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Erratum

Spinors in the Lorentz group and their implications for quantum mechanics

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Abstract. It is pointed out that the original article contains a wrong claim. Fortunately, it does not affect the other results reached in the paper.

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The result announced in the original article that $\mathbf{r}_1+\mathrm{i}\mathbf{r}_2+\mathbf{r}_4$ would allow to code the whole tetrad unambiguously is not generally valid. Fortunately, this wrong claim is not further used in the paper, such that the validity of the rest of the paper is not affected by it. In general, the knowledge of an additional second vector, e.g. $\mathbf{r}_3$ is needed for a complete unambiguous coding. A trivial error was made in the algebra used to derive (A.4) which thereby ceases to be generally valid. The tetrad can only be reconstructed from a linear combination $\mathbf{r}_1+\mathrm{i}\mathbf{r}_2+\mathbf{r}_4$ if the motion remains limited to the plane spanned by the vectors $\mathbf{r}_1$ and $\mathbf{r}_2$, such that the vector $\mathbf{r}_3$ remains fixed. The information about this vector $\mathbf{r}_3$ must then be given. The general notion that spinors code information about the tetrad remains valid. As a zero-length fourvector contains six independent real variables it contains the right number of parameters to code a general Lorentz transformation completely. But the only way we see to track the complete information unambiguously might be coding a pair of two complementary zero-length vectors, e.g. $\mathbf{r}_1+\mathbf{r}_4$ and $\mathbf{r}_2+\mathrm{i}\mathbf{r}_3$ separately. Even if one limits the formalism to the information content of the single zero-length vector $(\mathbf{r}_1+\mathbf{r}_4)$, as is e.g. usually done in the two-dimensional representation theory, then the spinors in the Dirac equation will still code (partial) information about a rotating frame rather than that we would be dealing with a particle that travels at the speed of light. For the sake of clarity we add that in (33) the notation $\mathbf{e}\cdot\sigma$ must be understood as the 4×4 counterpart of the 2×2 matrix $\mathbf{e}\cdot\sigma$ in the lift to the four-dimensional representation spanned by the gamma matrices.

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