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Instantly Propagating States

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Abstract

The current work considers the sprefield wave functions received as special g-qubit solutions of Maxwell equations in the terms of geometric algebra. I will call such g-qubits spreons or sprefields. The purpose of this article is to analyze behavior of such wave functions in scattering and measurements. It is shown that sprefields are defined through the whole three-dimensional space at all values of the time parameter. They instantly change all their values when get scattered, that is subjected to Clifford translation. In "measurements", when a sprefield acts on a static geometric algebra element through the Hopf fibration, sprefield collapses and new geometric algebra non static, rotating element is thereby created.

Keywords

Wave Functions, Geometric Algebra, Measurements, Scattering, Entanglement

1. Introduction

Usage of even subalgebra G_3^+ of geometric algebra G_3 [1] [2] [3] stems from generalization of complex numbers [3] [4]. The sprefield wave functions (states) received as special G_3^+ solutions of Maxwell equations [5] [6].

In terms of geometric algebra G_3^+, the electromagnetic Maxwell equation in free space

$$\left(\partial_t + \nabla\right) F = 0, \tag{1.1}$$

where $F = F_0 \exp\left[I_S\left(\omega t - k \cdot r\right)\right]$, has two linear independent solutions [3] [5] [6]:

$$\begin{cases} F_+ = \left(e_0 + I_3 h_0\right)\exp\left[I_S \omega\left(t - \left(I_3 I_S\right)\cdot r\right)\right] \\ \quad = \left(e_0 + I_3 h_0\right)\exp\left[I_S \omega t\right]\exp\left[-I_S\left[\left(I_3 I_S\right)\cdot r\right]\right] \\ F_- = \left(e_0 + I_3 h_0\right)\exp\left[I_S \omega\left(t + \left(I_3 I_S\right)\cdot r\right)\right] \\ \quad = \left(e_0 + I_3 h_0\right)\exp\left[I_S \omega t\right]\exp\left[I_S\left[\left(I_3 I_S\right)\cdot r\right]\right] \end{cases} \tag{1.2}$$

For arbitrary scalars λ and μ:

$$\lambda F_+ + \mu F_- = \left(e_0 + I_3 h_0\right) e^{I_S \omega t} \left(\lambda e^{-I_S\left[\left(I_3 I_S\right)\cdot r\right]} + \mu e^{I_S\left[\left(I_3 I_S\right)\cdot r\right]}\right) \tag{1.3}$$

is also solution of (1.1). The item in the second parenthesis is weighted linear combination of two states with the same phase in the same plane but opposite sense of orientation. These states are strictly coupled because bivector plane should be the same for both, does not matter what happens with that plane.

Formula (1.3) does not immediately look like an element of G_3^+ due to the factor $\left(e_0 + I_3 h_0\right)$. But necessary transformations of the initial bivector basis $\left\{B_1, B_2, B_3\right\}$ into triple of unit value orthonormal bivectors $\left\{I_S, I_{B_0}, I_{E_0}\right\}$ where I_S is unit value bivector, dualto the propagation direction vector$k$;unit value I_{B_0} is dual to initial vector of magnetic field h_0; unit value I_{E_0} is dual to initial vector of electric field e_0, change (1.3) into:

$$\lambda e^{I_{Plane}^{+}\varphi^{+}} + \mu e^{I_{Plane}^{-}\varphi^{-}} \tag{1.4}$$

where

$$\varphi^{\pm} = \cos^{-1}\left(\frac{1}{\sqrt{2}}\cos\omega\left(t \mp \left[\left(I_3 I_S\right)\cdot r\right]\right)\right),$$

$$I_{Plane}^{\pm} = I_S \frac{\sin\omega\left(t \mp \left[\left(I_3 I_S\right)\cdot r\right]\right)}{\sqrt{1+\sin^2\omega\left(t \mp \left[\left(I_3 I_S\right)\cdot r\right]\right)}} + I_{B_0} \frac{\cos\omega\left(t \mp \left[\left(I_3 I_S\right)\cdot r\right]\right)}{\sqrt{1+\sin^2\omega\left(t \mp \left[\left(I_3 I_S\right)\cdot r\right]\right)}} + I_{E_0} \frac{\sin\omega\left(t \mp \left[\left(I_3 I_S\right)\cdot r\right]\right)}{\sqrt{1+\sin^2\omega\left(t \mp \left[\left(I_3 I_S\right)\cdot r\right]\right)}}$$

The expression (1.4) is linear combination of two geometric algebra states, g-qubits, which are elements of the form $\alpha + I_{Plane}\beta$ with some arbitrary unit value bivector I_{Plane} in three dimensions.

