / IU within the NEP cloud that can be put into one-to-one correspondence with them. It is as if the set of all the connected pairs of EP, that infinity of oriented arcs, were like tiles forming an immense jigsaw puzzle which, when fitted together continuously, gave rise to that immense circumference, the linear universe in which the 1D beings believed they lived.

Our friends from OOMO included [in letter D59-2](#): “It is curious, for example, to note that the Physicists of the Earth in their blindness do not attribute dimensional character to the angle”.

I believe that the most important notion we should draw from this whole document is that the angle between the orientations of two IBOZOO UU, the IOAWOO, is not a dimensionless scalar but an **oriented angular dimension** which, according to its orientation within an n-dimensional weave, expresses the physical magnitudes we know: space, time, mass...

Two “angular segments”, IOAWOO, defined by two pairs of “orientations” of two different pairs of EP, are not equal merely because they subtend the same angle α . **The angular segments**, IOAWOO, in this theory of the IBOZOO UU, **could be called “oriented angles”**.

Even so, the little beings of the 1D world still had doubts: “Fine, all that is very well, but we also have a characteristic that we call mass. How does this NEP, this ‘Precursor

Cloud', account for these additional characteristics of our reality that are not purely spatial?" The beings from planet HU (sorry! I meant 'spatial segment HU') answered with great patience: "Bear in mind that we are proceeding slowly and presenting a reduced view of the IU / EP. In reality, these Precursor Elements (which are nowhere, since the information we call space is generated by them from their angular differences) have other 'orientations', all of them orthogonal to one another, whose angular differences between two IU account for the phenomenology that, in your view of Reality, you call mass." But we shall come to that later.

With all this, the HU ended up posing the following logical dilemma: "Imagine these two cases.

- 1) Reality, space and mass, is as you imagine it. You are made of atoms assembled into large macromolecules that form cells, and you know that your information-receiving organs, once they have received it from the 'outside', transform it into a series of electrochemical impulses that travel along the nerve pathways to your brain, and there a mysterious neurological process transforms those impulses into a 'Something' that your consciousness 'visualizes' and imagines to correspond faithfully to the external 'REALITY'.
- 2) A subset of EP of the EP cloud, connectedly ordered according to a design equivalent to what you call atoms, with their characteristics of position, charge, mass, etc., defines what you call the brain and receptor organs; these, just as before, capture information about the arrangement of the various connected, "external" EP, both in their 'space' characteristics and in their 'mass' characteristics (and other things, if there were any), and accumulate it according to an interpretative algorithm, a set of composition rules, which in the end offers consciousness a picture, a 'Something', which it visualizes as the 'REALITY' of the previous case, since we have seen that the information contained in that NEP completely defines the spatial structure of the (imagined) 'REALITY' and of its singularities of mass, etc.

And rhetorically they added: "Think of The Matrix. Those brains receive information from a computer in the form of nerve impulses, and the consciousness of the individual who owns that brain cannot distinguish this information from Reality. If the information, instead of coming from a computer, came from a self-contained system that informationally 'defined', down to the last detail, everything that makes up the brain—the atoms in their determined spatial positions, the molecules, the proteins, the receptor organs—as well as external Reality, EVERYTHING, then the information reaching the consciousness associated with each brain would be identical to that which reaches those brains from Reality or from a computer. Just as in The Matrix, consciousness could not tell whether external reality comes from a self-contained

system formed by (almost) infinitely many EP, or from that Reality which its brain imagines.”

Now the question: which of these two ‘REALITIES’ is the ‘True’ one?”

Letter D76: “We can reveal to you that the first “shock” suffered by the former mechanistic conceptions of the Cosmos was caused when our cosmophysicists came to ascertain the genuine nature of physical space.” (*emphasis mine*)

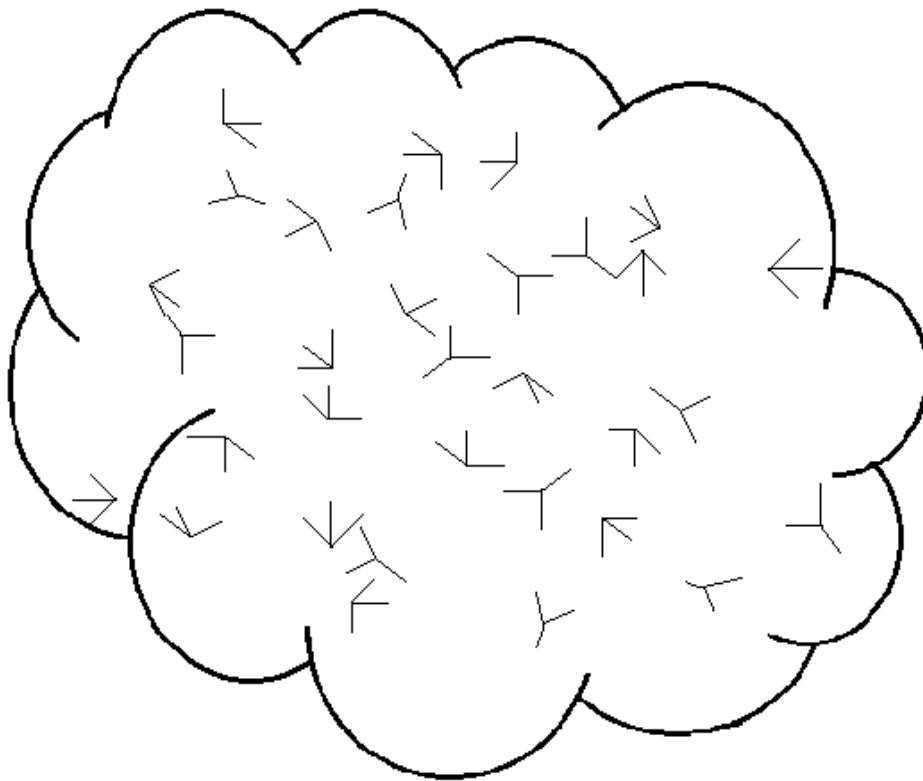
1.2. 1D / 2D / 3D

ONE-DIMENSIONAL UNIVERSE in an oriented 2D space within a 3D space

Let us go on, step by step, increasing the number of OAWOO, 'axes', of these IU / EP.

We have seen that a set of oriented EP, all rotating in the same plane (except those responsible for accounting for the magnitude mass), 'describe' the whole sequence of segments that make up a one-dimensional Universe, conceived as an immense circumference within a two-dimensional space (a plane) inaccessible to the one-dimensional beings who people that Universe. We may ask ourselves: are there more one-dimensional universes?

Let us now introduce Precursor Elements (IU) with three orthogonal axes oriented in a 3D space (the obvious objection to calling the environment inhabited by the EP, which are defined as prior to space, a "3D space" will be dealt with at length later). The NEP cloud will now look something like this.



We can look for a way of representing mathematically this (almost) infinite set of 'IBOZOO UU-3' (IU-3 or EP-3).

A Precursor Element with three orthogonal orientations is represented, with respect to an EP arbitrarily taken as reference, by a matrix of direction cosines. If we call $\mathbf{u}, \mathbf{v}, \mathbf{w}$ the three orientations of the represented EP, and $\mathbf{e}_1, \mathbf{e}_2, \mathbf{e}_3$ the three orientations of the reference EP, the matrix is:

$$EP = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \quad \text{where } a_{ij} = \cos \angle(\mathbf{u}_i, \mathbf{e}_j)$$

$$EP_{ref} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

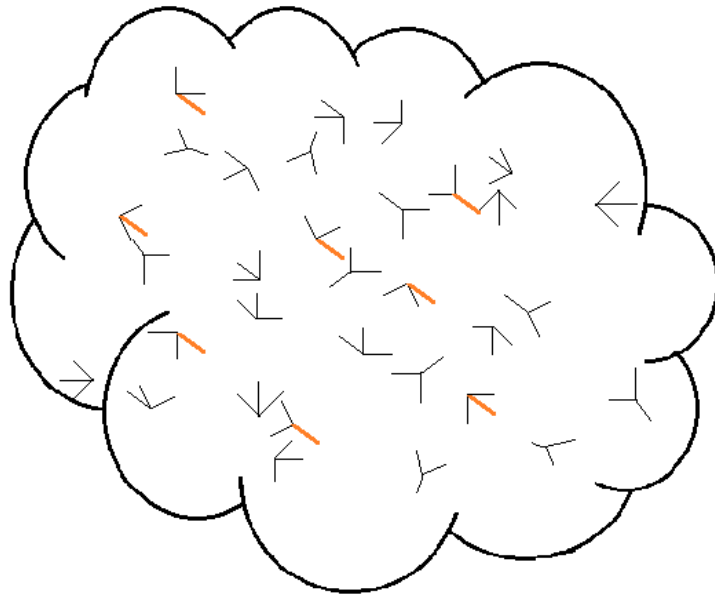
This matrix must satisfy two conditions: the sum of the squares of the elements of each row must equal 1 (normalization), and the scalar product of any two different rows must equal 0 (orthogonality).

$$\sum_{j=1}^3 a_{ij}^2 = 1 \quad (i = 1, 2, 3)$$

$$\sum_{j=1}^3 a_{ij} a_{kj} = 0 \quad (i \neq k)$$

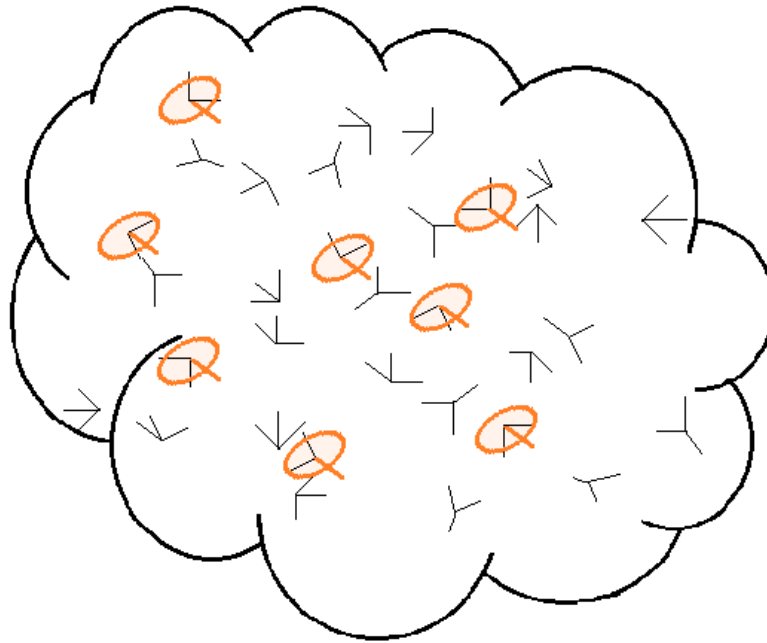
The reference EP, represented with respect to itself, is simply the identity matrix. What matters in this representation is not its formal appearance but what it expresses: an EP has no absolute properties; it exists only in relation to another EP. The matrix does not describe "what an EP is", but "how it differs" from another.

Let us now imagine that from among all of them we select all those that have one of their axes parallel to some given direction, for example that of one of them chosen at random.

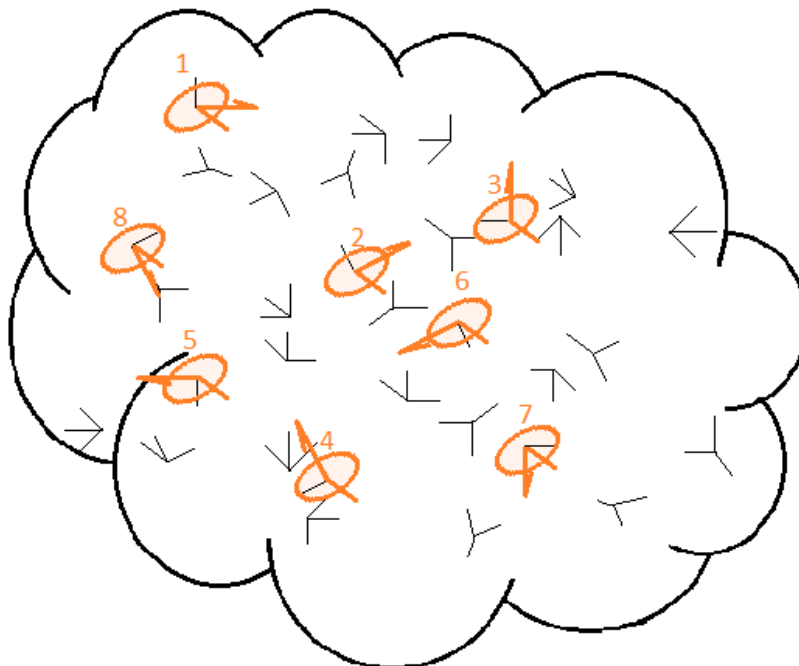


I imagine them as little umbrellas.

I imagine that two of their “axes” “define” the plane of the umbrella’s canopy, and the third axis would be the ‘shaft’. Well then, we have chosen all the little umbrellas whose shaft is parallel to that of any one of them.



Let us number them:



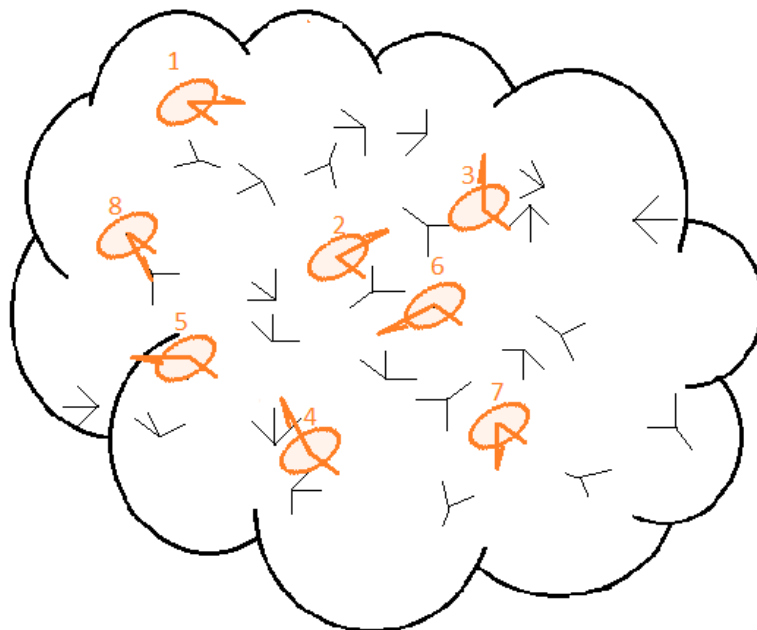
Within the canopy of the umbrella we see that the two axes that “define” it are not oriented in the same way in each EP considered. They are rotated by a certain angle relative to one another. For convenience we can look at only one of the axes (the other axis is always at 90° to its left), which represents unambiguously the orientation of each EP / IU in the orange plane. We have numbered them so as to be able to identify them later. We shall see that all this makes sense, but first let us continue, in parallel, with our algebraic notation for an EP.

When we select the subset of EP that have one of their orientations (the "umbrella shaft") parallel to that of the reference EP, the matrix takes on a particular form. The third row is (0, 0, 1), indicating that this orientation coincides exactly with that of the reference EP. The first two rows express the free rotation of the other two orientations in the plane of the "umbrella canopy", parametrized by a single angle α :

$$EP_{orange} = \begin{pmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

The angle α is the only degree of freedom that distinguishes one orange EP from another taken as reference. The matrix is not a description of an object in space: it is the encoding of a difference between two pre-spatial entities.

