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Erratum: Spin and the Honeycomb Lattice: Lessons from Graphene (Phys. Rev. Lett. 106, 116803 (2011))

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In the Letter [1] the valley index κ was not properly distributed in the definition of the lattice spin $\mathbf{S}$. Equation (8) should be corrected as follows:

$$\mathcal{H} = \frac{2v_F}{\hbar}\mathbf{S}\cdot\mathbf{u}, \quad \text{where} \tag{8a}$$

$$\mathbf{S} \equiv \frac{\hbar}{2}(\kappa\sigma_x\,\hat{\mathbf{a}}_d + \sigma_y\,\hat{\mathbf{a}}_s + \kappa\sigma_z\,\hat{\mathbf{a}}_n), \quad \text{and} \tag{8b}$$

$$\mathbf{u} \equiv (\mathbf{p}\cdot\hat{\mathbf{a}}_d)\,\hat{\mathbf{a}}_d + (\mathbf{p}\cdot\hat{\mathbf{a}}_s)\,\hat{\mathbf{a}}_s + \kappa(\Delta/v_F)\,\hat{\mathbf{a}}_n. \tag{8c}$$

As a consequence Eq. (10) and the sentence containing it have no explicit κ's. They are modified to read:

"The time evolution of the lattice spin operator is given by [14]

$$\frac{d\mathbf{S}}{dt} = \frac{2v_F}{\hbar}\mathbf{u}\times\mathbf{S}, \tag{10}$$

which is exactly the equation of motion of a magnetic dipole in a magnetic field, with the substitution $2v_F\mathbf{u}/\hbar \to -\gamma\mathbf{B}$ (here γ is the gyromagnetic ratio)."

Finally, in the Supplemental Material Eq. (B2) should read:

$$S_i = \frac{\hbar}{2}(\kappa\sigma_x, \sigma_y, \kappa\sigma_z), \quad \text{and} \tag{B2a}$$

$$\gamma^\mu = (\sigma_z, i\sigma_x, i\kappa\sigma_y), \tag{B2b}$$

and the penultimate paragraph should read: "Note also that while it is possible to define representations satisfying (B1) that do not include κ's, the forms (B2) are preferred. If instead all of the κ's were included in the definition of $\mathbf{u}$, the expectation value of $\mathbf{S}$ for a Hamiltonian eigenstate would show undesirable behavior under change of κ. More importantly, including the valley index κ in the definitions of the S_i and the γ^μ gives these operators the expected transformation properties under time reversal, which is implemented by taking $i \to -i$ and $\kappa \to -\kappa$. This prescription can be deduced by noting that $\mathcal{H}$ is invariant under time reversal and comparing Eq. (4) and Eq. (5) of the main text."

These changes do not otherwise impact the arguments presented in the Letter, or its conclusion, other than to strengthen it by demonstrating that the lattice spin that emerges from the honeycomb Hamiltonian transforms as expected under time reversal.

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[1] M. Mecklenburg and B. C. Regan, Physical Review Letters **106**, 116803 (2011).