Let us calculate $\lambda e^{I_{Plane}^{+}\varphi^{+}} + \mu e^{I_{Plane}^{-}\varphi^{-}}$ with $\lambda = \mu = 1$ (the $\sqrt{2}$ is included for normalization to further write the expression as exponent):

$$\begin{aligned}
& e^{I_{Plane}^{+}\varphi^{+}} + e^{I_{Plane}^{-}\varphi^{-}} \\
&= \frac{1}{\sqrt{2}}\cos\omega\left(t - \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) + \frac{1}{\sqrt{2}} I_S \sin\omega\left(t - \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) \\
&\quad + \frac{1}{\sqrt{2}} I_{B_0} \cos\omega\left(t - \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) + \frac{1}{\sqrt{2}} I_{E_0} \sin\omega\left(t - \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) \\
&\quad + \frac{1}{\sqrt{2}}\cos\omega\left(t + \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) + \frac{1}{\sqrt{2}} I_S \sin\omega\left(t + \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) \\
&\quad + \frac{1}{\sqrt{2}} I_{B_0} \cos\omega\left(t + \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) + \frac{1}{\sqrt{2}} I_{E_0} \sin\omega\left(t + \left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right) \\
&= \frac{2}{\sqrt{2}}\cos\omega\left(\left[\left(I_3 I_S\right)\cdot \vec{r}\right]\right)\left(\cos\omega t + I_S \sin\omega t + I_{B_0}\cos\omega t + I_{E_0}\sin\omega t\right)
\end{aligned} \tag{1.5}$$

I will call such g-qubits *spreons* or *sprefields*. The purpose of this article is to analyze behavior of such wave functions in scattering and measurements.

2. Scattering of Sprefields

The sprefield wave function:

$$\begin{aligned} & Sp\left(\omega,\vec{r},t,B_1,B_2,B_3\right) \\ & =\sqrt{2}\cos\omega\left(\left[\left(I_3B_1\right)\cdot\vec{r}\right]\right)\left(\cos\omega t+B_1\sin\omega t+B_2\cos\omega t+B_3\sin\omega t\right) \end{aligned} \tag{2.1}$$

can be written, following multiplication rules of basis bivectors, as:

$$Sp\left(\omega,\vec{r},t,B_1,B_2\right)=R\left(\omega,\vec{r},B_1\right)\left(\mathrm{e}^{B_1\omega t}+\mathrm{e}^{-B_1\omega t}B_2\right) \tag{2.2}$$

where $R\left(\omega,\vec{r},B_1\right)$ is a scalar valued function.

The specifics of (2.1)-(2.2) is that it is a non-local field object instantly spreading its modifications, caused by Clifford translations or by Hopf fibrations ("measurements"), through the whole 3D and time parameter values. In the Hopf fibration new element is created, not static one, opposite to the measured G_3^+ element, with stable rotation characteristics depending on the sprefield wave function parameters.

The scheme suggested in the current text is based on manipulation and transferring of quantum states (wave functions) as operators acting on observables, both formulated in terms of geometrical algebra. Wave functionsact in the current context on static G_3^+ elements through measurements, creating "particles".