Let us return to our “cloud” of oriented trihedra which “symbolize” the attributes of the IU, but let us not forget that in them there are no axes, there is no “point of origin” and they are not anywhere, and that their only characteristic is the ability to “look” in three orthogonal directions (possibly more than ten in the “genuine” ones). As we have seen, the two “axes” lying on the “umbrella canopy” are rigidly linked, and we have decided to ‘reduce’ those two axes to one of them (we can always recover the other at 90°)

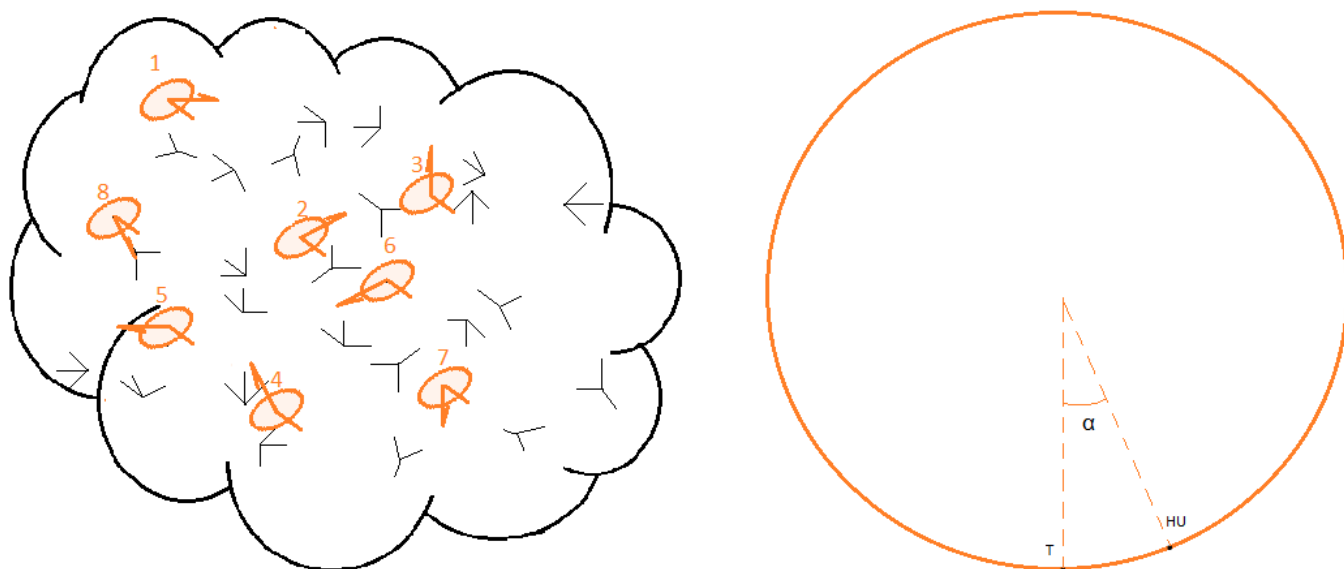


We call this set of EP the ‘Precursor Cloud’ (NEP), and we see that it is formed solely by these IU/EP which are nowhere, since there is “still” no (physical) space or time, no mass, nothing—only them.

For mathematicians, we resort once again to the reminder of [Hilbert space](#), which does not evoke a physical kind of space when we speak of orthogonal elements (functions, for example), or of the angle-distance between them.

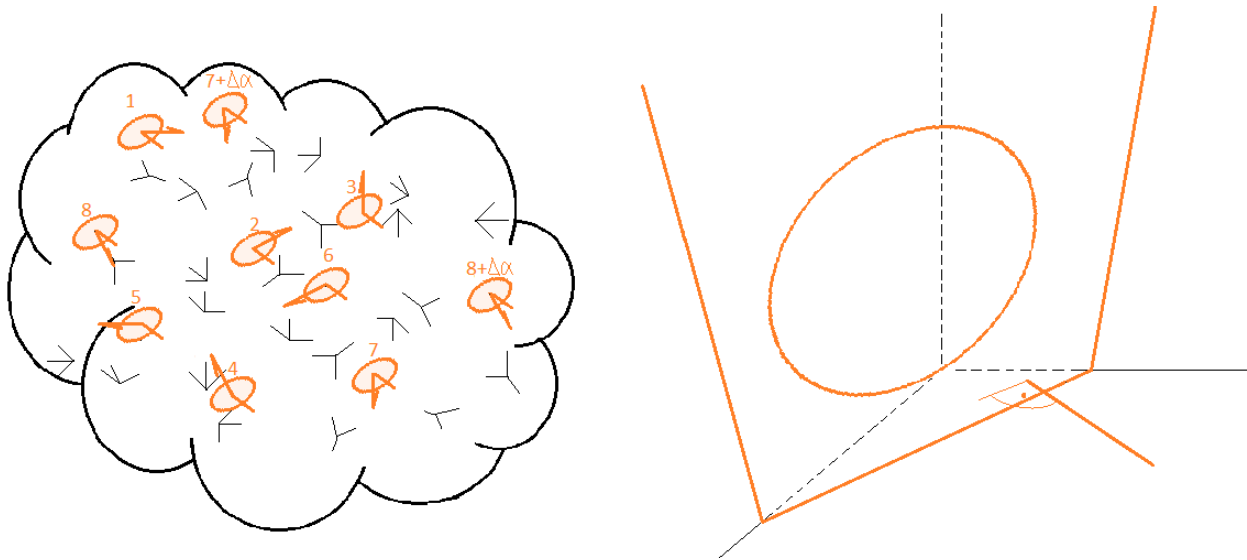
Repeating now the process carried out earlier for the 1D / 2D case, let us imagine two different situations. The first situation is that of this cloud of IU, which we call the NEP. The second is that of an (orange) plane in which there is a one-dimensional space (also orange) that curves within that two-dimensional space (the plane), and in which there is an “HU Segment” and a “T Segment”.

Let us place the two ‘universes’ side by side.



Let us be a little more didactic and draw the curved one-dimensional Universe within its plane, but drawing that “plane” (which contains the circumference) in a three-dimensional space.

Let us also draw a few more IU in the cloud “universe” (remember that there is an infinite—countable—number of them).



Since we have chosen the subset of IU that have one of their axes parallel to a given one, the other “axis” (which symbolizes the two that ‘rotate’ in the plane of the umbrella canopy) will be oriented in countless ways. In fact, to find out how many IU describe the ‘space’ of this WAAM, we would have to divide 2π (a complete circumference) by the minimum angular increment separating two maximally close OAWOO (axes), which we shall call ‘connected’ (the “quantum” of angle).

How many IU are there, then? What is that minimum increment? The Oomen have given us two figures which, read carelessly, seem to contradict each other. They are worth pausing over.

Let us begin with the older one. In letter D59-4 the Oomen state that not only energy is quantized but distance too: it is not possible to discriminate a length smaller than 12^{-13} centimetres, and they specify that this quantity is the angular relationship between two connected IBOZOO UU. Written in our decimal base, that figure is equivalent to about $9.3 \cdot 10^{-15}$ cm. It is therefore the quantum of IOAWOO that weaves space within our WAAM: the micro-segment of our connected EP.

Almost half a century later (2014), in one of their messages on the internet (O6-65), they give a very different figure: a minimum angular increment of about $6 \cdot 10^{-11}$ radians, “vérifié expérimentalement” (“experimentally verified”). For years I suspected it was one of those small errata the Oomen admit to scattering through their texts. For if we apply it to our geodesics, the result is absurd. If each quantum of angle corresponded to the quantum of distance of D59-4, the radius of curvature of the universe would be $R \approx 9.3 \cdot 10^{-15} \text{ cm} / 6 \cdot 10^{-11} \approx 1.6$ microns. A universe the size of a bacterium.

But let us read carefully. [The text of O6-65](#) does not speak of the relationships between connected EP within a universe, but of the orientation of each dimension with respect to the time axis T , and of how many WAAM are possible.

And the arithmetic confirms this reading. A complete turn holds $2\pi / 6 \cdot 10^{-11} \approx 10^{11}$ distinct orientations. A bundle of ten orthogonal orientations is fixed by 45 independent angles, as many as there are planes of rotation in ten dimensions ($10 \cdot 9/2 = 45$). And $(10^{11})^{45} = 10^{495}$, which is precisely the maximum number of WAAM they indicate. (The coincidence is exact if the increment is $2\pi \cdot 10^{-11} \approx 6.3 \cdot 10^{-11}$ rad, perfectly compatible with their “about $6 \cdot 10^{-11}$ ”.) There is no erratum: there are two different quanta. One separates one universe from another; the other weaves space within each universe.

What, then, is the value of the angular quantum that weaves our WAAM, the one of D59-4? If we take for the radius of curvature of our WAAM a value of the order of the observable universe, about 10^{28} cm, we obtain $\Delta\alpha \approx \ell / R \approx 9 \cdot 10^{-43}$, that is, of the order of 10^{-42} radians, $\ell \approx 9.3 \cdot 10^{-15}$ cm being the quantum of distance of D59-4. And a stretch of geodesic of length $2\pi R$ (what in a closed universe would be a complete turn) would contain $2\pi R / \ell \approx 7 \cdot 10^{42}$, of the order of 10^{43} connected EP. If the radius is larger, the quantum is even smaller and the number of EP even larger.

A finite number, but an unimaginable one. It is what the physicists of OOMO, according to letter D731, call AIGIOXAA: an “infinity” in the physical sense, distinct from AIGEOXUOO, mathematical infinity. That is the precise meaning of our “(almost) infinite”.

Note of caution:

The reader with a background in physics will raise an objection that we must not hide. A length of $9.3 \cdot 10^{-15}$ cm corresponds to the resolution reached with energies of about 2 GeV. In 1967 that was precisely the frontier of experimental physics. Today the great accelerators probe distances about a thousand times smaller without having detected any granularity of space. If the quantization of D59-4 is real, it cannot be a “pixelation” that shows up in particle collisions. It would have to be understood in some other way, and that is a question we leave open.

Let us continue. That is, for each of these IU that we have numbered there will be another IU which, having its “umbrella shaft” axis parallel, will have its other OAWOO (axis), the one that “rotates” in the “umbrella canopy plane”, separated by a minimum angular increment. This other one will be a “connected” IU (as our friends put it). Let us draw two of them, for example: the connected partner of “IU 7” and that of “IU 8”, which I have called “IU 7+ $\Delta\alpha$ ” and “IU 8+ $\Delta\alpha$ ”.

On the other hand, we shall now draw the “real one-dimensional universe” within its (orange) plane, but pointing out that the 2D space in which it lies (the orange plane) is just one more two-dimensional space among the (almost) infinite two-dimensional spaces that populate a three-dimensional space.

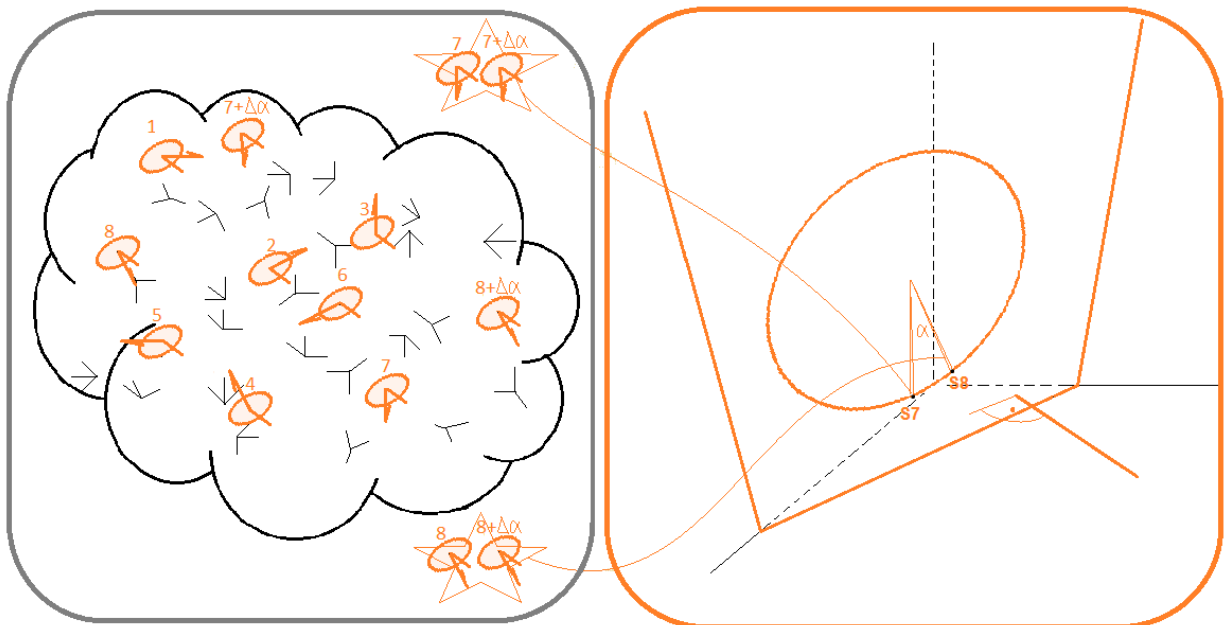
Two connected EP of the orange subset are represented thus:

$EP(\alpha)$ and $EP(\alpha + \Delta\alpha)$, where $\Delta\alpha$ is the minimum angular increment—the angular "quantum" of the WAAM:

$$EP(\alpha) = \begin{pmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad EP(\alpha + \Delta\alpha) = \begin{pmatrix} \cos(\alpha + \Delta\alpha) & \sin(\alpha + \Delta\alpha) & 0 \\ -\sin(\alpha + \Delta\alpha) & \cos(\alpha + \Delta\alpha) & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

The difference between the two matrices lies solely in the angle α in the four elements of the first two rows and columns. Everything else is identical: same orientation of the "shaft", same structure. It is precisely this minimal difference—and only it—that carries the information of the micro-segment of the one-dimensional universe corresponding to this pair. An isolated EP says nothing. The connected pair says everything: it unambiguously indicates a quantum of space, with its position and, as we shall see, with the other physical properties encoded in the additional orientations.

Finally, I would like to point out that, regardless of the "reality" these orientations may have—that of the "umbrella" plane of the axes of the IU and/or that of the two-dimensional space I have drawn—I have drawn them "parallel" (from an idealized, purely geometric point of view, knowing that, when we handle the EP mentally, we inevitably resort to didactic devices that presuppose the existence of space, so dear to the phantom that our mind generates and that we call 'Reality').



These two "Universes" seem to have nothing to do with each other. In one of them there are only IBOZOO UU (three-dimensional pseudo-IU) which are NOT anywhere and do not live in time, because they are "precursors" of (physical) space and of time. In the other there is a linear, one-dimensional universe, curved back on itself within a

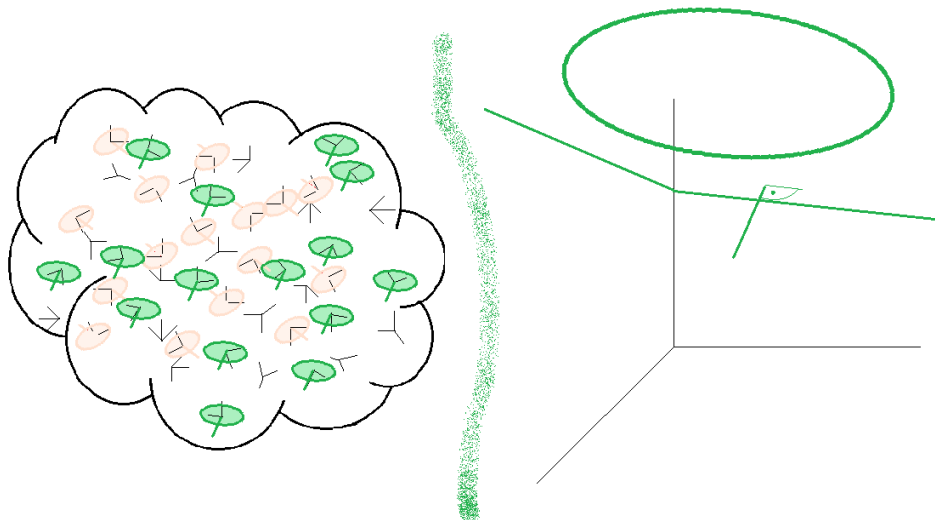
two-dimensional space oriented in a particular way in a more general space of three dimensions.

But do they really have nothing to do with each other? Let us recall what we have already seen.

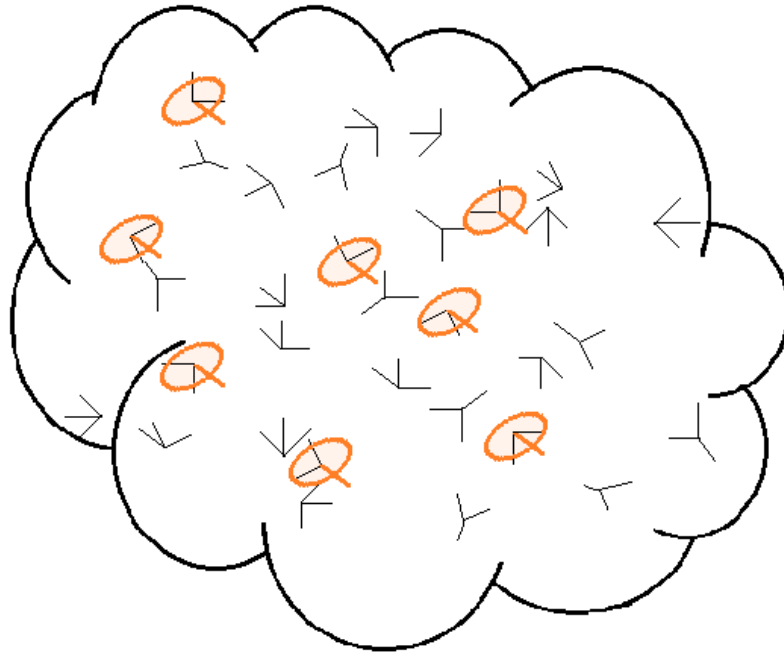
Let us look at the “quantum” of angle generated by “IU 7” and “IU $7+\Delta\alpha$ ”, and let us look at the micro-“Segment 7” (earlier I called it “Segment T”) of the “real one-dimensional universe”. Let us also look at the “quantum” of angle between “IU 8” and “IU $8+\Delta\alpha$ ”, as well as at the (micro) “Segment 8” of the “real world”.

