Mapping Penrose-Rindler Null Tetrads to the Advanced and Retarded Wheeler-Feynman-Aharonov Destiny & History Null Tetrads

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Abstract
This is a short mathematical note clarifying the use of Cramer's Transactional Interpretation in the Spinor Qubit Pre-Geometry of Wheeler's IT FROM BIT.

The mapping of the Penrose-Rindler Cartesian null tetrad of orthonormal base vectors to the Wheeler-Feynman tetrad of advanced and retarded 2D spherical wave front orthonormal base vectors is independent of the area/entropy of the wave fronts in the sense of the small 4D regions of LIFs in curved space-time.[1]

$$\begin{aligned}\hat{e}_R &\equiv \hat{R} \equiv \sin\theta\cos\phi\hat{i} + \sin\theta\sin\phi\hat{j} + \cos\theta\hat{k}\\ \hat{e}_\theta &\equiv \hat{\theta} \equiv \cos\theta\cos\phi\hat{i} + \cos\theta\sin\phi\hat{j} + \sin\theta\hat{k}\\ \hat{e}_\phi &\equiv \hat{\phi} \equiv -\sin\phi\hat{i} + \cos\phi\hat{j}\end{aligned} \tag{1.1}$$

Using Roger Penrose's "abstract index notation" the Cartesian tetrad world vectors are mapped to the Einstein-Podolsky-Rosen entangled Bell pair quantum states of 2 qubit strings.

$$\begin{aligned}\hat{i} &\to \frac{1}{\sqrt{2}}\left(o^A\iota^{A'} + i^A o^{A'}\right)\\ \hat{j} &\to \frac{1}{\sqrt{2}}\left(o^A\iota^{A'} - i^A o^{A'}\right)\\ \hat{k} &\to \frac{1}{\sqrt{2}}\left(o^A o^{A'} - i^A\iota^{A'}\right)\\ \hat{t} &\to \frac{1}{\sqrt{2}}\left(o^A o^{A'} + i^A\iota^{A'}\right)\end{aligned} \tag{1.2}$$

The mapping to the spherical wave advanced and retarded Wheeler-Feynman tetrads comes from the orthogonal transformation of spherical trigonometry. Hence

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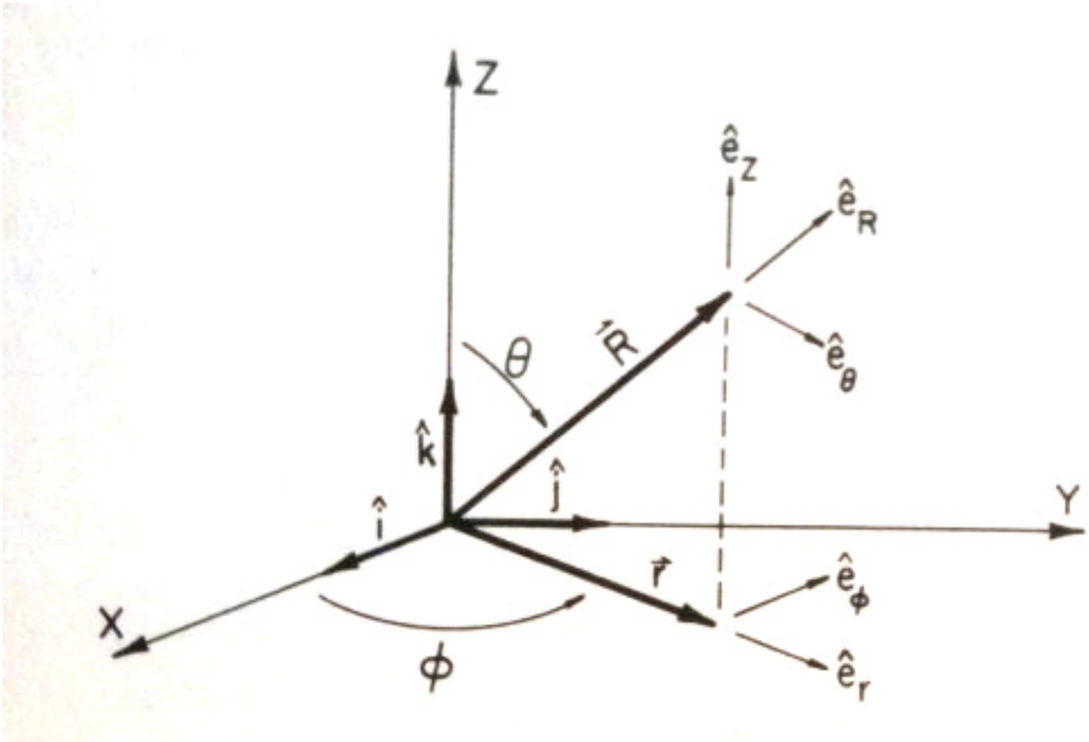
[1] From the equivalence principle (SEP) the LIF metric field is approximately Minkowski as in 1905 Special Relativity even though the spacetime is curved and the local 4^{th} rank curvature tensor need not be globally zero.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$$
\begin{aligned}
&\ell_{adv} \equiv \frac{1}{\sqrt{2}}\left(\hat{t}+\hat{R}\right) \\
&\rightarrow \frac{1}{2}\begin{pmatrix} \left(o^A o^{A'} + i^A \iota^{A'}\right) + \sin\theta\cos\phi\left(o^A \iota^{A'} + i^A o^{A'}\right) \\ +\sin\theta\sin\phi\left(o^A \iota^{A'} - i^A o^{A'}\right) + \cos\theta\left(o^A o^{A'} - i^A \iota^{A'}\right) \end{pmatrix} \\
&= \frac{1}{2}\begin{pmatrix} (1+\cos\theta) o^A o^{A'} + (1-\cos\theta) i^A \iota^{A'} + (\sin\theta\cos\phi + \sin\theta\sin\phi) o^A \iota^{A'} \\ +(\sin\theta\cos\phi - \sin\theta\sin\phi) i^A o^{A'} \end{pmatrix} \\
&n_{ret} \equiv \frac{1}{\sqrt{2}}\left(\hat{t}-\hat{R}\right) \\
&\rightarrow \frac{1}{2}\begin{pmatrix} \left(o^A o^{A'} + i^A \iota^{A'}\right) - \sin\theta\cos\phi\left(o^A \iota^{A'} + i^A o^{A'}\right) \\ -\sin\theta\sin\phi\left(o^A \iota^{A'} - i^A o^{A'}\right) - \cos\theta\left(o^A o^{A'} - i^A \iota^{A'}\right) \end{pmatrix} \\
&= \frac{1}{2}\begin{pmatrix} (1-\cos\theta) o^A o^{A'} + (1+\cos\theta) i^A \iota^{A'} \\ -(\sin\theta\cos\phi + \sin\theta\sin\phi) o^A \iota^{A'} - (\sin\theta\cos\phi - \sin\theta\sin\phi) i^A o^{A'} \end{pmatrix} \\
&m_{WF} \equiv \frac{1}{\sqrt{2}}\left(\hat{\theta}+i\hat{\phi}\right) \\
&\rightarrow \frac{1}{2}\begin{pmatrix} \cos\theta\cos\phi\left(o^A \iota^{A'} + i^A o^{A'}\right) + \cos\theta\sin\phi\left(o^A \iota^{A'} - i^A o^{A'}\right) \\ +\sin\theta\left(o^A o^{A'} - i^A \iota^{A'}\right) + i\left(-\sin\phi\left(o^A \iota^{A'} + i^A o^{A'}\right) + \cos\phi\left(o^A \iota^{A'} - i^A o^{A'}\right)\right) \end{pmatrix} \\
&= \frac{1}{2}\begin{pmatrix} \sin\theta\left(o^A o^{A'} - i^A \iota^{A'}\right) + (\cos\theta\cos\phi + \cos\theta\sin\phi - i\sin\phi + i\cos\phi) o^A \iota^{A'} \\ +(\cos\theta\cos\phi - \cos\theta\sin\phi - i\sin\phi - i\cos\phi) i^A o^{A'} \end{pmatrix}
\end{aligned}
\tag{1.3}
$$

