'transverse' Clifford conjugated ***direction*** null 1-vector $\tilde{0}\overline{n}$, $(\tilde{0}\overline{n})^2 = 0$ *never vanish*. We always have the invariant result (5.314) $n\overline{n} = (\tilde{\infty}n)(\tilde{0}\overline{n}) = 1 + \mathcal{B}$ of this hyperbola transformation.

5.7.1.3. The $\mathcal{B}$-bivector as an Information *Signal*

Of course, the ***non-directional*** scalar unit 1 is always preserved as the neutral element.
The defined pseudoscalar $\mathcal{B} \coloneqq \gamma_1\gamma_0 \Leftrightarrow n\wedge\overline{n} = \mathcal{B}$ as an $\mathcal{B}$-bivector supporting the Minkowski $\mathcal{B}$-plane is also always preserved by a hyperbola transformation. This pseudoscalar $\mathcal{B}$-bivector is defined as the product of the extension unit γ_1 acting on the information development unit γ_0.
The foundation idea of this is, that the propagating information *signal* about the extension has to be in balance. The primary *isometric measure* for this is the quadratic forms in balance (5.302)

(5.325) $\quad \gamma_0^2 + \gamma_1^2 = 0 \quad \Leftrightarrow \quad \gamma_0^2 = -\gamma_1^2,$

that demand the Clifford geometric algebra $\mathcal{G}_{1,1}(\mathbb{R})$ with signatures $(+,-)$.
In the natural geometric plane, we separate two points A, B by defining an ordinary unit 1-vector $\boldsymbol{\sigma}_1 \coloneqq \overrightarrow{AB}$, with $\boldsymbol{\sigma}_1^2{\coloneqq}1$ as an ordinary metric signature $(+)$ in Euclidean line $\mathcal{G}_{1,0}(\mathbb{R})$, plane $\mathcal{G}_{2,0}(\mathbb{R})$ or space $\mathcal{G}_{3,0}(\mathbb{R})$. We settle out with the simple algebra of $\mathcal{G}_{1,0}(\mathbb{R})$ with the basis $\{1{=}\boldsymbol{\sigma}_1^2, \boldsymbol{\sigma}_1\}$.
Here there is no pseudoscalar as $\lambda_1\boldsymbol{\sigma}_1\wedge\boldsymbol{\sigma}_1 = 0$ only the scalar auto-product $\boldsymbol{\sigma}_1{\cdot}\boldsymbol{\sigma}_1 = \boldsymbol{\sigma}_1\boldsymbol{\sigma}_1 = \boldsymbol{\sigma}_1^2{=}1$, as the quadratic measure. The extension magnitude of this is $|\boldsymbol{\sigma}_1| = \sqrt{\boldsymbol{\sigma}_1{\cdot}\boldsymbol{\sigma}_1} = 1$.
In the tradition, this represents a ruler line ***direction*** drawn on a plane surface through A and B.
As an external view, we let the abstract Minkowski $\mathcal{B}$-plane substance be projected into the plane surface, where we draw the 1-vector object $\boldsymbol{\sigma}_1 \coloneqq \overline{AB}$ one-to-one analogue to the physical extension ***direction*** in natural space. The idea is, that the $\mathcal{B}$-bivector is projection mapped onto $\boldsymbol{\sigma}_1$ Figure 5.52:

(5.326) $\quad \mathcal{B} \longrightarrow \mathcal{B} \coloneqq \gamma_1\gamma_0 = \mathcal{B}_1 \longrightarrow \boldsymbol{\sigma}_1$

The defined $\mathcal{B}$-bivector supports the Minkowski $\mathcal{B}$-plane ***direction*** governed by the stable invariant *null line* ***directions*** (5.310) of the *null basis* $\{n,\overline{n}\}$ with $n\wedge\overline{n} = \mathcal{B}$. The 1-vector $\boldsymbol{\sigma}_1$ support the objective ***direction*** of a physical line. The abstraction is the ***direction*** map:

(5.327) $\quad \boldsymbol{\sigma}_1 \leftrightarrow n\wedge\overline{n}.$

We interpret the $\mathcal{B}$-bivector $\mathcal{B} = n\wedge\overline{n}$ as the *isotropic*[272] *signal of* the objective unit ***direction*** $\boldsymbol{\sigma}_1$.
The force of Geometric Algebra is, that the maps are replaced by multiplication operations.
We make the direct connection $\gamma_1\gamma_0 \leftrightarrow \boldsymbol{\sigma}_1$ and replace it with $\boldsymbol{\sigma}_1 \leftleftarrows \gamma_1\gamma_0$. We generalise γ_1 and $\boldsymbol{\sigma}_1$ with more dimensions as γ_k and $\boldsymbol{\sigma}_k$, for k=1,2,3, and get the following multiplication rules

(5.328)