It is clear that we have repeated the same process as in the previous case, but there are two important differences:

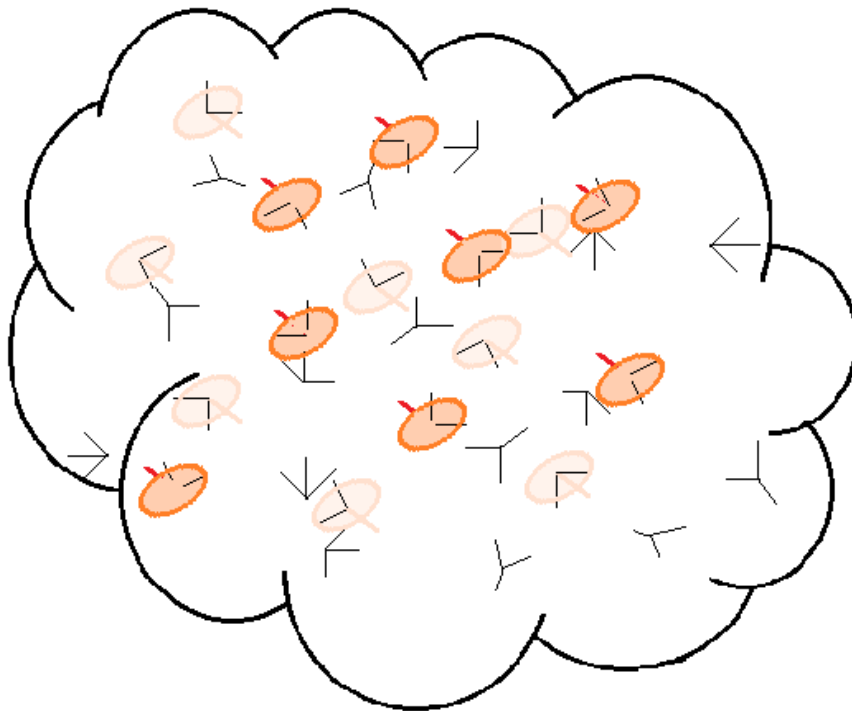
1. We have introduced a mathematical, matrix notation to express the EP (the orientations of the ‘axes’ of the EP), taking any one of them as reference.
2. We see that in this Precursor Cloud, NEP, the EP / IU of this cloud, besides containing all the information needed for an ‘interpretative algorithm’ (a set of rules) to build before a ‘consciousness’ an image equivalent to the one our brain manufactures from a series of electrochemical impulses—besides this, I repeat—this interpretation of the reality underlying idealized ‘Reality’ allows us to understand how (almost) infinitely many universes can coexist without being linked by relationships of distance, since obviously in another orientation of the plane of the umbrella canopy, the green one for example, we could make another circumference / 1D space emerge in a consciousness, one that would have no relationship of distance with that of the orange plane. However far our little 1D friend travelled through his orange universe, he could never find this “green 1D Universe”. When we come to make our 3D universe emerge from an oriented subset of EP, we shall see that it makes no sense to ask: where are those infinitely many universes the beings of OOMO speak of?



Before leaving three-dimensional IU behind, I would like us to look at something I have deliberately kept hidden. Let us go back to the drawing of the cloud of IU, and back to the moment when we chose the subset of IU whose umbrella “shaft” was parallel to that of any one of them, which we indicated with the colour orange.



We had said that we had taken all the IU that had one of their OAWOO parallel to the orange direction, but have we selected all of them? Let us see.



NO. In fact we had cheated a little and had taken only half of them. Of all the IU with one of their axes (the “umbrella” shaft) parallel to the orange direction, we had selected only those whose umbrella “shaft” pointed to the right (according to the idealized drawing we are using), but we can see that we had forgotten the “other half” of this orange WAAM, which, as we shall see, “builds” the same orange plane and the same orange circumference, but from the “other side”: that is, the twin pair, which we shall call UWAAM.

We had selected the EP with the "shaft" pointing in one direction. But among all the EP whose shaft is parallel to the orange direction there is also the other half: those whose shaft points in the opposite sense. Their matrix differs only in the sign of element (3,3):

$$EP_{UWAAM} = \begin{pmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & -1 \end{pmatrix}$$

This change of sign is not trivial. A matrix with a negative (3,3) element represents not a rotation but a reflection: its determinant is -1 instead of $+1$. What this means physically is that the carrier subspace has an inverted orientation with respect to the orange WAAM. The circumference this subset "generates" has exactly the same metric, the same quanta of distance, the same structure. But its chirality() is opposite: it is the mirror universe. The Oomen call it UWAAM. It is not a different universe located "somewhere else", because the EP are not anywhere. It is the same angular information read from the opposite orientation of the subspace that carries it.*

[() Note on chirality: chirality (from the Greek "cheir", hand) is the property of an object of not being superimposable on its mirror image. The most intuitive example is our hands: the right hand and the left hand have the same shape and the same measurements, but they cannot be made to coincide by rotation, only by reflection. A right-hand glove does not fit the left hand. In mathematics, a matrix with determinant $+1$ represents a rotation (which preserves chirality) and one with determinant -1 represents a reflection (which reverses it). The UWAAM is not the "rotated" WAAM: it is the "reflected" WAAM.]*

1.3. “Space of EP orientations” versus “physical space”.

It has been pointed out to me, rightly, that when we say that the various EP orient their OAWOO in a space of 3 or n dimensions, we are already prefiguring the existence of a space, and that it is therefore a sleight of hand to say that the EP are prior to space and that space arises from them.

The word “space”, like so many others in our language, is treacherous because of its many meanings. Let us remember that our primary, sensory notion of space includes as basic elements extension and its derivatives, position and distance. None of this applies to a [phase space](#), to a [Hilbert space](#) or to so many other freer uses of the word “space” (stage space, mental space, logical space...) in our languages, and yet we use the word “space”. Let us do the same here and rid ourselves of the prior notion of physical space.

When the Oomen (and we, following in their footsteps) explain the notion of OAWOO as that of the various orthogonal orientations of an IU (EP) in an n -dimensional space, we must understand that they are using a didactic device. It is obvious that when we speak of “orientations” our mind inevitably imagines oriented straight lines (vectors) in the physical space of our mind, a space so REAL to us that we even come to think that if all the matter in the Universe disappeared, space would go on existing. It is we who are introducing physical space as an element prior to the IU. Nevertheless, we must train ourselves to erase that image from our mind. The EP are made up only of orientations. The “space” in which they are “oriented” is not physical space. There is no extension in it, and therefore we cannot point to positions or distances within it. The truth is that there is no space in which the EP are oriented; only the EP exist, and the notion of spatiality arises from them.

Since I do not know how to handle this permanent source of possible confusion, I have decided from now on to use the word space as little as possible to locate the EP and to use other means of designation. The result will not always be satisfactory, but let us bear in mind that, unless we invent one, we shall never find a word in our languages that expresses the notion of an “environment of orientations” prior to the notion of physical space that our mind inevitably associates with the word “orientations”.

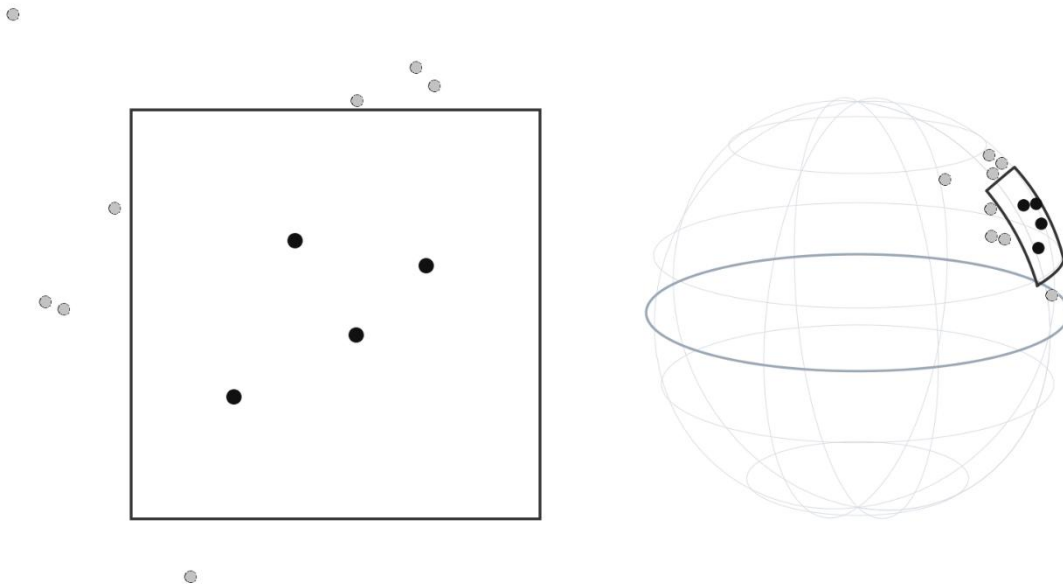
1.4. 2D / 3D / nD

TWO-DIMENSIONAL UNIVERSE IN A GIVEN 3D ORIENTATION IN AN nD SPACE

Continuing with our didactic approach, let us now imagine some two-dimensional, 2D, beings who believe they live in a flat Euclidean universe. Like our little 1D friends, at some point in their scientific development they come to imagine that perhaps their universe looks locally flat, Euclidean, because of the immense radius of curvature of their 2D universe, which is actually curved over a third dimension.

Let us imagine—the simplest case to treat graphically—that their 2D universe is the surface of an immense sphere, and that the universe they know extends over only a few minutes of arc.

Our 2D friends imagine that the flat space they inhabit extends indefinitely, even beyond their visually accessible universe.



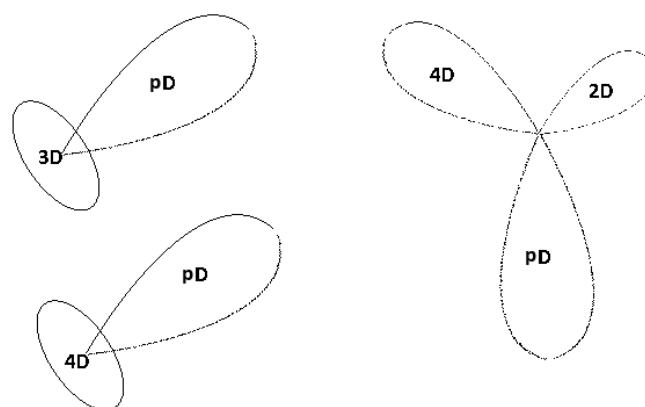
The known plane-galaxies are only part of the universe, which contains (grey) plane-galaxies beyond their capacity for observation. But their wise astrophysicists have already conjectured that their universe may not be “Euclideanly” flat. Perhaps it takes the form of a spherical surface.

Here again some visitors arrive from another plane-stellar system, U-2D, and describe to them their scientific consensus, which states that all that spatial reality they imagine is in fact nothing but the product of their minds, of their brain. Their “mental vision” of What There Is is nothing but a powerful cerebral synthesis of a grandiose train of nerve impulses reaching a node of cerebral articulation, where all those impulses compose that image, full of richness, which they consider reality.

But, the beings of U-2D go on to say, the authentic underlying Reality is nothing but a network of Precursor Elements, EP (or IU, as they call them), made up only of n orthogonal orientations in an “orientation-space”, NEP (*remember [Hilbert space](#)*), which carry in their angular differences of orientation all the information needed for certain networks of EP to appear, capable of structuring themselves as the equivalent of a biological system endowed with sensing organs, transmitting organs and synthesizing organs, capable of making “emerge”, from the angular information of the rest of the EP, a mental image identical to the one the little 2D beings imagined came from an external reality equivalent to their mental image of What There Is.

PAUSE. We are trying to decipher step by step the meaning and behaviour of these IBOZOO UU that our friends from OOMO have presented to us so succinctly. They have told us that these Precursor Elements of Reality, EP, can be interpreted, in the first instance, as a bundle or set of “ n ” orthogonal orientations.

We have drawn trihedra with axes, vectors or oriented directions, to visualize how these elements can make the notion of classical space emerge from nothing but angular differences between them. But now we must take a leap and move from 3D EP to more general EP with n orthogonal orientations. How can one draw a bundle of n orthogonal axes on paper? To give continuity to the narrative I have devised the following graphic device. From now on, instead of straight axes, I shall draw clover leaves and/or umbrella-shaped “bulbs” with a “shaft” in the shape of a “mallet” and the “canopy” as a 3D, 4D, pD orientation subspace, or whatever I need, orthogonal to one another.



Let us not forget that these bulbs represent something we might call “NEP-subspaces”, or simply subNEP. I apologize for the terminology I adopt in an attempt to eliminate the prejudices rooted in our minds. With this heavy repetition, at least, I hope to succeed.

Let us put all this into mathematical notation, which is where these ideas stop being a metaphor and begin to have force.

An EP with n orientations is represented, with respect to another EP taken as reference, by an $n \times n$ matrix whose rows are the direction cosines of each orientation of the EP with respect to the orientations of the reference EP. The reference EP, with respect to itself, is the identity matrix.

Now let us select the subset we are interested in: the EP whose "mallet" of orientations—all but three—remains parallel to that of the reference EP, leaving free only three orientations that "rotate" in the chosen 3D subspace. The matrix of an EP of this subset has a very characteristic block structure:

$$EP = \begin{pmatrix} a_{11} & a_{12} & a_{13} & 0 & 0 & \cdots & 0 \\ a_{21} & a_{22} & a_{23} & 0 & 0 & \cdots & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & \cdots & 0 \\ 0 & 0 & 0 & a_{44} & a_{45} & \cdots & a_{4n} \\ 0 & 0 & 0 & a_{54} & a_{55} & \cdots & a_{5n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & a_{n4} & a_{n5} & \cdots & a_{nn} \end{pmatrix}$$

The upper-left 3×3 block contains all the information of the emerging 2D universe: it is a rotation matrix in the selected 3D subspace, and its elements are the direction cosines of the three free orientations. The lower-right block is a matrix of order $(n - 3)$ and expresses that the "mallet" remains rigidly parallel to that of the reference EP (as we advance, we shall see that this mallet enjoys a great wealth of angular information linked to the differences of orientation within the subset of EP that determine this "mallet" subspace, and that this information accounts for other dimensions which our senses and our brain take to be time, mass, magnetic field, electric field...). The blocks of zeros guarantee that the free orientations and those of the mallet are mutually orthogonal: what happens in the 3D subspace has no projection onto the rest, and vice versa.

This block structure is the exact algebraic translation of the operation we have just described in words: "fix the mallet and let three orientations rotate". All the wealth of "spatial" dimension of the two-dimensional universe we are going to make emerge is therefore contained in that small 3×3 block, subject to the usual conditions:

$$\sum_{j=1}^3 a_{ij}^2 = 1 (i = 1, 2, 3), \sum_{j=1}^3 a_{ij} a_{kj} = 0 (i \neq k)$$

which reduce its nine elements to three degrees of freedom: the three Euler angles (φ, θ, ψ) . Two of them will place the (virtual) point on the sphere; the third will remain in reserve for the time being.

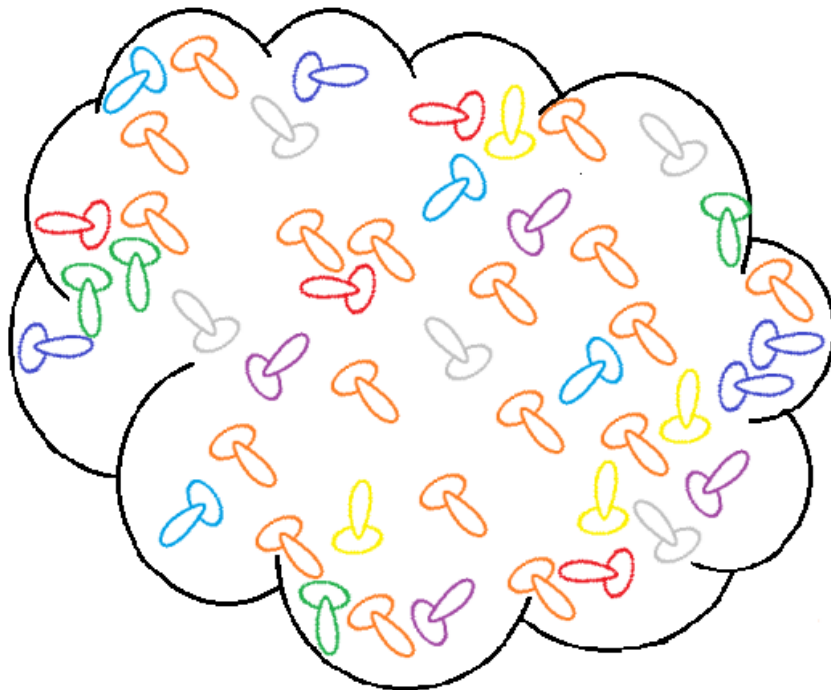
Although it is visually hard for us to imagine, creatures conditioned as we are by an experience of three-dimensional space, with this device we can understand that in an

“nD NEP” we can consider 3D subspaces oriented in a particular way, defined by a subset of EP whose characteristic is to have $p = n - 3$ of their OAWOO defining a parallel pD subspace (the one we called the “mallet”) and the remaining three defining a 3D subspace that is also parallel (let us always bear in mind that we use the term “NEP” or “space” for want of a better one; but just as mathematicians do not imagine a physical space when we speak of a “Hilbert space”, we must think likewise when we speak of the “space of EP orientations”).