Normalized wave functions as elements of G_3^+ are naturally mapped onto unit sphere $\mathbb{S}^3$. Two-state system is then just a couple of points on $\mathbb{S}^3$, $\left\{\alpha_1,\beta_1b_1^1,\beta_1b_1^2,\beta_1b_1^3\right\}$ *and* $\left\{\alpha_2,\beta_2b_2^1,\beta_2b_2^2,\beta_2b_2^3\right\}$, corresponding to wave functions:

$$\mathrm{e}^{I_{S_1}\varphi_1}=\alpha_1+I_{S_1}\beta_1=\alpha_1+\beta_1b_1^1B_1+\beta_1b_1^2B_2+\beta_1b_1^3B_3$$

$$\mathrm{e}^{I_{S_2}\varphi_2}=\alpha_2+I_{S_2}\beta_2=\alpha_2+\beta_2b_2^1B_1+\beta_2b_2^2B_2+\beta_2b_2^3B_3$$

with

$$\left(\alpha_1\right)^2+\left(\beta_1\right)^2\left(\left(b_1^1\right)^2+\left(b_1^2\right)^2+\left(b_1^3\right)^2\right)=\left(\alpha_1\right)^2+\left(\beta_1\right)^2=1$$

$$\left(\alpha_2\right)^2+\left(\beta_2\right)^2\left(\left(b_2^1\right)^2+\left(b_2^2\right)^2+\left(b_2^3\right)^2\right)=\left(\alpha_2\right)^2+\left(\beta_2\right)^2=1$$

in some bivector basis $B_1B_2B_3=1$, with multiplication rules $B_1B_2=-B_3$, $B_1B_3=B_2$, $B_2B_3=-B_1$.

Then it follows that two wave functions of an arbitrary two-function system are, in any case, connected by the Clifford translation[1]:

$$\mathrm{e}^{I_{S_2}\varphi_2}=\left(\mathrm{e}^{I_{S_2}\varphi_2}\mathrm{e}^{-I_{S_1}\varphi_1}\right)\mathrm{e}^{I_{S_1}\varphi_1}\equiv Cl\left(S_2,\varphi_2,S_1,\varphi_1\right)\mathrm{e}^{I_{S_1}\varphi_1} \tag{2.3}$$

The product of exponents $\mathrm{e}^{I_{S_2}\varphi_2}\mathrm{e}^{-I_{S_1}\varphi_1}$ is trivial in the case $S_1=S_2\equiv S$ (the case of geometrically unspecified imaginary unit plane in conventional quantum mechanics) $\mathrm{e}^{I_{S_2}\varphi_2}\mathrm{e}^{-I_{S_1}\varphi_1}=\mathrm{e}^{I_S(\varphi_2-\varphi_1)}$. Though in general case we have more complicated result:

[1]It is universally possible due to the hedgehog (hairy ball) theorem which says that there exists non-vanishing continuous tangent vector field on odd-dimensional sphere $\mathbb{S}^3$.

$$\begin{aligned} &Cl(S_2,\varphi_2,S_1,\varphi_1) \equiv e^{I_{S_2}\varphi_2} e^{-I_{S_1}\varphi_1} \\ &= \cos(\varphi_1)\cos(\varphi_2) + (s_1 \cdot s_2)\sin(\varphi_1)\sin(\varphi_2) + I_3 s_2 \cos(\varphi_1)\sin(\varphi_2) \\ &\quad + I_3 s_1 \cos(\varphi_2)\sin(\varphi_1) + I_3 (s_2 \times s_1)\sin(\varphi_1)\sin(\varphi_2) \end{aligned} \tag{2.4}$$

where s_1 and s_2 are vectors dual to planes S_1 and S_2 matching orientation of I_3.

The result of Clifford translation (2.4) is a G_3^+ element. From knowing Clifford translation connecting any two wave functions as points on $\mathbb{S}^3$ it follows that the result of measurement of any observable C by wave function $e^{I_{S_1}\varphi_1}$, for example $e^{I_{S_1}\varphi_1} C e^{-I_{S_1}\varphi_1} \equiv C(S_1,\varphi_1)$, immediately gives the result of (not made) measurement by $e^{I_{S_2}\varphi_2}$:

$$\begin{aligned} e^{I_{S_2}\varphi_2} C e^{-I_{S_2}\varphi_2} &= e^{I_{S_2}\varphi_2} e^{-I_{S_1}\varphi_1} e^{I_{S_1}\varphi_1} C e^{-I_{S_1}\varphi_1} e^{I_{S_1}\varphi_1} e^{-I_{S_2}\varphi_2} \\ &= e^{I_{S_2}\varphi_2} e^{-I_{S_1}\varphi_1} C(S_1,\varphi_1) e^{I_{S_1}\varphi_1} e^{-I_{S_2}\varphi_2} \\ &= Cl(S_2,\varphi_2,S_1,\varphi_1) C(S_1,\varphi_1) \overline{Cl(S_2,\varphi_2,S_1,\varphi_1)}^{\,2} \end{aligned}$$

This is geometrically clear and unambiguous explanation of strict connectivity of the results of measurements instead of "entanglement" in conventional quantum mechanics.

