Erratum: Spin of Dirac's relativistic membrane [Phys. Rev. E 59, 6286 (1999)]

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(i) Equations (3.6)–(3.8) should be replaced by

$$\begin{aligned}\mathbf{I}T^{\dagger}T=&(p^2+\mu^2+q^2+k^2f^2-\hbar\boldsymbol{\nabla}\cdot\mathbf{q})\mathbf{I}+[\hbar\boldsymbol{\nabla}\cdot\mathbf{f}-2(\mathbf{q}\cdot\mathbf{f})]\kappa\beta-i[\hbar\boldsymbol{\alpha}\cdot\boldsymbol{\nabla}\mu-2\mu(\boldsymbol{\alpha}\cdot\mathbf{q})]\boldsymbol{\beta}\\&+i[\{q_x,p_y\}-\{p_x,q_y\}-\kappa(\{f_x,p_y\}-\{p_x,f_y\})\boldsymbol{\beta}]\boldsymbol{\alpha}_x\boldsymbol{\alpha}_y\\&+i[\{q_x,p_z\}-\{p_x,q_z\}-\kappa(\{f_x,p_z\}-\{p_x,f_z\})\boldsymbol{\beta}]\boldsymbol{\alpha}_x\boldsymbol{\alpha}_z\\&+i[\{q_y,p_z\}-\{p_y,q_z\}-\kappa(\{f_y,p_z\}-\{p_y,f_z\})\boldsymbol{\beta}]\boldsymbol{\alpha}_x\boldsymbol{\alpha}_z\ ,\end{aligned}\tag{3.6}$$

since $\mathbf{p}=-i\hbar\boldsymbol{\nabla}$ and where κ is the eigenvalue of K and also assuming that K is a linear Hermitian operator. The linearization we look for requires $T^2=p^2+\mu^2$, and thus we conclude from the above matrix equation that we must impose $q_x=f_x$, $q_y=f_y$, $q_z=f_z$, i.e., $\mathbf{q}=\mathbf{f}$ and also $\kappa=\pm1$. Otherwise, in order that the third term of Eq. (3.6) vanishes we must have $q_x=\hbar x/r^2$, $q_y=\hbar y/r^2$ and $q_z=\hbar z/r^2$, where $r^2=x^2+y^2+z^2$. Hence, owing to the above results the linearized form of the Hamiltonian operator is

$$H=\boldsymbol{\alpha}\cdot\mathbf{P}+i(\boldsymbol{\alpha}\cdot\mathbf{q})\boldsymbol{\beta}K+\boldsymbol{\beta}\mu+\mathbf{I}V,\tag{3.7}$$

according to Eq. (3.4), where $\mathbf{P}=\mathbf{p}-i\mathbf{q}$, $p_j=-i\hbar\partial/\partial x^j$, $q^j=\hbar x^j/r^2$, and $|\mathbf{q}|=\hbar/r$.

(ii) The commutation rules (5.1) should be

$$[x^j,P_k]=i\hbar\delta^j_k,\quad [P_j,P_k]=0,\quad [\Omega_j,P_k]=i\hbar\varepsilon_{jkl}P_l,\quad [\Omega_j,q_k]=i\hbar\varepsilon_{jkl}q_l,\tag{5.1}$$

where Ω_z does not commute with f_x and f_y. Since in this case $\Omega_x=\Omega_y=0$ and assuming that Ω_z commutes with the operator K, then with the Hamiltonian (3.7) we obtain for the Ω_z component the result given in Eq. (5.2).

(iii) Below Eq. (5.11) we have $\mathbf{P}_r=1/r(\mathbf{r}\cdot\mathbf{P})$ and the matrices $\boldsymbol{\sigma}$ that appear in Eqs. (5.11), (5.13)–(5.15) are indeed the 2×2 Pauli spin matrices.

The above corrections do not alter the results derived in this paper.

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