All right, we may now say: “With the 1D beings who believed they lived in a straight (later curved) one-dimensional space, we have been able to see how a set of EP replaces, informationally, that fictitious 1D space which the 1-beings considered Reality. But how do these EP naturally express this more complex 2D reality?”

Let us take up earlier images again, but now, instead of umbrellas, we shall have “mushrooms”. Instead of “canopy” and “shaft”, we shall now have “cap” and “stem”, but these are now more complex, since the cap is made up of a non-spatial 3D orientation within an nD NEP-space, and the stem is a pD (or (n-3)D) NEP-subspace.

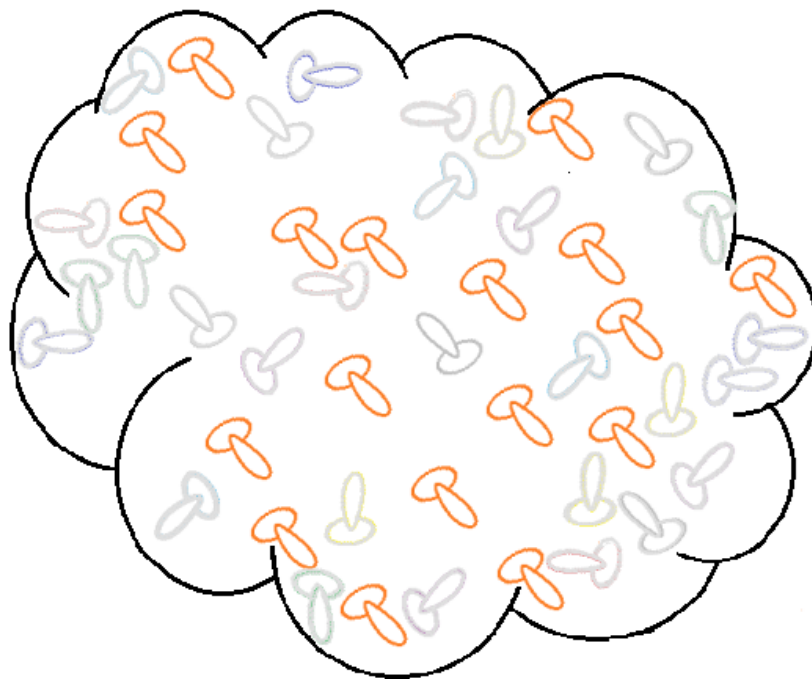
If we draw our didactic Cloud of Precursor Elements, NEP, we shall have something like this:



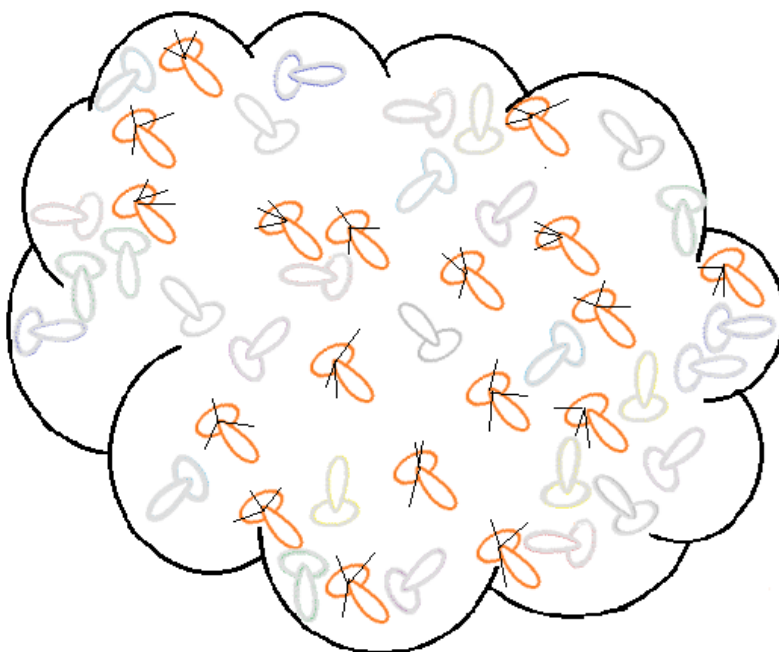
In each EP of n orthogonal orientations we can select three axes (orientations in the precursor NEP space). It is not that each EP has three axes specialized in configuring space; it is simply that if we consider any one of them and pick out any three axes, we

shall find among the almost infinite EP an infinity of EP that have three of their axes “rotating” in a primordial subspace parallel to the one chosen as reference. Just as in our previous case, if we selected any two axes of the 3D EP (the umbrella canopy), we found an infinity of 3D EP that had two of their axes rotating in the plane defined by the two axes of the reference EP. It is clear that here we cannot visualize 3D orientations and single them out among the infinitely many possible in an nD NEP, but by proceeding thus, didactically, drawing these “mushrooms” whose “cap” is a 3D subspace, we see that there are some with the cap oriented in countless ways in the general nD NEP (and, rigidly linked to it, the (n-3)D subspace, the “stem”).

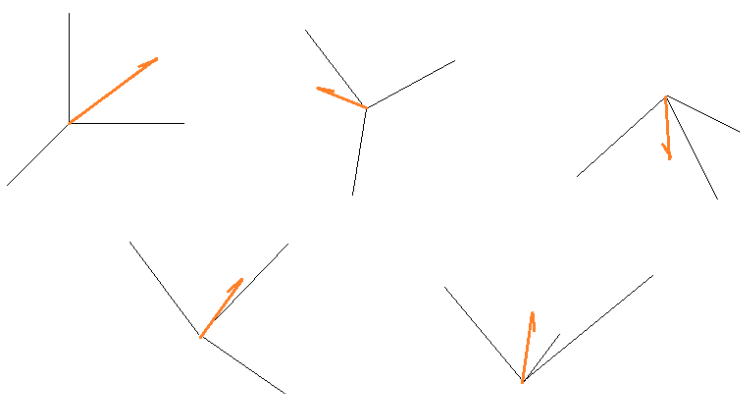
Let us now look only at those that have the cap and the stem oriented according to the orange subspaces (I regret the repeated use of “NEP” and “sub-NEP”, but I can think of no better way to hammer home the idea that, when speaking of the orientations of the EP, we must never imagine a space of the kind our mind imagines as “real physical space”):



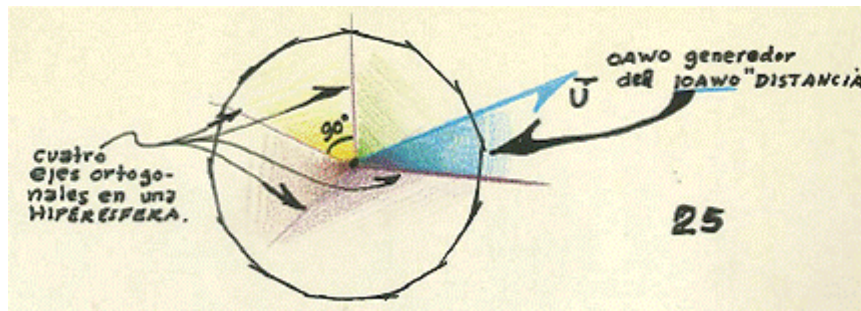
Let us now look at the 3D subspace symbolized by the cap. It is clear, as we have already pointed out, that this same 3D orientation is defined by an infinity of EP through three of their axes. Let us draw it symbolically here:



From now on we stop considering the rest of the orientations and place ourselves mentally in that orange 3D sub-NEP. The EP that have three of their axes rotating in this sub-NEP have their axes oriented in very different ways, but we could say that, relative to one another, they “look” in a given orientation among the 4π possible orientations. Something like this:

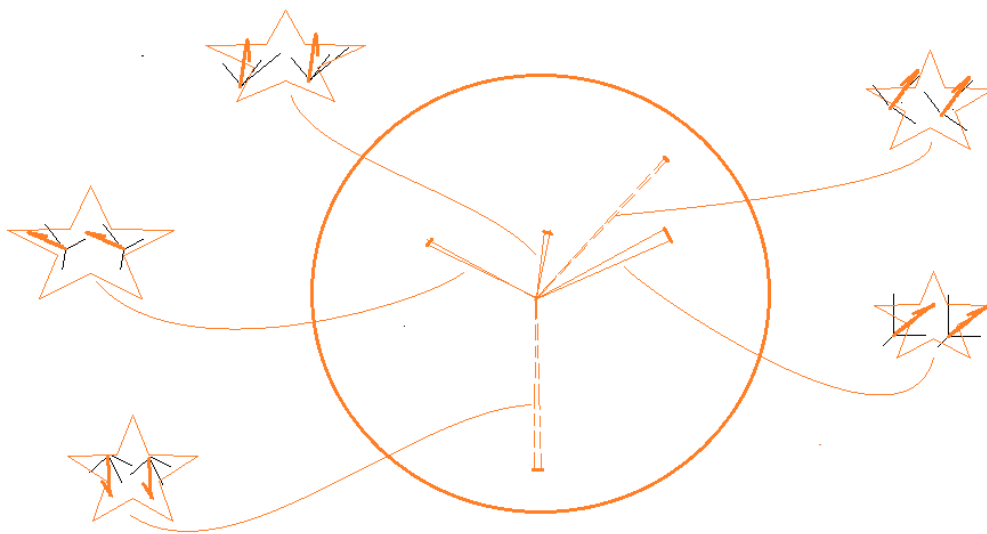


The device we use of symbolizing the orientation in which each EP “looks” as the bisector of the three axes was suggested to me by [these paragraphs of letter D59-3](#), and specifically by this image:



Later I shall try to go deeper into the meaning of the real OAWOO, but for the moment let us continue with this.

Something like this is what I am trying to represent here:



We can see that each connected pair of EP determines an oriented angular quantum, and the set of all oriented angular quanta determines a mesh of micro-segments across the whole spherical surface. The “physical space” in which our 2D friends believe they live is not an “empty mathematical space” prior to and independent of the massive bodies or the disturbances of electromagnetic or other fields that populate it. The “space” which the 2D beings believe pre-exists the elements that populate it is only an idealization of their mind. There is, yes, a substratum of angular elements, prior to space (and to time, as we shall see), which contain in their angular differences all the information that determines the subjective idealization they call “2D-Reality”.

Let us recall the motto of this work: “We can reveal to you that the first “shock” suffered by the former mechanistic conceptions of the Cosmos was caused when our cosmophysicists came to ascertain the genuine nature of physical space.” Overcoming

this “a priori”, this innate intuition of our mind that the space our mind conceives really exists as something independent of and prior to the “objects” that populate it, is the main aim of this work.

I believe that the most important notion we should draw from this whole document is that the angle between the orientations of two IBOZOO UU, the IOAWOO, is not a dimensionless scalar but an **oriented angular dimension** which, according to its orientation within an n-dimensional weave, expresses the physical magnitudes we know: space, time, mass...

LET US CONTINUE

Until now we have accepted the presentation of the IBOZOO UU (Precursor Elements or EP) as “bundles of orthogonal orientations in a NEP”. Let us remember, insistently, that the EP are not in the physical space we know; rather, they are characterized by the fact that they “look” along n orthogonal orientations, these orientations being the only thing in which they differ from one another. But let us now take a step forward. [In these paragraphs of letter D59-2](#) they introduce a less simplistic concept of OAWOO (which they had presented to us as an axis, a radius vector...) and show us how a hyperplane in an nD NEP can lead us to a broader understanding of OAWOO / “Orientation”. Since we are still trying to understand how the idea of 2D physical space “emerges” in the consciousness of the 2D beings from the information contained in an almost infinite multitude of EP linked in a 3D sub-NEP, let us restrict the idea of [those paragraphs](#) and fix it thus: “If you substitute the concept of OAWOO (linear Radius VECTOR of our previous more simplistic model) with that of HYPERPLANE of order **N=3** [N=4 in the original]”. Bear in mind that in a space of order N=3 a hyperplane is what we call a plane (nothing more).

Continuing with our narrative, let us now see how we move from those three one-dimensional orientations, which we have ended up representing as vectors to make them easier to handle mathematically, to 2D orientations.

When we represented an EP by three oriented axes, we wrote a matrix whose rows were the direction cosines of each axis with respect to the three axes of the reference EP. Each row, a triplet of numbers; each number, the cosine of the angle that axis forms with a reference axis.

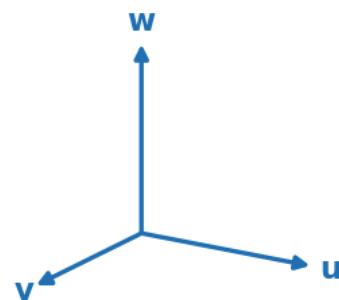
Well then: when we move to representing the EP by its three 2D orientations (its planes), the matrix does not change a single number. The only thing that changes is what we say its rows mean. For a plane passing through the origin is completely determined by its normal vector, and that normal vector is precisely one of the "axes" we had before. The row we used to read as "axis 'u' forms these angles with the reference axes" we now read as "the plane whose normal is 'u' forms these dihedral angles with the reference planes". The same direction cosines serve for both readings, because the angle between two planes is, by definition, the angle between their normals.

This is a well-known mathematical duality: in a space of n dimensions, an object of dimension $(n-1)$ —a hyperplane—and an object of dimension 1—its normal—are two sides of the same coin; they determine each other. That is why the matrix of an EP-3 serves equally well to describe "three orthogonal axes" or "three mutually orthogonal planes", and the reference EP remains, in both readings, the identity matrix.

Let us remember, once again (forgive the repetition, but this is where the mind slips), that neither the axes nor the planes are anywhere. The normal to a plane is not an arrow stuck into physical space: it is, once again, a pure orientation, like those functions of Hilbert space that are orthogonal to one another without being anywhere. The axis-plane duality is a duality between orientations, not between spatial objects.

1· Let us begin with our reference IBOZOO UU, or reference Precursor Element EP, which we represent didactically as three orthogonal vectors ([but let us not forget...](#))

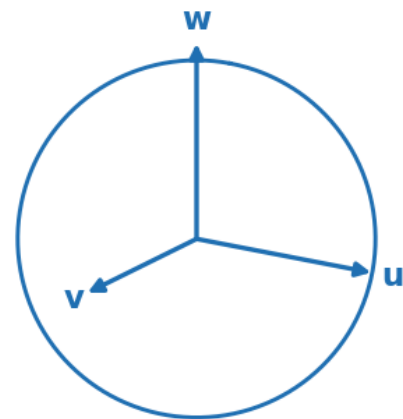
1 · EP de referencia (tres ejes)



2· Continuing with our narrative thread, in order to be able to represent the EP mathematically by their direction cosines with respect to any other EP, which we call the reference EP, we imagine that these oriented elements, OAWOO, are inscribed in a sphere (of modulus one).

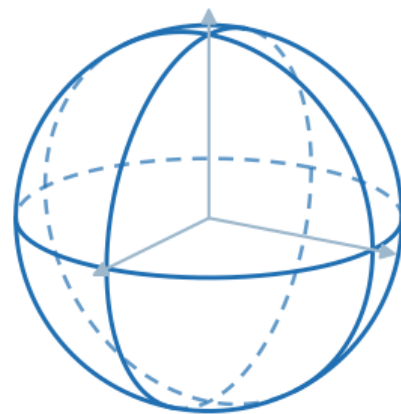
(but let us remember...)

2 · Inscrito en la esfera unidad



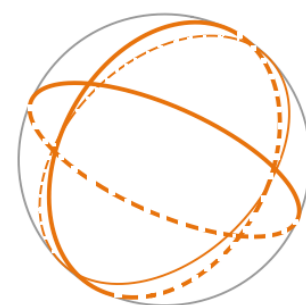
3· With this new notion of OAWOO, we now represent the three 2D orientations (planes, in our conception) that replace the earlier one of oriented one-dimensional axes.

3 · Sus tres planos: círculos máximos



4· Let us go on to represent, by its three orthogonal 2D orientations, any other EP, EP1 (orange, to distinguish it in our images).

4 · Otro EP (naranja): sus tres planos

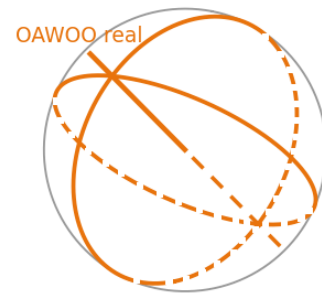


Let us always remember that an IBOZOO UU, an EP, is not a point in space and has no circumference or sphere around it; we must imagine its 2D orientations as pure orientations (how is one function oriented with respect to another in a Hilbert space? Are they located at some point in physical space?).

Those circles of intersection of the orthogonal 2D orientations with the sphere are nothing but didactic instruments we use in order to arrive at a mathematical representation of these Precursor Elements, EP, and at an understanding of how they “generate” the “physical space” we know.