Take the spreon (1.5):

$$\begin{aligned} &Sp(\omega,\vec{r},t,I_{S_0},I_{B_0},I_{E_0}) \\ &= 2\cos\omega\left(\left[(I_3 I_S)\cdot\vec{r}\right]\right)\left(\frac{1}{\sqrt{2}}\cos\omega t + \frac{1}{\sqrt{2}} I_S \sin\omega t \right. \\ &\quad \left. + \frac{1}{\sqrt{2}} I_{B_0}\cos\omega t + \frac{1}{\sqrt{2}} I_{E_0}\sin\omega t\right) \end{aligned}$$

By redifining for reading formulas easier $I_S \equiv B_1$, $I_{B_0} \equiv B_2$, $I_{E_0} \equiv B_3$ we have the following:

Sprefield when scattered by a G_3^+ element $\cos\gamma + \sin\gamma(\gamma_1 B_1 + \gamma_2 B_2 + \gamma_3 B_3) = e^{B\gamma}$, $\gamma_1 B_1 + \gamma_2 B_2 + \gamma_3 B_3 \equiv B$, unit value bivector if $\gamma_1^2 + \gamma_2^2 + \gamma_3^2 = 1$, becomes:

$$\begin{aligned} e^{B\gamma} Sp(\omega,\vec{r},t,B_1,B_2) &= e^{B\gamma} R(\omega,\vec{r},B_1)\left(e^{B_1\omega t} + e^{-B_1\omega t} B_2\right) \\ &= R(\omega,\vec{r},B_1)\left(e^{B\gamma} e^{B_1\omega t} + e^{B\gamma} e^{-B_1\omega t} B_2\right) \end{aligned}$$

Let us use again a general formula for the product of two geometric algebra exponents:

$$\begin{aligned} e^{I_{S_1}\alpha} e^{I_{S_2}\beta} &= \cos\alpha\cos\beta - (s_1 \cdot s_2)\sin\alpha\sin\beta + I_3 s_1 \cos\beta\sin\alpha \\ &\quad + I_3 s_2 \cos\alpha\sin\beta - I_3 (s_1 \times s_2)\sin\alpha\sin\beta \end{aligned}$$

where s_1 and s_2 are vectors dual correspondingly to bivectors I_{S_1} and I_{S_2}.

In $e^{B\gamma} e^{B_1\omega t}$ we have $\cos\alpha = \cos\gamma$, $s_1 = (\gamma_1,\gamma_2,\gamma_3)$, $\cos\beta = \cos\omega t$, $s_2 = (1,0,0)$ and in $e^{B\gamma} e^{-B_1\omega t}$, $s_2 = (-1,0,0)$. Thus,

[2]Difference in exponent signs from usual measurement definition is made just for some convenience. It means that the angle has opposite sign or can be thought that the bivector plane was flipped.

$$\mathrm{e}^{B\gamma}\mathrm{e}^{B_1\omega t} = \cos\gamma\cos\omega t - \gamma_1\sin\gamma\sin\omega t + (\gamma_1 B_1 + \gamma_2 B_2 + \gamma_3 B_3)\sin\gamma\cos\omega t + B_1\cos\gamma\sin\omega t + (\gamma_3 B_2 - \gamma_2 B_3)\sin\gamma\sin\omega t$$

$$\mathrm{e}^{B\gamma}\mathrm{e}^{-B_1\omega t} = \cos\gamma\cos\omega t - \gamma_1\sin\gamma\sin\omega t + (\gamma_1 B_1 + \gamma_2 B_2 + \gamma_3 B_3)\sin\gamma\cos\omega t - B_1\cos\gamma\sin\omega t + (-\gamma_3 B_2 + \gamma_2 B_3)\sin\gamma\sin\omega t$$

$$\mathrm{e}^{B\gamma}\mathrm{e}^{-B_1\omega t}B_2 = B_2\cos\gamma\cos\omega t - B_2\gamma_1\sin\gamma\sin\omega t + (-\gamma_1 B_3 - \gamma_2 + \gamma_3 B_1)\sin\gamma\cos\omega t + B_3\cos\gamma\sin\omega t + (\gamma_3 + \gamma_2 B_1)\sin\gamma\sin\omega t$$

