Erratum: Squeezing the collective spin of a dilute atomic ensemble by cavity feedback [Phys. Rev. A 81, 021804(R) (2010)]

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An error in our expression for $\tilde{S}_+$ (second column of page 2) led us to miscalculate by a factor of 2 the spin variance due to photon shot noise. The correction of this error alters numerical factors but does not affect the conclusions of the paper.

We should have defined $\tilde{S}_+ \equiv S_+(t)e^{-i\mathrm{Re}[f_1(0)]t}$, and thus Eqs. (7)–(11) should read

$$\langle \tilde{S}_+ \rangle_\beta = e^{-Q/(2S)} e^{iQS_z/S} S_+(0), \tag{7}$$

$$\langle \tilde{S}_+^2 \rangle_\beta = e^{-(2+i)Q/S} e^{2iQS_z/S} S_+^2(0), \tag{8}$$

$$\Delta\tilde{S}_y^2 = \frac{S^2}{2} + \frac{S}{4} - \left(\frac{S^2}{2} - \frac{S}{4}\right) e^{-2Q/S} \mathcal{G}_S(Q), \tag{9}$$

$$\langle \tilde{S}_y S_z + S_z \tilde{S}_y \rangle = (2S^2 - S) e^{-Q/(2S)} \sin\left(\frac{Q}{2S}\right) \mathcal{G}_S(Q/2), \tag{10}$$

and

$$\Delta\tilde{S}_y^2 \approx \frac{S}{2}\left(1 + 2Q + Q^2\right). \tag{11}$$

The second term in Eq. (11) indicates the spin variance QS due to photon shot noise, twice the value given in our original publication.

Although the numerical prefactors in subsequent expressions are of little consequence, we correct them here for completeness:

$$\sigma_{\alpha_0}^2 \approx 2/Q + Q^4/(24S^2),$$

$$\sigma_{\alpha_0}\sigma_{\alpha_0+\pi/2} \approx \sqrt{2Q},$$

$$Q_{\mathrm{curv}} = 12^{1/5} S^{2/5},$$

$$\sigma_{\mathrm{curv}}^2 = (5/2)12^{-1/5} S^{-2/5},$$

$$\sigma_{\alpha_0,r}^2 \approx \left(\frac{2}{Q} + \frac{Q}{3S\eta}\right) = \left(\frac{1}{2S\eta r} + \frac{4r}{3}\right),$$

$$Q_{\mathrm{scatt}} = \sqrt{6S\eta},$$

$$\sigma_{\alpha_0,r}^2|_{Q=Q_{\mathrm{scatt}}} = \sqrt{8/(3S\eta)},$$

$$r_{\mathrm{opt}} = \sqrt{3/(8S\eta)}.$$

The corrected version of Fig. 2 still indicates substantial squeezing, and the caption is unchanged.

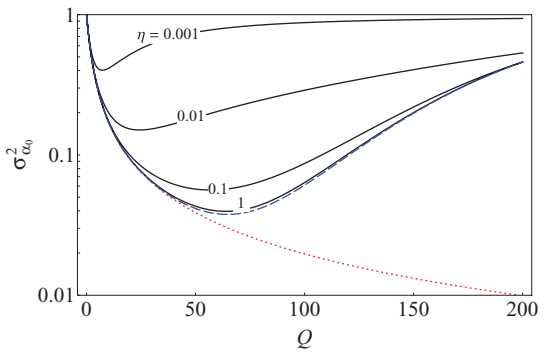

FIG. 2. (Color online) Minimum normalized variance $\sigma_{\alpha_0,r}^2$ as a function of shearing strength Q for $S = 10^4$ and various single-atom cooperativities $\eta = 0.001, 0.01, 0.1, 1$ (solid lines). The dashed line shows the limit σ_{curv}^2 due to the curvature of the Bloch sphere when free-space scattering is ignored. The dotted line shows the variance neglecting both free-space scattering and curvature, scaling as $1/Q$ for $Q \gg 1$.