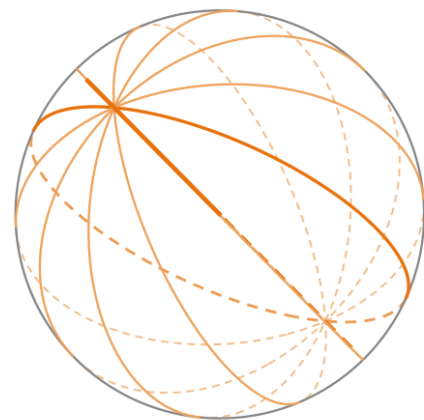
5· Both in this orange EP1 and in the blue EP that we have taken as the reference EP, we see that one of the 2D orientations is redundant, since we can always recover it as a 2D orientation orthogonal to the other two. Thus, when we dispense with one of those orientations, we find that a privileged 1D orientation appears: the orientation of the axis of intersection of the two 2D orientations. It is this 1D orientation that we shall consider the real OAWOO of this EP1.

5 · Bastan dos: eje de corte (OAWOO real)



6· Now, however, we observe that there are infinitely many pairs of orthogonal 2D orientations that have this same 1D orientation as their line of intersection. We can consider this bundle of orientations as a circular set of EP1, and represent it as EPc1

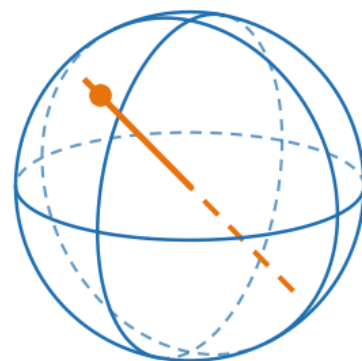
6 · El haz: círculos máximos con ese eje por diámetro



I represent them thus in the image, marking this bundle of orientations by its circles of intersection with that imaginary sphere we handle mentally in order to give a mathematical representation to these entities and to serve as a graphic aid.

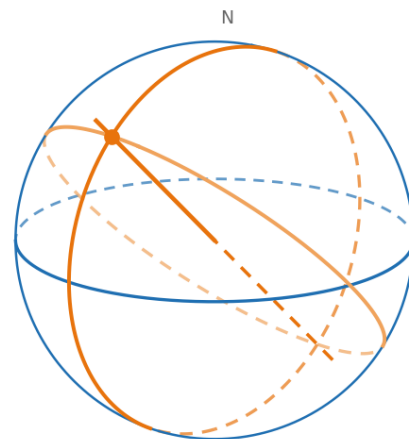
7· Let us mentally transfer this privileged 1D orientation, which we have called the real OAWOO, to the diagram representing the reference EP.

7 · El eje naranja en el EP de referencia



8· From among the (almost) infinite orthogonal pairs that make up this EPc1, we can select one that has one of its 2D orientations (plane / circle in our view) containing the orientation 'w' of our reference EP as we represented it in image 1·.

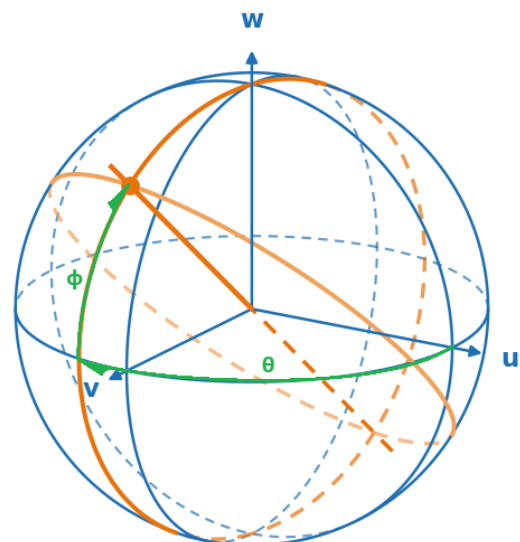
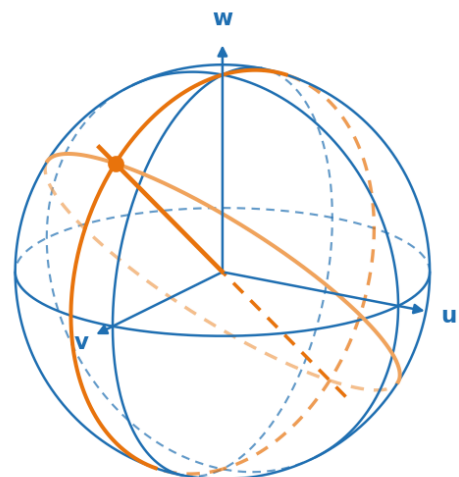
8 · Dos planos meridianos (naranja) que contienen al eje N



naranja oscuro: plano (eje, w)
naranja claro: perpendicular que contiene el eje
este último forma con el ecuador un ángulo = altura de P

9· We now recover the set of three 1D orientations, and of their 2D alternatives, that defined the reference EP.

9 · Síntesis: EP de referencia + eje y planos naranja



With all this we see intuitively how an orange EP1 (or its circular varieties EPc1) can be represented by two angles (θ and ϕ)

We have reached something important which it is now worth gathering up and following through to the end. Let us recall: when we dispensed with one of the three 2D orientations of an EP (the redundant one), a privileged 1D orientation appeared, the axis of intersection of the other two, which we called the real OAWOO. And we also saw that infinitely many pairs of orthogonal planes share that same axis of intersection: we grouped this bundle under the name EPc, a circular set of EP that all "point" towards the same 1D orientation.

What is this bundle good for? For the following, which is important in this construction. Let us take an EP and its connected partner, that is, another EP whose real OAWOO differs from that of the first by the minimum angular quantum. That connected pair determines an oriented IOAWOO: a micro-segment on the surface of the sphere. Now, a connected EP is not unique: we can move one quantum away in any of the directions that leave point P. Each direction of departure gives us a different connected EP, and the succession of connected EP chained together in the same direction goes on describing, [IOAWOO](#) by IOAWOO, quantum by quantum, a geodesic—a great circle—starting from P.

This is where the EPc bundle acquires its full meaning. To treat that geodesic in an orderly way, we choose from among the infinite pairs of planes of the bundle the one whose principal plane cuts the sphere precisely along that great circle. That plane "selects" for us the chain of IOAWOO, of connected EP, that make up the geodesic, and allows us to represent it with an economical, indexed notation. The geodesic ceases to be a new problem: it is, once again, a one-dimensional universe like the one we already knew, only now laid out on the sphere.

And now let us take a further step. From point P there starts not one geodesic but (almost) infinitely many, one for each direction of departure. Together, with all their connected EP, they weave around P a complete fan of IOAWOO, of oriented angular micro-segments. And if we repeat the same operation from any other point—that is, from each privileged orientation determined by its own EPc set—we obtain fans that overlap and fit together until they cover, tile by tile, the whole of the spherical surface. This complete mesh of oriented angular micro-segments is what, before a consciousness, "emerges" as the two-dimensional physical space in which our 2D friends believe they live.

But—and this is what I do not want to be lost—that mesh, on its own, accounts only for space. The sphere woven in this way would be a pure geometric skeleton, a place without things. For it to acquire what our friends would call full "physical existence", something more is needed: each IOAWOO micro-segment must carry, besides its spatial orientation, other angular differences measured in the orientations orthogonal to the spatial ones. It is those additional differences that, according to the Oomen, encode what we call mass, electric charge and the other non-spatial attributes. Space

arises from the mesh; the matter that inhabits it, from the orientations that the mesh carries "in addition". All of it, once again, angular differences between entities that are nowhere.

I want to give weight to, and stress more and more, the notion of **IOAWOO**, of **oriented angle**, since what matters is not only its angular dimension: its orientation is decisive. Our friends point out its importance to us [in these paragraphs](#): "It is precisely that IOAWOO θ (ANGLE-DIMENSION) that confers on the IBOZOO UU all its transcendent meaning"

Let us close this chapter, 1.4, which I have entitled "Two-dimensional universe in a given 3D orientation in an nD space", with a preview which, with the help of Claude Opus, will serve as the entrance to the next and final chapter, which explains how the IBOZOO UU, the EP, are able to account, through their IOAWOO, for our three-dimensional physical space, which we imagine pre-exists everything created.

Up to now we have measured the separation between two EP in the most natural way for our mind: as the angle between their real OAWOO, calculated by means of the scalar product of two unit vectors. And it has worked. But if we want to converge [with the formula the Oomen offer us in the central part of letter D59-2](#), we must understand that this way of measuring the angle, while correct, is only a particular case of something more general. Let us go step by step, for the ground is delicate.

Let us start with what is familiar. The angle between two straight lines in a plane—the cosine of the angle between their direction vectors—is defined by a simple scalar product. The cosine of the angle between two planes in three-dimensional space corresponds to the angle between their normals: another scalar product. And the angle between two hyperplanes in a space of n dimensions is, again, the scalar product of their unit normals. This is the Euclidean definition, and it is exactly the one we have been using for the distance between EP. It is direct and clean.

But it has a limitation we cannot ignore. The Euclidean definition of angle takes it for granted that space is flat. It works wonderfully in that case, but it behaves badly as soon as there is curvature, and it also behaves badly when the elements we are comparing "touch at infinity".

The model with which the Oomen represent the IU must be able to express all possible "physical" spaces, flat or curved. We need a definition of angle that is also valid in curved spaces and that, moreover, does not depend on the coordinate system we arbitrarily choose. That definition is provided by projective geometry.

It is worth presenting what projective geometry is, if only in broad outline, because the name is more frightening than the thing. It is, in a few words, the geometry that remains when we take away from geometry everything that can be measured. In it there are no distances or angles: there are only relations of incidence (this point lies on this line, this line lies in this plane) and a single numerical invariant, called the cross-ratio, which is preserved however much we project and distort the figures. Think of the shadows a spotlight casts on screens tilted in different ways: lengths change, angles change, but there is a certain proportion of proportions—the cross-ratio of four aligned elements—that remains unaltered. That is the fundamental invariant, the projective equivalent of what distance is in Euclidean geometry.

And here comes what [Cayley and Klein](#) discovered in the nineteenth century, which seems to me to resonate profoundly with everything we have been saying about the EP. If within projective space, which knows nothing of measurement, we choose a special surface of the second degree—a quadric, which we shall call fundamental—and agree to measure all angles and distances by means of the cross-ratio referred to that quadric, then we recover, depending on which quadric is chosen, Euclidean, spherical or hyperbolic geometry. The metric is not a primitive datum of space: it emerges from the choice of a reference quadric.

For our “Real Universe”, the choice of the quadric that explains our physical space will be made by the Oomen after painstaking empirical measurements of the curvature of our Cosmos, so as to determine the parameters that describe it. In this way, moreover, the Oomen will be able to describe other WAAM of different curvature, distinct from ours.

Let us apply it. Any two hyperplanes—let us call them P and Q —determine a pencil: the set of all the hyperplanes that contain their intersection. Now, within that pencil there are exactly two hyperplanes that are tangent to the fundamental quadric. We call them P_∞ and Q_∞ . We do not choose them; the geometry itself fixes them, and it is they that anchor the measurement of the angle to the structure of space rather than to a whim of coordinates. The angle between P and Q is then defined as the cross-ratio of these four hyperplanes:

$$\theta = \theta(P, Q) = \frac{1}{2i} \log R(P, Q, P_\infty, Q_\infty)$$

And when this cross-ratio equals -1 , we say that the two hyperplanes are orthogonal. This is, from now on, our definition of orthogonality between the orientations of an EP: it is not the perpendicularity of two arrows stuck into a prior space, but a pure projective relationship, referred to the fundamental quadric.

If we expand that cross-ratio in coordinates, describing the two hyperplanes by their coordinates $U = (U_0, U_1, \dots, U_n)$ and $V = (V_0, V_1, \dots, V_n)$, we obtain, after the algebra (see again [Cayley-Klein](#) and, in Spanish, [D. Maravall's address at the UPV](#)), this:

$$\cos \Theta = \frac{\varepsilon \left[\frac{U_0 V_0}{\lambda^2} + U_1 V_1 + \dots + U_n V_n \right]}{\sqrt{\left[\frac{U_0^2}{\lambda^2} + U_1^2 + \dots + U_n^2 \right] \left[\frac{V_0^2}{\lambda^2} + V_1^2 + \dots + V_n^2 \right]}}$$

which is, letter by letter, the formula that appears in letter D59-2. And now its two parameters are no longer mysterious and reveal themselves to us as old acquaintances.

The parameter ε describes the curvature of the fundamental quadric. For $\varepsilon = +1$ the quadric is a hypersphere of positive curvature, which is precisely the model the Oomen adopt for the IU. For $\varepsilon = -1$ it would be a hyperboloid, of negative curvature.

The parameter λ singles out one of the coordinates from all the others. When $\lambda = 1$, all the coordinates are equivalent and the formula collapses, elegantly, into the familiar Euclidean scalar product:

$$\cos \Theta = U \cdot V$$

That is to say: all the calculations we have made so far, with our humble scalar products, were already this formula, only in its simplest case, with $\varepsilon = 1$ and $\lambda = 1$. We need not throw away any of the ground we have covered: what we were measuring was, without knowing it, a cross-ratio with respect to an imaginary quadric located at infinity.

And when λ is purely imaginary, the first term of the formula will change sign, and the resulting geometry will no longer be Euclidean or spherical, but that of Minkowski: the geometry of the space-time of relativity. That distinguished coordinate, the one with the changed sign, will be time. But let us not get ahead of ourselves: we shall deal with this when we incorporate time as one more orientation of the EP, orthogonal to the spatial ones, just as the Oomen themselves indicate to us.

Before continuing with the next chapter, where we shall try to see how these Precursor Elements, EP, are also able to explain the three-dimensional space of our everyday experience, I would like to explain why we are so abruptly introducing projective geometry here.

We must understand that the Oomen have adapted themselves to our logical and mathematical tools in order to introduce us pedagogically, if only at a very superficial level, to their theory of the IBOZOO UU. Evidently, as [they themselves point out in their letter D59-2](#), a large part of their logical scaffolding rests on a tetravalent logic that denies the principle of “[NON-CONTRADICTION](#)”, according to which a proposition cannot be both True and False at the same time, and likewise rejects the principle of

[“EXCLUSION of a THIRD TERM”](#), which states that a proposition can only be True or False. That is, in Ooman tetravalent logic, besides the options “[True](#)” and “[False](#)”, the only valid ones in our Boolean logic, the options of “[True and False](#)” at the same time are admitted (like Schrödinger’s cat, which was alive and dead at the same time), as well as the option of “Some form other than True or False” or, put another way, “[True outside our physical realm](#)”. To understand this, I encourage you to read [letter NR20](#).

In the same way, they resort to our mathematics to present the rudiments of their theory of the IU. It is in this use of our mathematics that we discover that the formulas they present to us can be recovered from works on projective geometries.

Why do we believe that projective geometry is of great use in the attempt to approach this theory of the IU?

If we recall our knowledge of cosmology on Earth, we have long been speculating about the geometry of the space of our Universe. Is our Universe open or closed? Does it have an elliptic or a hyperbolic geometry? It is evident that a general theory such as that of the IU must account for both possibilities, and even for the possibility that our Universe is flat, Euclidean.

That is why the definitions of angle within projective geometry—which dispenses with distances because they are not invariant under projection, and recovers them only on choosing a reference quadric—are so attractive for our work.

The Oomen do not discover the geometry of our universe on the basis of the IU. It is rather the other way round. Having established empirically, so they claim, that our present universe is open, they need their theory to explain this type of universe, just as it must be able to explain closed and even flat universes.

Projective geometry is very well suited to this need for the orientations of the IU to express hyperbolic, elliptic and flat spaces in their angular differences. I suppose it is for this reason that the Oomen, adapting themselves to our mathematical environment, use [descriptions](#) and [formulas](#) that are compatible with (or derived from) our projective geometries.

1.5. 3D / 4D / nD

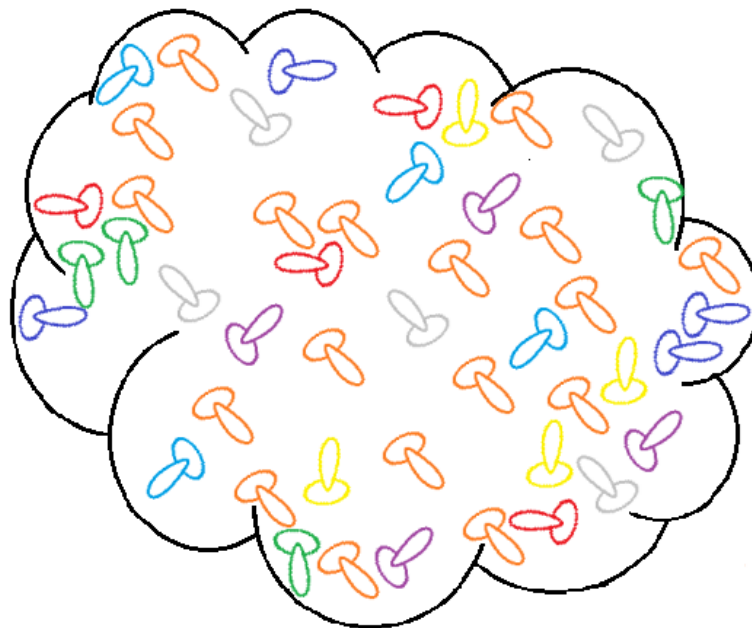
THREE-DIMENSIONAL UNIVERSE IN A GIVEN 4D ORIENTATION IN AN nD SPACE

Continuing on our way, we now come to consider those IBOZOO UU, those Precursor Elements, EP, which describe our three-dimensional Universe in their information of oriented angular differences, IOAWOO.