Then it follows that the result of scattering is:

$$\begin{aligned} &R(\omega,\vec{r},B_1)\big[\cos\gamma\cos\omega t - \gamma_2\sin\gamma\cos\omega t + (\gamma_3-\gamma_1)\sin\gamma\sin\omega t \\ &+\big((\gamma_3+\gamma_1)\sin\gamma\cos\omega t + \gamma_2\sin\gamma\sin\omega t + \cos\gamma\sin\omega t\big)B_1 \\ &+\big(\gamma_2\sin\gamma\cos\omega t + (\gamma_3-\gamma_1)\sin\gamma\sin\omega t + \cos\gamma\cos\omega t\big)B_2 \\ &+\big((\gamma_3-\gamma_1)\sin\gamma\cos\omega t - \gamma_2\sin\gamma\sin\omega t + \cos\gamma\sin\omega t\big)B_3\big] \end{aligned} \tag{2.5}$$

This scattered sprefield is defined in all points $\vec{r}$ of three-dimensional space and time parameter values t and is obviously independent of when scattering took place.

In some special cases of the scattering element, we get the following:

If sprefield is scattered by $\cos\gamma + \sin\gamma B_1$ the result is:

$$R(\omega,\vec{r},B_1)\big[\cos(\omega t+\gamma) + \sin(\omega t+\gamma)B_1 + \cos(\omega t+\gamma)B_2 + \sin(\omega t-\gamma)B_3\big]$$

If sprefield is scattered by $\cos\gamma + \sin\gamma B_2$ the result is:

$$\begin{aligned} &\sqrt{2}R(\omega,\vec{r},B_1)\left[\cos\omega t\sin\left(\gamma-\frac{\pi}{4}\right) + \sin\omega t\cos\left(\gamma-\frac{\pi}{4}\right)B_1\right. \\ &\left.+\cos\omega t\cos\left(\gamma-\frac{\pi}{4}\right)B_2 + \sin\omega t\sin\left(\gamma-\frac{\pi}{4}\right)B_3\right] \end{aligned}$$

If sprefield is scattered by $\cos\gamma + \sin\gamma B_3$ the result is:

$$R(\omega,\vec{r},B_1)\big[\cos(\omega t-\gamma) + \sin(\omega t+\gamma)B_1 + \cos(\omega t-\gamma)B_2 + \sin(\omega t+\gamma)B_3\big]$$

All these g-qubits are defined for all values of t and $\vec{r}$, in other words the result of Clifford translation by spreon (1.5) instantly spreads through the whole three-dimensions for all values of time.

The resulting state (10) is simultaneously redefined for all values of t. We particularly have changing of state backward in time. That is obvious demonstration that the suggested theory allows indefinite event casual order. In that way the very notion of the concept of cause and effect disappears, thus we might not perceive time.

3. Measurements by Sprefields

The Hopf fibration, measurement of any observable $C_0 + C_1B_1 + C_2B_2 + C_3B_3$ in the current formalism is [3]:

$$C_0 + C_1B_1 + C_2B_2 + C_3B_3 \xrightarrow{\alpha+\beta_1B_1+\beta_2B_2+\beta_3B_3}$$
$$C_0 + \left(C_1\left[\left(\alpha^2+\beta_1^2\right)-\left(\beta_2^2+\beta_3^2\right)\right]+2C_2\left(\beta_1\beta_2-\alpha\beta_3\right)+2C_3\left(\alpha\beta_2+\beta_1\beta_3\right)\right)B_1$$
$$+\left(2C_1\left(\alpha\beta_3+\beta_1\beta_2\right)+C_2\left[\left(\alpha^2+\beta_2^2\right)-\left(\beta_1^2+\beta_3^2\right)\right]+2C_3\left(\beta_2\beta_3-\alpha\beta_1\right)\right)B_2 \quad (3.1)$$
$$+\left(2C_1\left(\beta_1\beta_3-\alpha\beta_2\right)+2C_2\left(\alpha\beta_1+\beta_2\beta_3\right)+C_3\left[\left(\alpha^2+\beta_3^2\right)-\left(\beta_1^2+\beta_2^2\right)\right]\right)B_3$$