Note in the limit $\theta \rightarrow 0$ defining the North Pole we have[2]

$$
\begin{aligned}
&\ell_{adv} \equiv \frac{1}{\sqrt{2}}\left(\hat{t}+\hat{R}\right) \underset{\theta\rightarrow 0}{\rightarrow} o^A o^{A'} \\
&n_{ret} \equiv \frac{1}{\sqrt{2}}\left(\hat{t}-\hat{R}\right) \underset{\theta\rightarrow 0}{\rightarrow} i^A \iota^{A'} \\
&m_{WF} \equiv \frac{1}{\sqrt{2}}\left(\hat{\theta}+i\hat{\phi}\right) \\
&\underset{\theta\rightarrow 0}{\rightarrow} \frac{1}{2}\begin{pmatrix} (\cos\phi + \sin\phi - i\sin\phi + i\cos\phi) o^A \iota^{A'} \\ +(\cos\phi - \sin\phi - i\sin\phi - i\cos\phi) i^A o^{A'} \end{pmatrix} \\
&\rightarrow 0
\end{aligned}
\tag{1.4}
$$

[2] Where the cylindrical radial coordinate in the x-y plane $r \rightarrow 0$ in Fig 1 above. Therefore, the azimuthal longitude ϕ is indeterminate, hence, the last line in (1.4) is ambiguous -- similarly for the South Pole. We can imagine the zero statistical mean of randomly distributed ϕ . Of course, the choice of the polar axis is arbitrary.

Similarly, the South Pole $\theta \to \pi$

$$\begin{aligned}
&\ell_{adv} \equiv \frac{1}{\sqrt{2}}\left(\hat{t} + \hat{R}\right) \\
&\underset{\theta\to\pi}{\longrightarrow} i^{A}\iota^{A'} \\
&n_{ret} \equiv \frac{1}{\sqrt{2}}\left(\hat{t} - \hat{R}\right) \\
&\underset{\theta\to\pi}{\longrightarrow} o^{A}o^{A'} \\
&m_{WF} \equiv \frac{1}{\sqrt{2}}\left(\hat{\theta} + i\hat{\phi}\right) \\
&\underset{\theta\to\pi}{\longrightarrow} \frac{1}{2}\begin{pmatrix} \left(-\cos\phi - \sin\phi - i\sin\phi + i\cos\phi\right)o^{A}\iota^{A'} \\ \left(-\cos\phi + \sin\phi - i\sin\phi - i\cos\phi\right)i^{A}o^{A'} \end{pmatrix} \\
&\to 0
\end{aligned} \tag{1.5}$$