5.7.2.2. The Traditional Display of the Minkowski space

In Figure 5.54 we display the extension in two dimensions γ_1, γ_2 (two 1-vector ***directions***) as an extension plane $\gamma_1\gamma_2$, supported by an ordinary spacelike bivector ***direction*** $\gamma_1\gamma_2$, where

(5.332) $(\gamma_1\gamma_2)^2 = \gamma_1\gamma_2\gamma_1\gamma_2 = -\gamma_1\gamma_1\gamma_2\gamma_2 = -1.$

We 'look' into the depth of the passed side of this extension plane of Figure 5.54 with a unit circle ring ○ symbolising the rotation symmetry around the information development ***direction***. Then we have two ***directions*** of the two Minkowski $\mathcal{B}_k$-bivector-planes

(5.333) $\mathcal{B}_1 \coloneqq \gamma_1\gamma_0, \quad \mathcal{B}_2 \coloneqq \gamma_2\gamma_0, \quad \text{with} \quad \mathcal{B}_1^2 = \mathcal{B}_2^2 = 1.$

We add these two together as a function of the circular rotation with the Euler angle argument θ

(5.334) $\mathcal{B}_\theta = \cos(\theta)\mathcal{B}_1 + \sin(\theta)\,\mathcal{B}_2 \quad = \gamma_\theta\gamma_0 = \quad (\cos(\theta)\gamma_1 + \sin(\theta)\,\gamma_2)\gamma_0$

Right multiplying the last parenthesis with $-\gamma_1\gamma_1$=1 we achieve the Euler rotation

(5.335) $\mathcal{B}_\theta = \gamma_\theta\gamma_0 = \quad (\cos\theta + \gamma_1\gamma_2\sin\theta)\gamma_1\gamma_0 = \quad (e^{\gamma_1\gamma_2\theta})\mathcal{B}_1.$

To intuit this, we project the subject $\mathcal{B}$-planes $\mathcal{B}_1, \mathcal{B}_2$, and $\mathcal{B}_\theta$ into our object plane given by $\boldsymbol{i} \coloneqq \boldsymbol{\sigma}_2\boldsymbol{\sigma}_1$, using the projection mapping operation rules expressed in (5.328)

(5.336) $\boldsymbol{\sigma}_1 \overset{\leftarrow}{=} \gamma_1\gamma_0 = \mathcal{B}_1, \qquad \boldsymbol{\sigma}_2 \overset{\leftarrow}{=} \gamma_2\gamma_0 = \mathcal{B}_2, \quad \text{and} \quad \hat{\mathbf{r}}_\theta \overset{\leftarrow}{=} \gamma_\theta\gamma_0 = \mathcal{B}_\theta = e^{\gamma_1\gamma_2\theta}\mathcal{B}_1 \overset{\rightarrow}{=} e^{\boldsymbol{i}\theta}\boldsymbol{\sigma}_1.$

Now the extension plane supported by $\gamma_1\gamma_2$ is mapped into the Euclidean plane supported by $\boldsymbol{i} = \boldsymbol{\sigma}_2\boldsymbol{\sigma}_1 \overset{\leftarrow}{=} \gamma_1\gamma_2$. Here the rotation is described by the 1-rotor $\hat{\mathbf{r}}_\theta\boldsymbol{\sigma}_1 = e^{\boldsymbol{i}\theta}$, for $\forall\theta \in \mathbb{R}$.
Also for the $\mathcal{B}_\theta$ ***direction***, we note that $\gamma_\theta^2 = -1$ is Minkowski space extension signature (−).
The nilpotent isotropic signal of information from the isometric idea $|\gamma_\theta| = |\gamma_0| = 1$ when gives the *null line* balance $|\tau\gamma_\theta| = |\tau\gamma_0| = \tau \in \mathbb{R}$. This *null line* situation is rotated with $e^{\gamma_1\gamma_2\theta}$ around the development ***direction*** γ_0 in a so-called *null cone*. When inside this cone, information can be exchanged for future expectations called events or from passed phenomena called memory.
The development is driven by the circling oscillator ○$= e^{\gamma_1\gamma_2\theta} \overset{\leftarrow}{=} e^{\boldsymbol{i}\theta} = e^{\boldsymbol{i}\theta\omega\tau}$, where the phase angle is $\theta = \omega\tau = \tau$ by defining the development parameter $\tau \in \vec{\mathbb{R}}\,[\widehat{\omega}^{-1}]$, setting its frequency energy $\omega = \widehat{\omega} \coloneqq 1[\widehat{\omega}]$ as the counting clock norm. Then null tangent on the *null cone* seems to follow a conic spiral with expanding radius of $c|\theta\gamma_\theta| = c|\tau\gamma_\theta|$ relative to the reference $|\gamma_0|$=1. For $|\theta|$ >1 the tangent speed of the oscillator rotating *null cone* in the display will grow and exceed the speed of information $c1$. It is obvious that the extended circumference arcus speed of the circle oscillator does not exceed $c1$, (c=1) therefore a unit circle oscillator $|\hat{\mathbf{r}}_\theta|=|\gamma_\theta|=|\gamma_0|$=1 is the binding. The plane rotation $e^{\boldsymbol{i}\theta} = e^{\boldsymbol{\sigma}_2\boldsymbol{\sigma}_1\theta} = e^{\gamma_1\gamma_2\theta}$ initiates a third normal extension ***direction*** $\boldsymbol{\sigma}_3 \overset{\leftarrow}{=} \gamma_3\gamma_0$ as an axis of rotation in $\mathfrak{Z}$-space.[275] The a priori idea is, that information development isometry is isotropic distributed over all extended ***directions*** in $\mathfrak{Z}$-space, whence we judge