Apply this formula for measurement by spreon (1.5):

$$2\cos\omega\left(\left[\left(I_3I_S\right)\cdot\vec{r}\right]\right)\left(\frac{1}{\sqrt{2}}\cos\omega t+\frac{1}{\sqrt{2}}I_S\sin\omega t+\frac{1}{\sqrt{2}}I_{B_0}\cos\omega t+\frac{1}{\sqrt{2}}I_{E_0}\sin\omega t\right),$$

that is use:

$$B_1 = I_S,\quad B_2 = I_{B_0},\quad B_3 = I_{E_0}$$

$$\alpha = 2\cos\omega\left[\left(I_3I_S\right)\cdot\vec{r}\right]\frac{1}{\sqrt{2}}\cos\omega t;\quad \beta_1 = 2\cos\omega\left[\left(I_3I_S\right)\cdot\vec{r}\right]\frac{1}{\sqrt{2}}\sin\omega t$$

$$\beta_2 = 2\cos\omega\left[\left(I_3I_S\right)\cdot\vec{r}\right]\frac{1}{\sqrt{2}}\cos\omega t;\quad \beta_3 = 2\cos\omega\left[\left(I_3I_S\right)\cdot\vec{r}\right]\frac{1}{\sqrt{2}}\sin\omega t$$

The result of measurement is:

$$O\left(C_0,C_1,C_2,C_3,I_S,I_{B_0},I_{E_0},\omega,t,\vec{r}\right)$$
$$=4\left(\cos\omega\left[\left(I_3I_S\right)\cdot\vec{r}\right]\right)^2\left[C_0+C_3I_S+\left(C_1\sin2\omega t+C_2\cos2\omega t\right)I_{B_0}\right. \quad (3.2)$$
$$\left.+\left(C_2\sin2\omega t-C_1\cos2\omega t\right)I_{E_0}\right]$$

Geometrically, this result means that the observable bivector plane rotates by $\frac{\pi}{2}$ around vector e_2, such that the C_3 component becomes lying in plane I_S. Two other components lying in planes orthogonal to I_S rotate around normal to I_S with angular velocity $2\omega t$. Both scalar and bivector parts get scalar factor $4\left(\cos\omega\left[\left(I_3I_S\right)\cdot\vec{r}\right]\right)^2$.

Formula (3.2) shows that only component of the result of measurement lying in plane I_S does not depend on the value of time parameter.

We know that any two observables can be connected through Clifford translation. If we are concerned only in the I_S component of the result of measurement then with placing another observable value C_3^{new} in (3.1) the latter can be written, in assumption that the I_S old observable component is not zero, as:

$$4sign\left(C_3\right)sign\left(C_3^{new}\right)\left(\cos\omega\left[\left(I_3I_S\right)\cdot\vec{r}\sqrt{\left|\frac{C_3^{new}}{C_3}\right|}\right]\right)^2\left[\cdots+C_3I_S+\cdots\right]$$

Thus, all the I_S components of any observable do simultaneously exist whilst we only made measurement of one observable. All the other observables values are calculated at values $\vec{r}\sqrt{\left|\frac{C_3^{new}}{C_3}\right|}$.

Consider more complicated way to get component of the result of measurement not depending on time parameter.