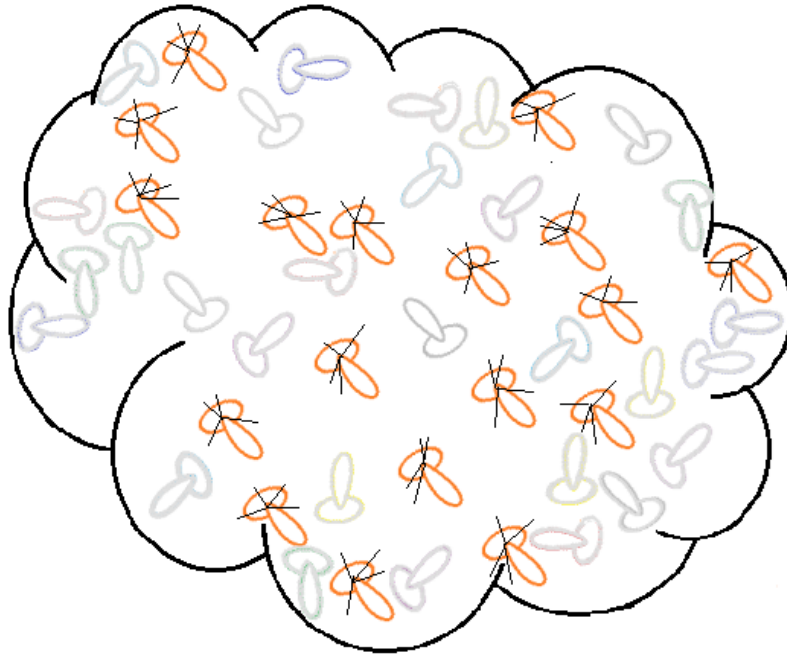
Among the (almost) infinite countable EP that exist within the general NEP cloud, we look at any four of their 1D orientations and assign a colour to that 4D orientation.

We again represent the set of EP with that mushroom-shaped image in which the cap represents a subspace of 4D orientations (making it clear, as always, that the word “space” here does not refer to a metric space like our physical one, but to a space of pure orientations) and the “stem” a subspace of pD orientations ($p = n - 4$).

We go on representing them in colours to distinguish those that can be grouped with other EP having that same subspace of orientations parallel.



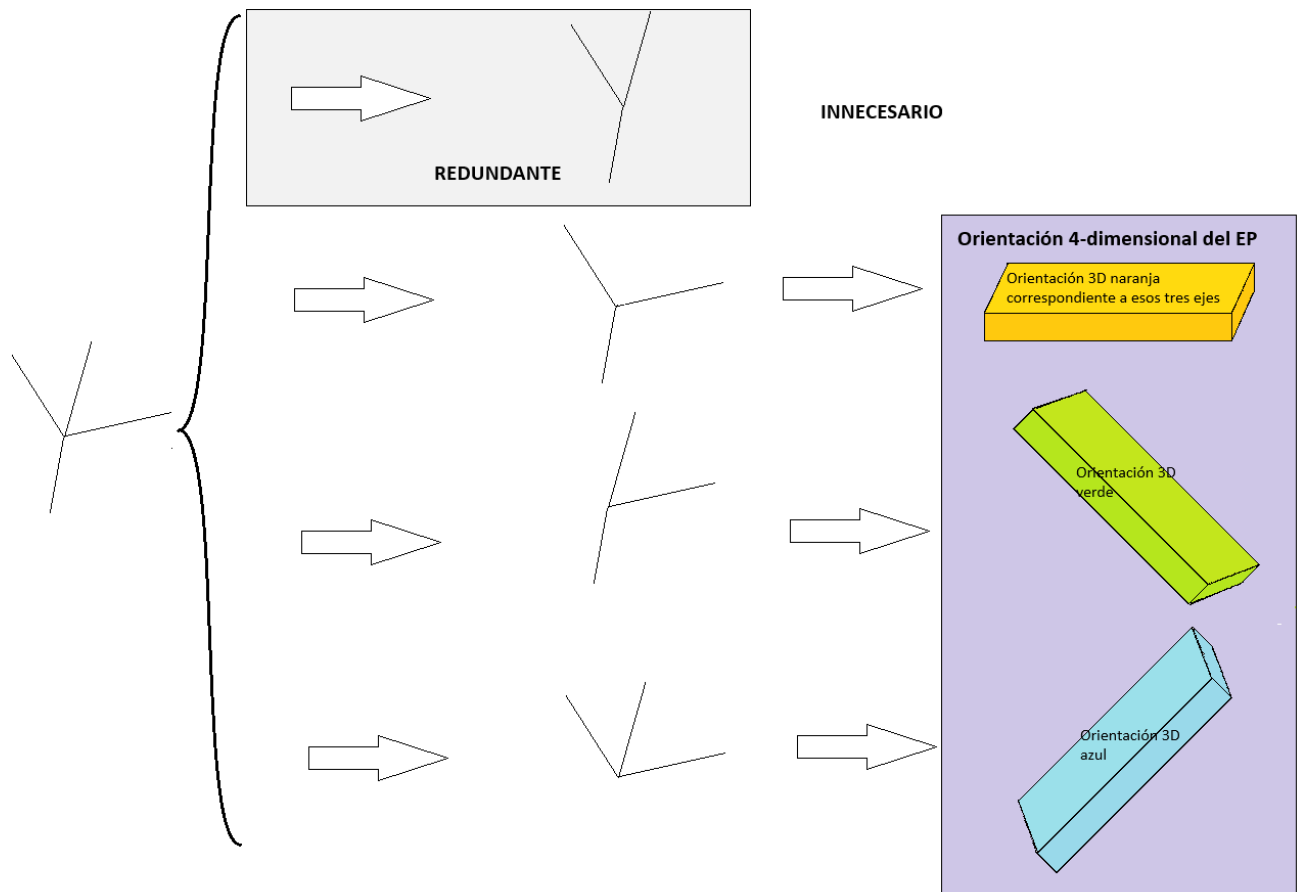
If we “enter” the 4D orientation of any one of them, the orange one for example, we see that this orientation is now defined by four orthogonal “axes”.



We shall follow the same path as in the previous cases to visualize how an (almost) infinite set of linked (connected) EP—or rather the IOAWOO (oriented quanta of arc)—determine the whole weave of a three-dimensional universe.

Unfortunately, in this case the graphic support is less powerful. We are used to seeing 2D representations of 3D elements. This is because, although “Reality” is three-dimensional, our sensing organs capture it as a projection onto a plane (the retina), and we only reconstruct its three-dimensionality through the stereoscopy of our binocular vision. That is why it is so familiar to us to look at a painting, a film or images on television and partially reconstruct their three-dimensionality. With four orthogonal dimensions our eidetic capacity is greatly diminished. Even so, I shall try to make use of the ground already covered to evoke these 4D images.

Just as in the previous case, we can dispense with one of the four 1D orientations, since we can always recover it by orthogonality with the other three. We can also move from a representation by four 1D axes to one by four orthogonal 3D orientations, and in this case too we can dispense with one of them (the top one in the figure) as redundant.



What I am trying to visualize with this image is how, from the four axes, 1D orientations—out of the 12 we assume an EP has—we can consider four combinations of three axes, each of these four combinations defining a 3D orientation, a hyperplane, within the general 4D orientation. It is similar to what we did in section 1.4 (steps 1 to 9), where, from the three axes of an EP, we took the three possible combinations of two axes, each defining a 2D orientation, a 2D hyperplane (simply a plane). Just as we then discarded one of the three planes as redundant, here we do the same and discard one of the four combinations, since that 3D orientation in the 4D subspace can always be recovered by orthogonality with the other three. I have represented the three 3D orientations in the general 4D space as three 3D parallelepipeds oriented orthogonally in a 4D environment. In the figure I have tried to visualize all this with colours. It is impossible for us to visualize something of which our visual cortex has no experience, but I hope the idea will be understood by analogy with the previous case (section 1.4).

We are now reaching the core of this whole work as regards the “emergence” of 3D physical space from the IOAWOO, the oriented arc segments, of the EP

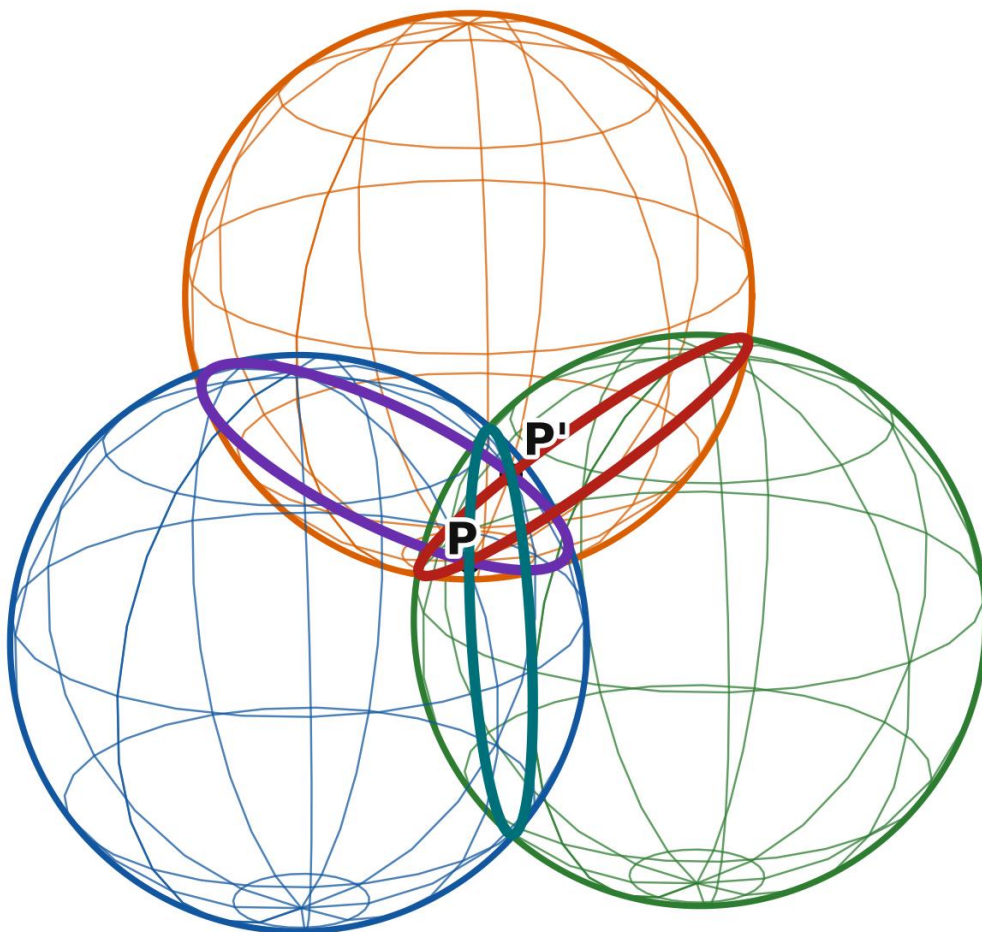
[D59-2](#): “Let us therefore suppose a SPHERE (IMAGE 16) which would constitute one of the infinite meridian HYPERPLANES of a HYPERSPHERE of order $N = 4$ (If you are not familiar with this concept, imagine that if we call meridian Plane the section of a

sphere passing through its centre, the sphere being of order $N = 3$, then for a HYPERSPHERE of 4 dimensions its "section" would be precisely a figure of $N-1$ dimensions, that is to say a sphere"

If we recall our previous case, the two orthogonal planes to which we reduced the three "spatial" orientations of the EP cut the sphere—which served us as a mental device for doing mathematics with the orientations—along two orthogonal circles. Now these three orthogonal hyperplanes, 3D orientations, to which we have reduced the four "spatial" orientations of the EP, "section" the hypersphere along three orthogonal spheres.

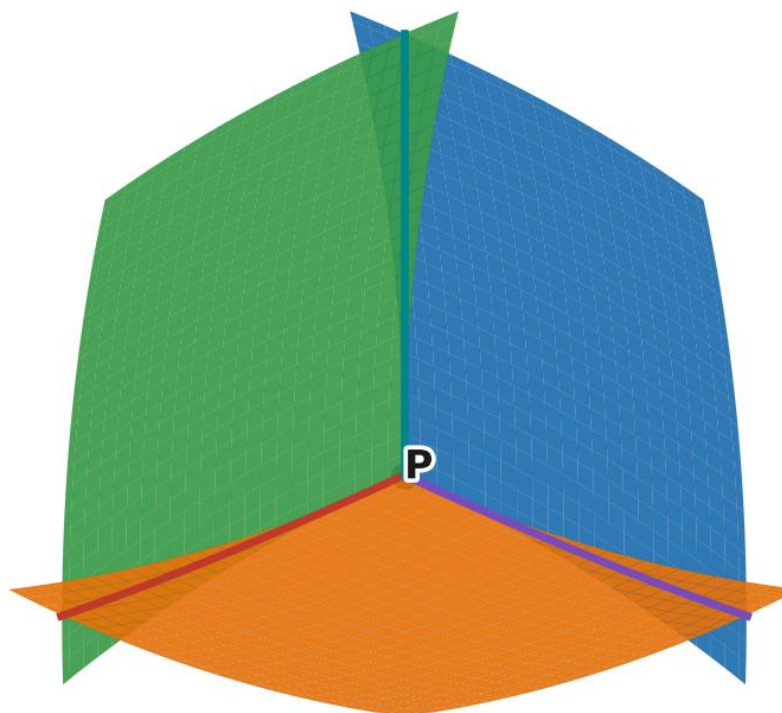
Obviously we cannot represent visually three orthogonal spheres, each of which is the section of the hypersphere by one of the three 3D hyperplanes in a 4D orientation space; even so, I have asked Claude Opus to draw an image that expresses this.

Las tres esferas se cortan dos a dos en círculos máximos y las tres a la vez sólo en dos puntos: P y su antípoda



Let us now turn our attention to the axis P-P' and, more closely still, to the neighbourhood of P.

En el entorno de P las tres esferas parecen planas:
el triedro ortogonal del habitante 3D



We see that the three orthogonal spheres determine two points of intersection, P and P'. The straight line joining these two points is the common intersection of the three hyperplanes, and it is the normal (the orthogonal “vector”) of the hyperplane we have discarded as redundant. Indeed, we shall see that a hyperplane and its orthogonal “vector” are interchangeable in our matrix representation of the IU / EP.

A hyperplane passing through the centre, in the chosen 4D orientation, has the equation

$$U_0x_0 + U_1x_1 + U_2x_2 + U_3x_3 = 0$$

and its coefficients (U_0, U_1, U_2, U_3) are the components of its normal. But the components of that normal, referred to the reference EP, are exactly the direction cosines we were already writing as a row of the matrix.

Row i of the EP matrix is the coordinate vector of OAWOO-hyperplane i of that EP.

There are not two objects; there is only one, written in two ways. With that, the projective formulas cease to be an appendix and become the way of reading the matrix we already had.

We have just mentioned the reference EP. Let us look at it a little.

In projective language, the reference EP is the one that supplies the coordinate system: its four OAWOO are the coordinate hyperplanes $(1, 0, 0, 0)$, $(0, 1, 0, 0)$, $(0, 0, 1, 0)$, $(0, 0, 0, 1)$. Its matrix is the identity, as always.

Let us recall what we have already seen, as support for what follows:

Let us apply it. Any two hyperplanes—let us call them P and Q —determine a pencil: the set of all the hyperplanes that contain their intersection. Now, within that pencil there are exactly two hyperplanes that are tangent to the fundamental quadric. We call them P_∞ and Q_∞ . We do not choose them; the geometry itself fixes them, and it is they that anchor the measurement of the angle to the structure of space rather than to a whim of coordinates. The angle between P and Q is then defined as the cross-ratio of these four hyperplanes:

$$\theta = \theta(P, Q) = \frac{1}{2i} \log R(P, Q, P_\infty, Q_\infty)$$

And when this cross-ratio equals -1 , we say that the two hyperplanes are orthogonal. This is, from now on, our definition of orthogonality between the orientations of an EP: it is not the perpendicularity of two arrows stuck into a prior space, but a pure projective relationship, referred to the fundamental quadric.

But it is worth separating two things that until now went together, and this is where the chapter gains rigour:

- The **reference EP** supplies the coordinates (which numbers we write).
- The **fundamental quadric** supplies the rule of measurement (what those numbers mean).