$\boldsymbol{\sigma}_k \leftleftarrows \gamma_k\gamma_0,$	$\boldsymbol{\sigma}_k\gamma_0 \leftleftarrows \gamma_k,$	$\boldsymbol{\sigma}_k\gamma_k \leftleftarrows \gamma_0,$
$-\boldsymbol{\sigma}_k \leftleftarrows \gamma_0\gamma_k,$	$\gamma_0\boldsymbol{\sigma}_k \leftleftarrows -\gamma_k,$	$\gamma_k\boldsymbol{\sigma}_k \leftleftarrows -\gamma_0.$

$\quad \boldsymbol{\sigma}_k \longleftarrow \mathcal{B}_k \coloneqq \gamma_k\gamma_0.$

By this we have introduced a Minkowski space foundation basis $\{\gamma_0, \gamma_1, \gamma_2, \gamma_3\}$ for the metric Clifford algebra $\mathcal{G}_{1,3}(\mathbb{R})$ with signatures $(+,-,-,-)$, we will call it a Dirac-Clifford algebra.[273]

5.7.2. The Traditional Display of the Minkowski $\mathcal{B}$-plane

In the tradition, the time axis is displayed vertically, and the spatial extension is displayed horizontally as in Figure 5.50. Here we try to make an autonomous measure of the development seen from the ***entity*** for our intuition. Therefore, we choose the cyclic ***quantum*** oscillator[274] of the ***entity*** as an autonomous reference and make that unit count from this oscillator the measure of ***one quantum*** count of development γ_0. A space extension γ_k shall as a priori presumption be measured relative to the development as a signal of information about extension in a founding balance as (5.325)

(5.329) $\quad \gamma_0^2 + \gamma_k^2 = 0 \Leftrightarrow \gamma_0^2 = -\gamma_k^2, \quad$ for each $k = 1,2,3,$ $\quad$ as the ***primary quality of isometry***.

[272] The expression *isotropic signal* is the modern way to say Einstein's presumption of constant light speed in all space ***directions***.
[273] We have chosen the basis names γ_μ as Hestenes [6] who mention the isomorphism with the group of Dirac matrices: called γ_μ.
We will look further into this structure of *isotropic information signals* relative to *space extension* below in chapter 7.1. etc…
[274] The ***quantum*** oscillator is introduced and described in chapter I. 3 section 3.6

This is equivalently expressed as the nilpotent *null basis* $\{n,\overline{n}\}$ by (5.311) $n^2 = \overline{n}^2 = 0$, and causes that the isotropic speed of information is one:

(5.330) $\quad c = \dfrac{|\gamma_k|}{|\gamma_0|} = 1, \qquad$ because $|\gamma_0| = |\gamma_k| = 1, \qquad$ (5.303), (5.300)-(5.301).

This is an a priori analytic judgment for the founding measurement of extension by an information signal travelling along the extension. These balanced units are displayed in Figure 5.53 as a S^1 unit circle ○ for the autonomous ***entity*** for the unit basis $\{1, \gamma_0, \gamma_k, \mathcal{B}_k \coloneqq \gamma_k\gamma_0\}$ from ***one quantum*** count measure γ_0 of development for a Minkowski $\mathcal{B}_k$-plane.

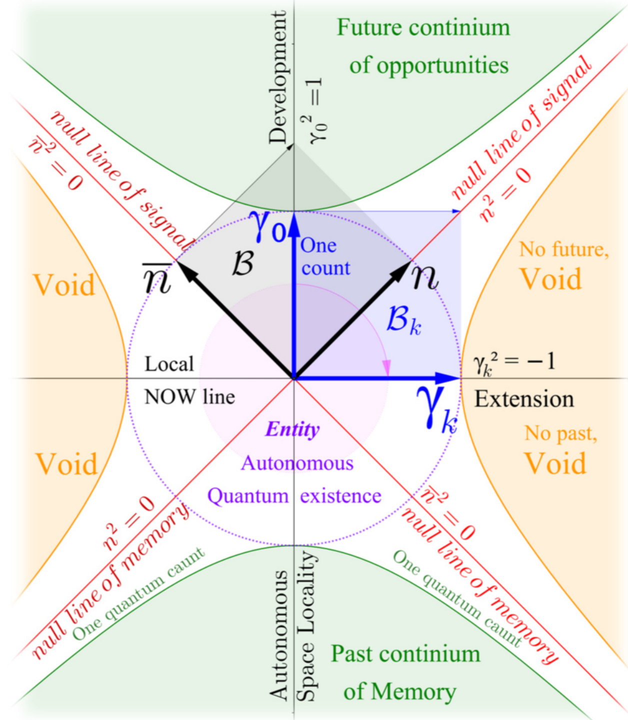

Figure 5.53 The Minkowski $\mathcal{B}_k$-plane in one γ_k extension ***direction*** relative to information development unit count γ_0.
The local origo for the ***entity*** is displayed as the intersection of the Space Locality line for the development ***direction*** and the Local NOW line for the extension ***direction***.
The isotropic *null lines* are an indication of the balance (5.330) $|\tau\gamma_0| = |\tau\gamma_k| = \tau \in\mathbb{R}$ where the speed of information is one.
The invariant hyperbolic transformation (5.322) makes a signal of ***one quantum*** information possible inside the white areas of this display figure. This Minkowski $\mathcal{B}$-plane display makes it possible for YOU (as a Thomas Aquinas GOD) to 'look' into areas of Void, where the autonomous ***entity*** neither can experience any information signals by light nor gravitation.