Assume the spreon is scattered by some state $\cos\gamma+\sin\gamma\left(\gamma_1 I_S+\gamma_2 I_{B_0}+\gamma_3 I_{E_0}\right)$ before the measurement. The result of the measurement in general case is a bit tedious. Let us take as the first example the bivector components with $\gamma_2=1$, $\gamma_1=\gamma_3=0$. In that case the result of measurement, from (3.1), of $C_0+C_1 I_S+C_2 I_{B_0}+C_3 I_{E_0}$ can be calculated as its measurement by $\cos\gamma+\sin\gamma I_{B_0}$:

$$C_0+C_1 I_S+C_2 I_{B_0}+C_3 I_{E_0}\xrightarrow{\cos\gamma+\sin\gamma I_{B_0}}$$
$$C_0+\left(C_1\cos 2\gamma+C_3\sin 2\gamma\right)I_S+C_2 I_{B_0}+\left(C_3\cos 2\gamma-C_1\sin 2\gamma\right)I_{E_0}$$

followed by measurement by

$$2\cos\omega\left(\left[\left(I_3 I_S\right)\cdot\vec{r}\,\right]\right)\left(\frac{1}{\sqrt{2}}\cos\omega t+\frac{1}{\sqrt{2}}I_S\sin\omega t+\frac{1}{\sqrt{2}}I_{B_0}\cos\omega t+\frac{1}{\sqrt{2}}I_{E_0}\sin\omega t\right)$$

that gives, using (3.2):

$$\begin{aligned}&4\left(\cos\omega\left[\left(I_3 I_S\right)\cdot\vec{r}\,\right]\right)^2\Big[C_0+\left(C_3\cos 2\gamma-C_1\sin 2\gamma\right)\left(\cos 2\gamma I_S-\sin 2\gamma I_{E_0}\right)\\&+\left(\left(C_1\cos 2\gamma+C_3\sin 2\gamma\right)\sin 2\omega t+C_2\cos 2\omega t\right)I_{B_0}\\&+\left(C_2\sin 2\omega t-\left(C_1\cos 2\gamma+C_3\sin 2\gamma\right)\cos 2\omega t\right)\left(\cos 2\gamma I_{E_0}+\sin 2\gamma I_S\right)\Big]\end{aligned}$$

If we take new orthonormal bivector basis:

$$\left\{\cos 2\gamma I_S-\sin 2\gamma I_{E_0},\sin 2\gamma I_S+\cos 2\gamma I_S,I_{B_0}\right\}\equiv\left\{I_{1\gamma},I_{2\gamma},I_{B_0}\right\}$$

the result of measurement reads:

$$\begin{aligned}&4\left(\cos\omega\left[\left(I_3 I_S\right)\cdot\vec{r}\,\right]\right)^2\Big[C_0+\left(C_3\cos 2\gamma-C_1\sin 2\gamma\right)I_{1\gamma}\\&+\left(C_2\cos 2\omega t+\left(C_1\cos 2\gamma+C_3\sin 2\gamma\right)\sin 2\omega t\right)I_{B_0}\\&+\left(C_2\sin 2\omega t-\left(C_1\cos 2\gamma+C_3\sin 2\gamma\right)\cos 2\omega t\right)I_{2\gamma}\Big]\end{aligned}$$

that has constant value in plane $I_{1\gamma}$ plus rotation in planes I_{B_0} and $I_{2\gamma}$ with angular velocity 2ω.

In that way we particularly get $\vec{r}$-dependent variety of constant components of the results of measurements:

$$4\left(\cos\omega\left[\left(I_3 I_S\right)\cdot\vec{r}\,\right]\right)^2\left[C_0+\left(C_3\cos 2\gamma-C_1\sin 2\gamma\right)I_{1\gamma}\right]$$

Similar results are for other cases of scattering state: $\gamma_1=1$, $\gamma_2=\gamma_3=0$ and $\gamma_3=1$, $\gamma_1=\gamma_2=0$.

4. Conclusions

All measured observable values are instantly spread through the whole set of three-dimension points and time parameter values. If the measuring results represent a function value, the values are available altogether, not through evaluating one by one.

The current approach transcends qubit entangled computational schemes since the latter have tough problems of creating large sets of communicating qubits. All the efforts today in building “quantum” computers are in implementation of qubits (in various physically possible variants) effectively talking to each other, thus emulating entanglement.

In the current scheme any observable can be placed into continuum of the $(t,\vec{r})$ dependent values of the sprefield. All other observables' measurement results are particularly connected by Clifford translations thus giving any number of values $O\left(C_0, C_1, C_2, C_3, I_S, I_{B_0}, I_{E_0}, \omega, t, \vec{r}\right)$, spread over three-dimensions and at all instants of time not generally following cause/effect ordering.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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