They are independent. And what comes now closes a circle. For the form Q to take the simple diagonal expression of the letter, the coordinate system must be adapted to the quadric; that is, the four reference hyperplanes must be **mutually orthogonal in the projective sense**: cross-ratio -1 two by two. And [that is precisely the definition of an EP: a bundle of mutually orthogonal OAWOO.](#)

Consequently: **any EP can be taken as reference, because every EP is, by definition, a system of principal axes of the quadric.** The Ooman postulate that the reference must be supplied by another, arbitrarily chosen IU is thus justified from within the formalism, not imposed.

We continue by fixing the meaning of the points P and P' determined by our EP with respect to the arbitrary reference EP, but let us always remember that a single EP does not “exist (physically)” and determines nothing. We speak of a point P or P' only in

order to approach what truly has the sense of “physical existence”, which is the IOAWOO (oriented angle in the space of orientations) defined by two EP.

Let us go deeper into the meaning of the real OAWOO, identified angularly:

In the 4D orientation, three hyperplanes intersect in a straight line, and that line is the set of vectors orthogonal to the three normals. If the four rows are orthonormal, that vector is **the fourth row** of the matrix representing the EP with respect to the reference EP.

real OAWOO = the row we had discarded as redundant

The same happened in our previous case: for two planes, their axis of intersection was the normal of the third, discarded plane. This is the general rule, and it is worth stating because it has a fine narrative effect: **what we discard as redundant is precisely what points.**

So the angular position of P on the hypersphere is given, with no further calculation, by the direction cosines of that fourth row, $(a_{41}, a_{42}, a_{43}, a_{44})$, three of which are independent because of normalization. [These are the three direction cosines the letter mentions, and the three IOAWOO that define "the respective values of three-dimensional space as we conceive it".](#)

With the above there is nothing to "insert": the matrix already is the projective object. Each row is a hyperplane, each element a cosine of IOAWOO, the fourth row the real OAWOO. The conditions of normalization and orthogonality we have been requiring are the Euclidean version ($\varepsilon = \lambda = 1$) of projective orthogonality.

Let us now give mathematical form to the quantum of IOAWOO (the oriented angle in 4D of two connected EP) starting from the matrix representation we are using.

Let M and M' be the matrices of two EP with respect to a common reference. Since the choice of reference is arbitrary, the object with physical meaning is the **relative matrix**

$$\mathcal{R} = M' M^T$$

which describes the second EP taking the first as reference. All the information of the pair is there, and it does not depend on the external reference we used to write them.

Connectedness is then expressed precisely: two EP are connected when $\mathcal{R}$ differs from the identity by the minimum angular quantum,

$$\mathcal{R} = \exp (\Delta \alpha A) \approx I + \Delta \alpha A$$

with A antisymmetric and normalized. And this cleanly separates the two things we needed to distinguish in the mesh:

- $\Delta\alpha$, the **quantum**, always the same: the size of the micro-segment.
- A , the **direction** of the step: which geodesic we are moving along.

The fan of geodesics starting from P is, literally, the set of possible A . And the IOAWOO between the real OAWOO of the two is obtained as always:

$$\cos \Delta \alpha = \varepsilon \frac{Q(n, n')}{\sqrt{Q(n, n) Q(n', n')}}}$$

where n, n' are the respective fourth rows.

We are trying to accompany the narrative with teaching images. Our mind understands this matrix part better if we accompany it with a visual approach. We saw more easily how, in a 3D orientation space, the (almost) infinite set of quanta of IOAWOO, of quanta of oriented angles, formed a dense weave of angular micro-segments that “wove” densely over the whole spherical surface; and, in saying “wove”, we must clearly understand that from an (almost) infinite series of EP with three orthogonal orientations in an environment that is not spatial in the physical sense, a “physical space” “emerges” through that network of (almost) infinite oriented angular micro-segments, since in it we can point to positions and distances, which was not the case in the “orientation spaces”.

It will now be harder for us to visualize this same thing for a 4D space, but by extrapolating from the above we can take a leap and try to visualize how, in a 4D space, the (almost) infinite micro-IOAWOO weave a very dense network of oriented micro-angles over a hypersurface whose geometry is fixed by ε and λ . Of course, in this case, that hypersurface is three-dimensional, just as our physical space is.

It is curious to note how the Oomen already pointed out, in one of their letters, [D41-15](#), the possible existence not only of [three-dimensional universes full of galaxies, like ours](#), but even of [two-dimensional universes](#).

Before closing these chapters, devoted to showing how, with the help of the explanations about the IBOZOO UU they have given us in their letters, we are able to understand how the information we call “physical space” arises from them, I wanted to show how the formulas of projective trigonometry that appear in their letter D59-2 can be derived from our own knowledge of projective geometry. This is the result Claude Opus gave me:

Derivation: from projective geometry to the formulas of D59-2

Step 1. The bilinear form of the absolute

Hyperplanes are described by dual coordinates $U = (U_0, U_1, \dots, U_n)$. The absolute quadric is given, in hyperplane coordinates, by a symmetric bilinear form. Let us take the diagonal form with weights:

$$Q(U, V) = \frac{U_0 V_0}{\lambda^2} + U_1 V_1 + U_2 V_2 + \dots + U_n V_n$$

and define $\Omega = \varepsilon Q$, with $\varepsilon = \pm 1$.

Step 2. The definition by cross-ratio

Two hyperplanes P, Q generate the pencil $H(t) = P + tQ$, where P corresponds to $t = 0$ and Q to $t = \infty$. The two hyperplanes tangent to the absolute are the isotropic ones of the pencil, those satisfying $\Omega(H, H) = 0$:

$$\Omega(P, P) + 2t \Omega(P, Q) + t^2 \Omega(Q, Q) = 0$$

with roots

$$t_{1,2} = \frac{-\Omega(P, Q) \pm \sqrt{\Omega(P, Q)^2 - \Omega(P, P)\Omega(Q, Q)}}{\Omega(Q, Q)}$$

Step 3. Calculation of the cross-ratio

For four elements of the pencil with parameters $0, \infty, t_1, t_2$ the cross-ratio reduces (the term with ∞ tends to 1) to:

$$R(P, Q, P_\infty, Q_\infty) = \frac{t_1}{t_2} = \frac{\Omega(P, Q) - \sqrt{D}}{\Omega(P, Q) + \sqrt{D}}, \quad D = \Omega(P, Q)^2 - \Omega(P, P)\Omega(Q, Q)$$

Step 4. The logarithm returns the cosine

Let us call c the normalized quotient:

$$c = \frac{\Omega(P, Q)}{\sqrt{\Omega(P, P)\Omega(Q, Q)}}$$

Then $\sqrt{D} = \sqrt{\Omega(P, P)\Omega(Q, Q)} \sqrt{c^2 - 1}$, and the cross-ratio becomes

$$R = \frac{c - \sqrt{c^2 - 1}}{c + \sqrt{c^2 - 1}}$$

If we set $c = \cos \theta$, then $\sqrt{c^2 - 1} = i \sin \theta$, and therefore

$$R = \frac{\cos \theta - i \sin \theta}{\cos \theta + i \sin \theta} = \frac{e^{-i\theta}}{e^{i\theta}} = e^{-2i\theta}$$

Applying the letter's definition:

$$\theta = \frac{1}{2i} \log R = \frac{1}{2i} (-2i\theta) = -\theta$$

That is, **the definition by cross-ratio reduces exactly to** $\cos \theta = c$. All the projective machinery collapses into a quotient of bilinear forms.

Step 5. Substituting the specific form

Since $\Omega = \varepsilon Q$ and $\varepsilon^2 = 1$, the ε survives in the numerator but disappears from the denominator:

$$\cos \theta = \frac{\varepsilon \left[\frac{U_0 V_0}{\lambda^2} + U_1 V_1 + \dots + U_n V_n \right]}{\sqrt{\left[\frac{U_0^2}{\lambda^2} + U_1^2 + \dots + U_n^2 \right] \left[\frac{V_0^2}{\lambda^2} + V_1^2 + \dots + V_n^2 \right]}}$$

Which is, term by term, the letter's formula. Note that the asymmetric position of the ε (in the numerator, not in the denominator), which might seem a whim, is a necessary consequence of $\varepsilon^2 = 1$.

Step 6. The sine: Lagrange's identity

Here is the part that seems to me the most revealing. From $\sin^2 \theta = 1 - \cos^2 \theta$:

$$\sin^2 \theta = \frac{Q(U, U) Q(V, V) - Q(U, V)^2}{Q(U, U) Q(V, V)}$$

The numerator is a Gram determinant, and for a diagonal form with weights w_k Lagrange's identity (Binet–Cauchy) gives:

$$\left(\sum_k w_k U_k^2 \right) \left(\sum_k w_k V_k^2 \right) - \left(\sum_k w_k U_k V_k \right)^2 = \sum_{k < l} w_k w_l (U_k V_l - U_l V_k)^2$$

With our weights $w_0 = 1/\lambda^2$ and $w_i = 1$ for $i \geq 1$, the terms split into two families: those involving index 0 (weight $1/\lambda^2$) and those that do not (weight 1):

$$= \frac{1}{\lambda^2} \sum_{i=1}^n (U_0 V_i - U_i V_0)^2 + \sum_{1 \leq i < j \leq n} (U_i V_j - U_j V_i)^2$$

And since the terms are symmetric in i, j and vanish on the diagonal, $\sum_{i < j} (\cdot) = 1/2 \sum_{i, j} (\cdot)$.

Writing the brackets as 2×2 determinants:

$$\sin^2 \theta = \frac{\frac{1}{\lambda^2} \sum_{i=1}^n \begin{vmatrix} U_0 & U_i \\ V_0 & V_i \end{vmatrix}^2 + \frac{1}{2} \sum_{i, j=1}^n \begin{vmatrix} U_i & U_j \\ V_i & V_j \end{vmatrix}^2}{\left[\frac{U_0^2}{\lambda^2} + \dots + U_n^2 \right] \left[\frac{V_0^2}{\lambda^2} + \dots + V_n^2 \right]}$$

This is exactly the letter's sine formula, including the 2×2 determinants, the factor $1/\lambda^2$ in the first sum and the factor $1/2$ in the second. There is nothing arbitrary about it: it is forced by Lagrange's identity.

And the $\begin{vmatrix} U_k & U_l \\ V_k & V_l \end{vmatrix}$ determinants have a name of their own: they are the **Plücker coordinates** of the pencil determined by the two hyperplanes. That is, the sine of the angle measures the "separation" of the pencil in each of its coordinate planes.

Claude's remark on the above:

Two notes of honesty

On the ε in the sine formula. In the cosine its position comes out forced, as we saw. In the sine it is not so clean: if $\varepsilon = -1$ (hyperbolic case), $1 - \cos^2$ can be negative, because there $|\cos| > 1$ and what is actually being calculated is a $\sinh$. The honest reading is that the ε in the sine acts as a sign corrector, guaranteeing that the radicand is positive and marking the transition from circular to hyperbolic functions. I have not found a derivation that places it there by pure algebraic necessity.

On the role of λ . It comes out this cleanly: $\lambda = 1$ makes all the weights equal (the standard elliptic case, that of the IU model); a purely imaginary λ makes $w_0 = 1/\lambda^2$ negative, and the signature becomes that of Minkowski; $\lambda \rightarrow \infty$ cancels w_0 , the absolute degenerates and the Euclidean case is obtained. It is the complete Cayley-Klein classification within a single formula. That the letter specifies " $\lambda \neq 0$, λ real or imaginary" fits exactly with this.

TOPIC 2. Time and mass

2.1. Time and space-time

Before going on, I would like to highlight the limitations of this work. Already before this point, but significantly from here on, [I must insist that we are applying to the IBOZOO UU tools—terrestrial mathematics and two-valued logic—that in all probability are not the appropriate ones](#). The Oomen themselves warn us that their logic is tetravalent. What follows does not claim to be a theory. What I am trying to show is that the EP scheme is, at least, compatible with what our physics already knows. That is why I shall now be briefer. Although I am still thinking about how to give continuity and depth to this work, I want to end these last sections with a sketch of how this theory of the IBOZOO UU, of which our friends have shown us barely the rudiments, can lead very directly to our theory of special relativity, and specifically to Minkowski space-time.

In letter D59-3 the Oomen describe what we call physical space as an emergence from a network of EP, and specifically as the mesh that arises from the (almost) infinite quanta of IOAWOO formed by pairs of connected EP. Each of these EP “points”, within 4D space, to a privileged orientation by means of what they call the [real OAWOO \(\$\bar{U}\$ \)](#), which is the “synthesis” of the four orthogonal orientations that oscillate within the 4D orientation common to all those EP and that define a three-dimensional WAAM, with three degrees of freedom. Time is defined by the variation, in each EP of a linked network of EP, of [another real OAWOO \(\$\bar{T}\$ \)](#) which, within a frame of two axes perpendicular to the previous ones, is “condemned” to move in a single plane. [The minimum angle between the time axes of two connected EP is the instant, the UIWIIIOO](#).

How does Einstein’s relativity appear? It suffices to suppose that the two temporal orientations are related to the spatial ones in a “hyperbolic” rather than a circular way. That single choice guarantees that the “distance” between two events, $ds^2 = c^2 dt^2 - dx^2$, is the same for every observer. No equation needs to be added: the invariance is already contained in the definition of the EP as a bundle of orthogonal orientations.

It remains to clarify what we mean by velocity, because an EP does not move: it is nowhere in space. What we call a particle, a proton for example, is a linked system of connected EP whose real temporal OAWOO ($\bar{T}$) all point in the same direction. For this system to “move” means that, from one UIWIIIOO to the next, the distance IOAWOO that define it vary. No EP has moved: it is other EP that come to configure the particle. [This is what the Oomen tell us in D59-4](#): the electron as such does not exist; there exists a chain of IBOZOO UU whose OAWOO successively change their orientation, and that constitutes the illusion of motion. Velocity is therefore the variation of the distance IOAWOO that define a linked system of EP in one quantum of time, and it shows up as a tilt of the common $\bar{T}$ of that system with respect to the $\bar{T}$ of the observer.

In one UIWIIIOO the system can move, at most, one quantum of distance. That is the speed of light, $c = \ell/\tau$, and that is why no speed can exceed it. But it is not the only possible speed, because in each UIWIIIOO the system may advance one quantum or not. Speeds lower than c are averages over many UIWIIIOO: a system that advances one quantum every ten UIWIIIOO

has, on our scale, a speed of $c/10$. Curiously, our relativistic quantum mechanics says something very similar: according to the Dirac equation, the instantaneous velocity of an electron is always $\pm c$, and what we measure is only its average.

On the scale of the universe, what is conserved are the light cones, not the distances, and there our tools are insufficient.

I asked Claude to make all this explicit in the mathematical, matrix language we are using to describe the IBOZOO UU, or Precursor Elements, EP, as we have decided to call them. This is the result:

Special relativity in the matrix representation of the EP

1. Six orientations and a quadric. Of the twelve orientations of each EP, our WAAM, as far as space-time is concerned, uses six; the rest form the mallet, parallel in all the EP of this WAAM. We order them thus: x, y, z, u ([spatial frame; u points to the \$\bar{U}\$ of the reference EP](#)) and t, w ([temporal frame; w points to its \$\check{T}\$](#)). In the spatial part the fundamental quadric was elliptic; it now has signature (4,2):

$$G = \text{diag}(1, 1, 1, 1, -1, -1)$$

An EP is still a bundle of mutually orthogonal orientations, but orthogonality is now measured with G . The condition $MM^T = I$ becomes

$$M G M^T = G$$

2. Events as points of the quadric. An event (what a linked system of EP is at a given UIWIIIOO) is represented, with respect to the reference EP, by a six-component vector lying on the quadric, $G(X, X) = 0$. Measuring lengths in quanta ℓ , the event occurring at (x, y, z) at instant t is

$$X = \begin{pmatrix} x \\ y \\ z \\ 1/2(1 + s^2) \\ ct \\ 1/2(1 - s^2) \end{pmatrix}, \quad s^2 = c^2 t^2 - x^2 - y^2 - z^2$$

As in D59-2, X is defined up to a factor: it is a projective point, a direction, not a position.

3. The interval, a ratio of bilinear forms. Let $N = (0,0,0,1,0,-1)$ be the fixed direction formed by u and w , which plays the role of a point of the absolute. For two events X and Y :

$$ds^2 = c^2 \Delta t^2 - \Delta x^2 - \Delta y^2 - \Delta z^2 = \frac{2 G(X, Y)}{G(X, N) G(Y, N)}$$

It is the same structure as the cosine formula of D59-2: a quotient of bilinear forms that does not depend on the scale of X or of Y .

4. Light is orthogonality. $ds^2 = 0$ is equivalent to $G(X, Y) = 0$: two events joined by a light ray have vectors that are orthogonal with respect to the quadric. If $G(X, Y) > 0$, one can causally influence the other; if $G(X, Y) < 0$, neither can influence the other.