(5.337) $|\gamma_\theta| = |\gamma_1| = |\gamma_2| = |\gamma_3| = |\gamma_0| = 1.$

From this isotropic isometry, we have ambiguity in what space extension ***direction*** to intuit for ***one quantum*** of information as a unit ***direction*** $\mathcal{B}$-bivector. The information isometry can only follow one nilpotent pair *null lines* ***direction*** $\mathcal{B} = \mathcal{n}\wedge\overline{\mathcal{n}}$ inside its Minkowski $\mathcal{B}$-plane ***direction***.
One intuit picture is the oscillation rotation of the information $\mathcal{B}_\theta$-plane has one persistent oscillating 1-vector extension ***direction*** γ_θ always orthogonal to the future-oriented development ***direction*** γ_0 principal isotropic in all spatial ***directions*** a priori orthogonal to all these extensions $\forall\gamma_\theta\cdot\gamma_0 = 0$, it can be perpendicular to some extensions $\gamma_0 \perp \gamma_\theta$ and parallel to one other ***direction***, e.g. $\gamma_0 \parallel \gamma_3$, but still always orthonormal $\gamma_0\cdot\gamma_k = 0$ and $|\gamma_\mu| = 1$, $\mu = 0{,}1{,}2{,}3$, as .
Actively γ_0 can be parallel with one straight line extension ***direction*** e.g., $\boldsymbol{\sigma}_3 \overset{\leftarrow}{=} \gamma_3\gamma_0$, $\gamma_3\cdot\gamma_0 = 0$ and ambiguously simultaneous bee curved[276] along the circumference arcus of the oscillating unit circle radius $|\hat{\mathbf{r}}_\theta| = |\gamma_\theta|$=1 so that $\gamma_0 \perp \gamma_\theta$ and substantial $\gamma_0\cdot\gamma_\theta = 0$, (see below Figure 5.55).

[275] In chapter 6 we will look further into the structure of the three-dimensional natural $\mathfrak{Z}$-space
[276] The ideology of a tangent vector is not necessary strait. Straitens of a non-extensive development γ_0 ***direction*** has no meaning.

Only one ***direction*** in the form of a $\mathcal{B}_\theta$-plane can participate in the propagation of ***one quantum*** of active information at a time. This ***quantum direction*** is the nilpotent unit (5.312) $\mathcal{B}_\theta = \mathcal{n}\wedge\overline{\mathcal{n}}$. To possess the ***quality*** of autonomous extension for an ***entity*** it has to give its own measure in form of an oscillator giving the a priori count of development. The frequency energy of this oscillator we use as the norm i.e., $|\omega|$=1. The ***direction*** of oscillation we describe by the Euclidean plane bivector $\gamma_1\gamma_2 \overset{\rightarrow}{=} \boldsymbol{\sigma}_2\boldsymbol{\sigma}_1 = \boldsymbol{i}$. The ***direction*** of development γ_0 is orthonormal to both γ_1 and γ_2 expressed by (5.303). The bivector idea $(\gamma_1\gamma_2)$ is also orthogonal to γ_0 in that the inner product

(5.338) $\gamma_0\cdot(\gamma_1\gamma_2) = ½(\gamma_0\gamma_1\gamma_2 - \gamma_1\gamma_2\gamma_0) = 0.$[277]

Hereby we decide on a shortcut and promote the subject idea $(\gamma_1\gamma_2)$ to the object $\boldsymbol{\sigma}_2\boldsymbol{\sigma}_1 = \boldsymbol{i}$

(5.339) $\gamma_1\gamma_2 = \boldsymbol{\sigma}_2\boldsymbol{\sigma}_1 = \boldsymbol{i} = \boldsymbol{i}_3$

and name $\boldsymbol{i}_3$ for the plane bivector seen from a third extension direction (see below Figure 5.55). The plane circle oscillator for the autonomous isometric measure is short

(5.340) ○ $= e^{\gamma_1\gamma_2\theta} = e^{\boldsymbol{i}\theta} = e^{\boldsymbol{i}_3\theta}.$

This circular oscillating 1-rotor of form $e^{\boldsymbol{i}\theta}$ for the Euclidean plane leaves all the multivectors we have treated above invariant, but of course, changes their ***directions***. Special the $\mathcal{B}_\theta$-bivector ***direction*** is rotated in this oscillation. Inside this $\mathcal{B}_\theta$-plane the nilpotent *null* ***directions*** $\mathcal{n}$ and $\overline{\mathcal{n}}$ is invariant preserved also by the hyperbola transformation (5.322).

[277] Here we use the mixed grade rule (6.43) below.
When it comes to the wedge part $\gamma_0\cdot(\gamma_1\gamma_2) = ½(\gamma_0\gamma_1\gamma_2 - \gamma_1\gamma_2\gamma_0) = \gamma_1\gamma_2\gamma_0 = \mathcal{i}\gamma_3$ we get a 3-vector as later below III. (7.15), where this three-vector concept is dual to the 1-vector idea γ_3 by the ***grade***-4 pseudoscalar $\mathcal{i}$ of STA.

For quotation reference use: ISBN-13: 978-8797246931