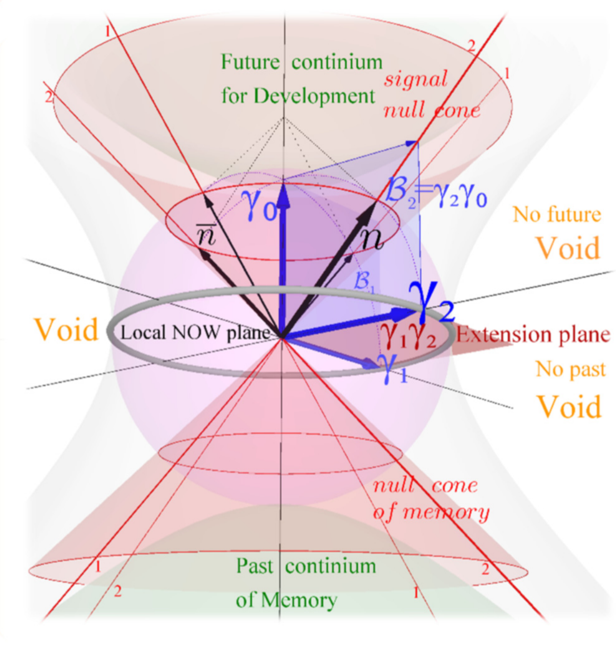

Figure 5.54 The Minkowski space with two γ_1, γ_2 extension ***directions*** forming the extension plane $\gamma_1\gamma_2$ ***direction*** relative to the development unit count γ_0. The local origo for the ***entity*** is now the intersection of the space locality line for the development ***direction*** and the local NOW plane of the extension plane ***direction***. The isotropic *null cone* is an indication for the balance $|\tau\gamma_0| = |\tau\gamma_\theta| = \tau \in\mathbb{R}$, where $\gamma_\theta = \cos(\theta)\,\gamma_1 + \sin(\theta)\,\gamma_2 = (\cos\theta + \gamma_1\gamma_2\sin\theta)\gamma_1 = e^{\gamma_1\gamma_2\theta}\gamma_1$ for the rotational plane symmetry of this *null cone*.
In that $\gamma_1\gamma_2 = -\gamma_2\gamma_1 = \gamma_2\gamma_0\gamma_1\gamma_0 = \boldsymbol{\sigma}_2\boldsymbol{\sigma}_1 = \boldsymbol{i}$ for the extension plane, we have $\gamma_\theta = e^{\boldsymbol{\sigma}_2\boldsymbol{\sigma}_1\theta}\gamma_1$, for the rotation.
Letting this act on the development symmetry γ_0 we get $\mathcal{B}_\theta = \gamma_\theta\gamma_0 = e^{\boldsymbol{\sigma}_2\boldsymbol{\sigma}_1\theta}\gamma_1\gamma_0 \;\leftrightarrow\; \hat{\mathbf{r}}_\theta = e^{\boldsymbol{\sigma}_2\boldsymbol{\sigma}_1\theta}\boldsymbol{\sigma}_1$. Using the Euclidian plane pseudoscalar $\boldsymbol{i} = \boldsymbol{\sigma}_2\boldsymbol{\sigma}_1$ the oscillation is $e^{i\theta}$.

The white areas along the *null lines* in Figure 5.53 are where ***one quantum*** of development is an isometric measure of one unit of extension. This unit measure $n\overline{n} = 1 + \mathcal{B}$, (5.314) or just the $\mathcal{B}$-bivector is invariant by hyperbola transformation (5.319) as (5.320) $\mathcal{B}_k = \gamma_k(\lambda)\gamma_0(\lambda)$, for $\forall\lambda \in\mathbb{R}$, $\lambda \neq 0$, in its ***direction*** and magnitude, $\mathcal{B}_k^2{=}1$. Here in one dimension of the extension ***direction*** γ_k, the invariant $\mathcal{B}_k$-bivector seems to have no restriction against development by $x^0\gamma_0$, $x^0 \in\mathbb{R}$ of the extension $x^k\gamma_k$, $x^k \in\mathbb{R}$, as long as the memory knowledge of the past, giving

(5.331) $\quad |x^k| \leq |x^0|$, for k=1,2,3.

Note we use upper indices x^k for the contravariant coordinates due to the mixed metric (5.300)-(5.301).