5. Change of observer. An observer is another reference EP. The matrices that satisfy $MGM^T = G$ and also preserve N ($MN = N$) preserve $G(X, Y)$ and $G(X, N)$, and therefore ds^2 . They form a 10-parameter group, the Poincaré group: 3 rotations (circular planes among x, y, z), 3 changes of velocity (hyperbolic planes (x_i, t)) and 4 translations (planes that mix x, y, z, t with u and w). For example, a change of velocity in the plane (x, t) :

$$B(\eta) = \begin{pmatrix} \cosh\eta & 0 & 0 & 0 & -\sinh\eta & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ -\sinh\eta & 0 & 0 & 0 & \cosh\eta & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

One checks that $B G B^T = G$ because $\cosh^2\eta - \sinh^2\eta = 1$. Applied to X , it leaves s^2 intact and transforms x and t . With $\tanh\eta = v/c$ and $\cosh\eta = \gamma = 1/\sqrt{1 - v^2/c^2}$:

$$x' = \gamma(x - vt), \quad t' = \gamma\left(t - \frac{v}{c^2}x\right)$$

These are the Lorentz transformations. The hyperbolic angle η is the tilt of the system's common $\check{T}$ with respect to the observer's $\check{T}$. Since $\tanh\eta < 1$ for every η , no tilt gives a speed equal to or greater than c .

6. What is conserved on a large scale. Six orientations define 15 planes of rotation. The previous 10 preserve N . The remaining 5 do not: a dilation (the plane (u, w)) and four "special conformal" transformations. These 5 preserve the condition $G(X, Y) = 0$, but not the value of ds^2 : they keep the light cones, not the distances. The dilation, which changes the scale without altering the light cones, is the natural candidate to describe expansion, that is, a flexible quantum ℓ .

Note. The mathematical construction is Dirac's (1936) for Minkowski space. What the EP contribute is the reading: the six axes of D59-3 and the quadric of D59-2.

2.2. Mass and related matters. General relativity.

The section on mass that now follows is highly speculative, since the Oomen have greatly restricted their information on these last components of Reality.

Let us not forget, however, the motto of this work, [Letter D76](#): “We can reveal to you that the first “shock” suffered by the former mechanistic conceptions of the Cosmos was caused when our cosmophysicists came to ascertain **the genuine nature of physical space.**” [This theory of the IBOZOO UU aims to explain everything](#) that the Oomen regard as Reality, including here the Non-Physical Realities. That is why, in this work, we concentrate above all on trying to “visualize” didactically how our spatial reality arises naturally from the angular relationships between pre-spatial entities which are nowhere, have no volume or mass and are not subject to any field, and which nevertheless contain, in a visually very intuitive way, all the information corresponding to that rich phenomenology we call Physical Reality.

We venture, then, beyond space and time, to try to see how far we can go in describing our Reality, made up also of mass and its corollary, the gravitational field, as well as of the electric and magnetic fields (although we shall leave the latter aside).

Within this theory of the IBOZOO UU, we must logically try to explain the phenomenon of mass, and the gravitational field it generates, with the resources of angular differences between the “IOAWOO” of the EP that define our WAAM (or any other).

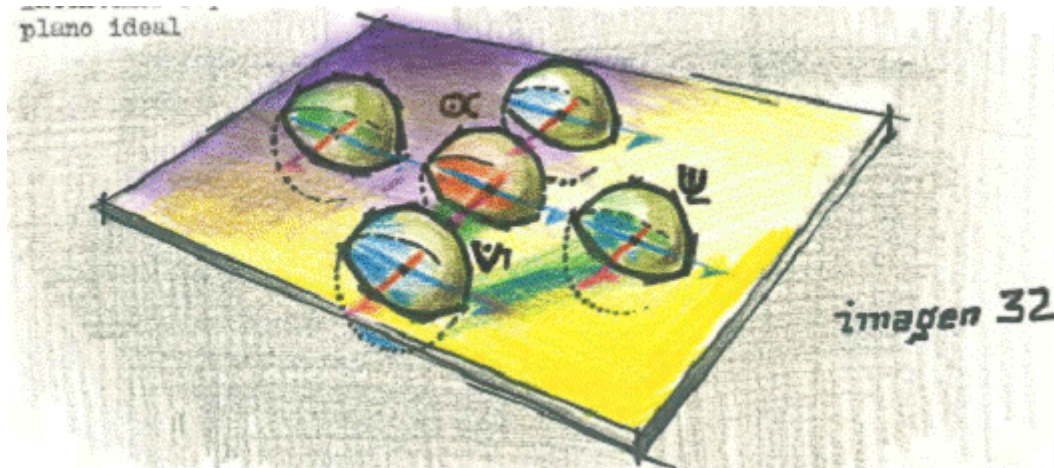
Based on the scattered information present in the letters and tweets received over 58 years, we conjecture that, for the EP to be able to describe reality, it is enough for us to consider that they have 12 orthogonal orientations, 12 OAWOO. Since we have used 6 of them to describe three-dimensional space and time, we are left with another 6: the “mallet” of our didactic visual aid, the mushroom.

As a first simplification, we can imagine the phenomenon of mass in a network of EP as an angular separation in a plane, that is, in a 2D orientation orthogonal to the 6D orientation formed by the sextet that describes space-time. That is, if all the EP that make up a small spatial neighbourhood have their mass IOAWOO aligned in the same direction, but within that set of EP we find a small linked subset, a network of EP, that differs by a certain angular amount from the rest of the EP describing the surrounding space, we shall say that, in this case, that network is endowed with a singularity, and that is what we call mass.

How does this singularity operate, how does it modify the conditions of its surroundings? The truth is that we have no direct answer. Nevertheless—and I have already warned that what follows is highly speculative—we find throughout the communications from OOMO a series of pieces of information that allow us to dare to speculate.

1. [D59-4](#): “Let us try to represent ideally an AYUU (NETWORK) of IBOZOO UU on an ideal plane, in such a way that none of the IBOZOO UU orients any of the [OAWOO](#) (“AXES”) that compose it perpendicularly to the [fictitious Plane](#) we have drawn with coloured pencil leads (IMAGE 32). We say that () is “connected” with () (DUUOII) and that () is DUUOII (connected) with ()... An OEMII will consider that network “EMPTY”. He will illusorily identify it with

NOTHINGNESS. For him there will be no MATTER, no GRAVITATIONAL or ELECTROMAGNETIC FIELDS, no WEAK INTERACTIONS, no NUCLEAR INTERACTIONS. In short: he will extrapolate such an (AYUU) (NETWORK) from the COSMOS he knows.



But imagine that the IBOZOO UU represented in ORANGE orients one of its OAWOO, which we call OAWOO YEY, at an angle that we idealize in (IMAGE 33) as $\alpha = (\pi/6)$ radians.”

2. [W1](#): “We never act according to the reductionist logic that would be either to link everything to WOA as a root cause of a Multi-Universe whose evolution is deterministic in every detail, or in assuming *the entire WAAM-WAAM is governed solely by the stochastic physical laws that apply to the underlying chains of EBOZZOOO we use to model it.*”

3. [D105-1](#): “Imagine an immense plain, or perhaps a gigantic table, over which millions of playing cards have been spread uniformly and symmetrically, face down. Deliberately, a player has laid out a long row of identical cards, perhaps the ACE of CLUBS, one of which has been placed face up. An observer flying a few decimetres above the immense gaming table in an imaginary helicopter would see nothing but a great surface covered with the colour of the backs of the cards, and, as the dominant note of colour, the ACE of CLUBS turned face up.

The cards represent the IBOZOO UU.

A hidden player under the table can make the pilot of the vehicle believe that the card “advances”, “runs” across the table. With a rod, and through holes in the table, he successively turns over all the ACES OF CLUBS that were on the board, laid out in a row, taking care to turn the previous ones face down.

If he is skilful and does it at dizzying speed, the observer will suffer the optical illusion that our reference card skates, slides, when in reality not a single one of the multicoloured cards has moved from its original position.

But he can carry his joke further still. Each time he turns up an ACE OF CLUBS he also turns over one adjacent card, two in the second operation, three in the next... so that the observing pilot sees the ACE OF CLUBS not only “slide”, but a whole polychromy of cards appear magically around it.

Perhaps the example would have been more fortunate had we replaced the cards by many-faced polyhedra, which would better represent some IBOZOO UU, but this model would then have lost expository simplicity.”

All the above may seem very insufficient as information (and it is), and we may even point out that mass is never mentioned; but in point 1 we see that they show how a set of IBOZOO UU describing a plane has its OAWOO YEY orientation aligned with the plane. In this case there is nothing in that space, only empty space. But suddenly one of the IBOZOO UU orients its OAWOO YEY at a certain angle, which makes it a singularity. Mysteriously, the Oomen leave it there, but we can see that it is something very similar to what I speculated about, a few paragraphs above, as an angular mass depression.

In the series of tweets by OAXIIBOO 6 that we have grouped under the heading W1, we see that they tell us they work on the assumption that all physical laws are stochastic, that is, that random processes intervene in them and make their outcome unpredictable. It is true that the laws of large numbers, statistical probabilities, lead to laws of deterministic appearance even when individual behaviours are random, haphazard or unpredictable.

Finally, in letter D105-1, they represent the evolution of the IBOZOO UU in time in a cryptic but thought-provoking way. We saw in the previous chapter how a network of connected EP that have their temporal OAXOO aligned ([note that the Oomen specifically use the terms OAXOO and IOAXOO, instead of the more general OAWOO, to refer to the OAWOO and IOAWOO that describe space \(UXGIGII\) and time \(UIWII\)](#)) will, at the next instant (UIWIIIOO), be represented by another network of EP that will (or will not, as the case may be) have slightly varied its OAXOO and its OAWOO. Here, in this letter D105-1, they show us how the particle—the pair of connected EP or the network of EP that describe it—comes to be described at the next UIWIIIOO by another network, apparently identical; but the curious thing is that beside it a progressively larger number of multicoloured cards keep appearing. It is as if the singularity that represented that particle, that network of EP, were progressively “infecting” its surroundings at a constant speed.

Linking all this together, I venture to propose an interpretation.

An elementary particle, a specific mass, is described by a network of connected EP which, besides describing its position in space and time, have their mass axis, their IOAWOO YEY, rotated by a given angle with respect to the neutral orientation. This network of IOAWOO, of angular micro-segments describing a micro-volume in space and a given instant in time, is endowed with a singularity in its angular mass orientation (YFY?). What happens next, once an instant UIWIIIOO has elapsed? That network is replaced by another with its spatial orientations infinitesimally modified in a random way. But, according to letter D105-1, that singularity gradually spreads to its surroundings. Progressively, one quantum of distance per quantum of

time (at the speed of light, c), that singularity, that angular separation of the particle, propagates into its spatial surroundings.

With all this, I ask myself: does the creation of this depression orthogonal to space-time around that mass singularity not suggest to us Einstein's General Relativity?

I asked Claude to help me give mathematical body to this intuition.

Mass and gravity in the matrix representation of the EP (sketch)

1. Eight orientations. Of the twelve orientations of each EP, six describe space-time (previous box). We now take two more, m and n , which form the plane in which the OAWOO YEY rotates: the "plane of mass". The remaining four stay in the mallet. The matrix of an EP with respect to the reference EP is written in blocks:

$$M = \begin{pmatrix} M_{ET} & C \\ C' & M_m \end{pmatrix}$$

with M_{ET} of order 6 (space-time), M_m of order 2 (mass) and C , C' the cross blocks. In an empty region, such as the AYUU of D59-4, $C = 0$ and $M_m = I$, and we recover exactly the picture of special relativity.

2. The singularity. A network of EP whose OAWOO YEY is rotated by an angle μ with respect to the neutral orientation (the example of D59-4 is $\mu = \pi/6$) has

$$M_m = \begin{pmatrix} \cos\mu & -\sin\mu \\ \sin\mu & \cos\mu \end{pmatrix}$$

If the cross blocks remained zero, that rotation would have no projection onto space-time: mass would be invisible. Our hypothesis is that the singularity acts because the space-time orientations of the EP in its neighbourhood tilt towards the plane of mass. In the simplest case, a tilt $\beta(r)$ in the plane formed by the radial direction $\hat{r}$ (the one pointing away from the singularity) and the axis m :

$$\begin{pmatrix} \cos\beta & \sin\beta \\ -\sin\beta & \cos\beta \end{pmatrix}$$

so that $C \neq 0$, with elements of the order of $\sin\beta$.

3. What general relativity says: the depression exists. Flamm (1916) showed that the geometry of space around a spherical mass M is exactly that of a three-dimensional hypersurface curved towards a fourth orthogonal direction w :

$$w(r) = 2\sqrt{r_s(r - r_s)}, \quad r_s = \frac{2GM}{c^2}$$

The tilt of that hypersurface, $\tan\beta = dw/dr$, satisfies exactly

$$\sin^2\beta = \frac{r_s}{r} = \frac{2GM}{c^2 r}$$

It is, literally, the “orthogonal depression” of our intuition.

4. A single angle for space and for time. With that same angle, the complete Schwarzschild metric is written

$$ds^2 = \cos^2\beta \, c^2 dt^2 - \frac{dr^2}{\cos^2\beta} - r^2(d\theta^2 + \sin^2\theta \, d\varphi^2)$$

$\cos\beta$ is the rate of clocks (gravitational time dilation); $1/\cos\beta$, the stretching of radial rulers; and $\sin\beta = v_{esc}/c$, the escape velocity in units of c . Some values: at the surface of the Earth $\beta \approx 7,7''$; at that of the Sun, $\beta \approx 0,12^\circ$; on a white dwarf, $\beta \approx 1,2^\circ$; on a neutron star, $\beta \approx 36^\circ$. At the horizon of a black hole, $\beta = 90^\circ$: the spatial orientation has become “vertical” and nothing comes back.

5. How many orientations are needed? Schwarzschild space-time does not fit into 5 flat dimensions (Kasner, 1921), but it does fit into 6 (Fronsdal, 1959): exactly two more than the four of space-time, a plane. Fronsdal’s embedding is

$$z_1 = 2r_s\sqrt{1 - r_s/r} \sinh \frac{ct}{2r_s}, \quad z_2 = 2r_s\sqrt{1 - r_s/r} \cosh \frac{ct}{2r_s}$$

$$\left(\frac{dz_3}{dr}\right)^2 = \frac{r_s}{r} \left(1 + \frac{r_s}{r} + \frac{r_s^2}{r^2}\right), \quad (z_4, z_5, z_6) = r(\sin\theta\cos\varphi, \sin\theta\sin\varphi, \cos\theta)$$

with $ds^2 = dz_1^2 - dz_2^2 - dz_3^2 - dz_4^2 - dz_5^2 - dz_6^2$. In it, time appears as a hyperbolic angle in the plane (z_1, z_2) , with a “radius” proportional to $\cos\beta$: a remarkable echo of the $\check{T}$ of D59-3, condemned to move in a plane.

6. Stochastic dynamics (D105-1). Let $\sigma = \sin^2\beta$. If the singularity “spreads” to its surroundings by means of random jumps that never exceed one quantum of distance per UIWIIIOO, then on a large scale σ obeys a telegraph-type equation (Kac), with propagation speed c :

$$\frac{1}{c^2} \frac{\partial^2 \sigma}{\partial t^2} + \frac{1}{cL} \frac{\partial \sigma}{\partial t} - \nabla^2 \sigma = \frac{8\pi G}{c^2} \rho$$

where L is the mean persistence length of the jumps and ρ the mass density. In the stationary regime we are left with Poisson’s equation, $\nabla^2 \sigma = -8\pi G\rho/c^2$, whose solution

outside a point mass is

$$\sigma = \frac{2GM}{c^2 r} = \frac{r_s}{r}$$

This is exactly the Flamm and Schwarzschild relation of point 3. Changes propagate at speed c : the “polychromy” of cards of D105-1, growing by one quantum each UIWIIIOO.

7. Assessment. *The scheme accounts for the shape of the field (in $1/r$), for its propagation speed (c), and for the curvature of space and the dilation of time from a single angle. It also accounts for the equivalence principle, because β is a property of the network of EP and not of the body passing through it: everything falls in the same way. It does not account for the value of G , for the non-linearity of Einstein’s equations (the energy of the field itself also gravitates), for rotating masses or for cosmology. Nor does it clarify the role of the damping term, since gravitational waves are not attenuated in that way. Finally, the relationship between the rotation μ of the singularity and the tilt β it produces in its surroundings is a postulate, not a deduction.*

Note. The results of Flamm, Kasner, Fronsda and Kac belong to our physics. What the EP contribute is the reading: mass does not curve space; it tilts the space-time orientations of neighbouring EP towards its own plane. Gravity is an angle.

TOPIC 3. Final comments

2.1.

There would remain many things in our physical Reality to explain with this theory of the IBOZOO UU: the electric and magnetic fields, attractive and repulsive forces, motion, energy... but I believe the Oomen have deliberately avoided going any further.

The attentive reader will detect a great many unexplained things, leaps without a safety net in the reasoning, and contradictions. Some of them, I think, are not really so, but I cannot go any further, and so I am going to leave this part unfinished, although I hope to keep adding things as I let them mature, give them coherence and weave them together.

Thank you very much for reading this far,

Manuel R.

(1st version, October 2026)