

Erratum: Creation and Detection of Skyrmions in a Bose-Einstein Condensate [Phys. Rev. Lett. 103, 250401 (2009)]

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We report an error in the representation of the local spin, or ℓ vector, [Eq. (2)] of both the Skyrmion and half-Skyrmion in our Letter. We made the assumption that the three-component spin texture created in the $F = 2$ manifold of ^{87}Rb and described by Eq. (1),

$$\Psi(r) = \sqrt{n(r)} \begin{pmatrix} \cos^2(\beta(r)/2) \\ 0 \\ \sqrt{2}e^{i\varphi} \sin(\beta(r)/2) \cos(\beta(r)/2) \\ 0 \\ e^{2i\varphi} \sin^2(\beta(r)/2) \end{pmatrix}, \quad (1)$$

was an effective spin-1 system composed of states: $|2, 2\rangle$, $|2, 0\rangle$, $|2, -2\rangle$. It was further assumed that this pseudo-spin-1 system was equivalent to one consisting of spin states: $|2, 1\rangle$, $|2, 0\rangle$, $|2, -1\rangle$.

We presented the following ℓ vector for our spin textures:

$$\vec{\ell}(r) = \hat{z} \cos\beta(r) + \sin\beta(r)(\hat{x} \cos\varphi + \hat{y} \sin\varphi), \quad (2)$$

where $n(r)$ is the density of the cloud, (r, φ) are polar coordinates, and $\beta(r)$ is the bending angle. For the spin textures we created, Eq. (2) is only valid if both of the above assumptions hold. A full calculation of the expectation value of the local spin, $\langle \hat{F} \rangle = \vec{\ell}$, using the spin-2 order parameter of Eq. (1) and the spin-2 angular momentum spin matrices does not produce the ℓ vector of Eq. (2). As a result, the plots of the local spin, Figs. 1(e) and 2(e), are incorrect. All other representations of the data are based on the wave function, Eq. (1), and are still valid.

In light of this error, it is not clear whether the classification of these spin textures as a Skyrmion and half-Skyrmion is still appropriate.