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Erratum: Energetically stable singular vortex cores in an atomic spin-1 Bose-Einstein condensate [Phys. Rev. A 86, 013613 (2012)]

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The following errors appear in the article. Note that the results and conclusions remain unaffected by the corrections.

Figure 1(b) of the article erroneously mixes the two cases where a singly quantized polar vortex is and is not, respectively, accompanied by a simultaneous winding of the nematic axis $\hat{\mathbf{d}}$, hence misrepresenting the topology. Figure 1 included here shows the correct representation in each case and replaces the original figure (caption modified accordingly).

The expressions for the density and spin healing lengths on page 3 are incorrect. They should read

$$\xi_n = l\left(\frac{\hbar\omega}{2c_0 n}\right)^{1/2}, \quad \xi_F = l\left(\frac{\hbar\omega}{2\,|c_2|\,n}\right)^{1/2}.$$

The correct definitions have been used in calculations and analysis.

In the Appendix, the spinor wave function in the basis transformation of the axially symmetric vortex in Eqs. (A1)–(A3) is parametrized in terms of β and f. Although the symbol β elsewhere in the paper is used to describe the angle between the spin vector and the z axis, its meaning in Eqs. (A1)–(A3) is different. The expressions (A1)–(A3) describe the core of the singular ferromagnetic vortex in numerical calculations when the spin magnitude varies between $|\langle\hat{\mathbf{F}}\rangle| = 1$ and $|\langle\hat{\mathbf{F}}\rangle| = 0$. They can also represent more general vortex solutions, provided $|\langle\hat{F}_z\rangle|/|\langle\hat{\mathbf{F}}\rangle|$, where $\hat{F}_z$ is the z component of $\hat{\mathbf{F}}$, remains sufficiently small for values of $|\langle\hat{\mathbf{F}}\rangle|$ close to zero. Note that the basic principle of the basis transformation can be understood even when Eq. (A1) is simplified; we could, e.g., simply specify that $f = 0$ and $g \sin\beta = \sqrt{2}$ inside the core and $f = 1$ and $\beta = \pi$ outside the core [here β is the parameter appearing in Eq. (A1)].

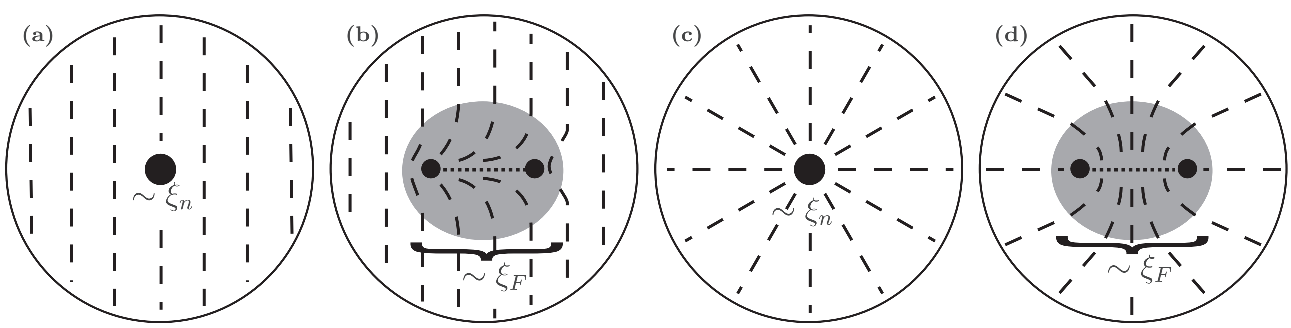

FIG. 1. Schematic illustration of vortex-core structures for a singly quantized singular vortex in the polar phase of a spin-1 condensate. The states in (a) and (b) both exhibit the topology of an asymptotically uniform texture of the nematic axis. Similarly, (c) and (d) show the same topology with the vortex containing a 2π winding of the nematic axis. In (a) and (c) the atom density vanishes at the vortex-line singularity, with the core size determined by the characteristic length scale ξ_n (healing length) associated with the spin-independent interaction strength. In (b) and (d) the atom density is nonvanishing in the core region, whose size is determined by the characteristic length scale ξ_F of the spin-dependent interaction strength. The vortex line singularity has now split into two half-quantum vortices with the atoms in the ferromagnetic phase at the precise location of the singularities. In all figures we show the nematic axis as a dashed line and the dotted lines in (b) and (d) indicate a disclination plane for the nematic axis. Inside the core region (shaded area) of (b) and (d) the broken symmetry of the polar ground-state manifold is restored (as explained in the text). Outside the core the topological properties of the vortices are the same as those in (a) and (c), respectively.

