Ruckenstein and Lévy Respond: We disagree with the main point of the Comment, namely that there is an additional "off mass shell" contribution to the spin transport equations of (dilute) polarized gases, which has been ignored by previous authors. This somewhat subtle point can be easily clarified by considering the systematic derivation of the full kinetic equations in the formulation due to Kadanoff and Baym.[1,2] Within this approach, the terms under discussion arise from the commutator of the magnetization density operator $\hat{M}(\mathbf{R},T,\mathbf{p})=\mathbf{m}(\mathbf{R},T,\mathbf{p})\cdot\boldsymbol{\tau}/2$ carried by quasiparticles of momentum $\mathbf{p}$ and their associated one-particle energy $\epsilon_p\delta_{\alpha\beta}+\Sigma_{\alpha\beta}(\mathbf{R},T,\mathbf{p},\omega=p^2/2m)$.

The spin-dependent part of Σ (the only part relevant to the spin dynamics) can be written as $\hat{\Sigma}=\hat{\Sigma}_{\rm HF}+\hat{\Sigma}_c$. The first term,

$$\Sigma_{\rm HF}(\mathbf{R},T,\mathbf{p},\omega=\epsilon_p)=\pm\frac{1}{2}\int\frac{d^3q}{(2\pi)^3}\left\langle\frac{\mathbf{p}-\mathbf{q}}{2}\middle|T_0(\mathbf{p}+\mathbf{q})\middle|\frac{\mathbf{q}-\mathbf{p}}{2}\right\rangle\mathbf{m}(\mathbf{R},T,\mathbf{q})\cdot\boldsymbol{\tau},\tag{1}$$

is the Hartree-Fock contribution to the energy and represents the interaction of the particle spin with mean local magnetic field of the background, and

$$\Sigma_c(\mathbf{R},T,\mathbf{p},\omega=\epsilon_p)=\pm\frac{1}{2}\int\frac{d^3q}{(2\pi)^3}\frac{d^3k}{(2\pi)^3}\frac{d^3k'}{(2\pi)^3}(2\pi)^3\delta(\mathbf{p}+\mathbf{q}-\mathbf{k}-\mathbf{k}')\times\frac{\langle\frac{1}{2}(\mathbf{p}-\mathbf{q})|t|\frac{1}{2}(\mathbf{k}-\mathbf{k}')\rangle\langle\frac{1}{2}(\mathbf{k}-\mathbf{k}')|t|\frac{1}{2}(\mathbf{q}-\mathbf{p})\rangle}{\epsilon_p-\epsilon_k-\epsilon_{k'}+\epsilon_q}\mathbf{m}(\mathbf{R},T,\mathbf{q})\cdot\boldsymbol{\tau}\tag{2}$$

corresponds to the change in energy due to collisions with other particles. T_c is the frequency-independent part of the *many-body* scattering matrix while in (2) t denotes the ordinary scattering amplitude for two particles in the vacuum generalized to include off-shell processes. Upper and lower signs denote bosons and fermions, respectively. Since $dM(\mathbf{R},T,\mathbf{p})/dt\propto i[\hat{\Sigma},\hat{M}]$, we immediately recognize the terms discussed by Bashkin as arising from the collision contribution (2).

However, Bashkin ignored the higher-order corrections to the local field contribution coming from the second-order term in the many-body T matrix. It is not hard to see that in the dilute limit,[3]

$$\left\langle\frac{\mathbf{p}-\mathbf{q}}{2}\middle|T_0(\mathbf{p}+\mathbf{q})\middle|\frac{\mathbf{q}-\mathbf{p}}{2}\right\rangle=\mathrm{Re}\left[\left\langle\frac{\mathbf{p}-\mathbf{q}}{2}\middle|t\middle|\frac{\mathbf{q}-\mathbf{p}}{2}\right\rangle\right]-2\int\frac{d^3k}{(2\pi)^3}\frac{d^3k'}{(2\pi)^3}(2\pi)^3\delta(\mathbf{p}+\mathbf{q}-\mathbf{k}-\mathbf{k}')\times\frac{\langle\frac{1}{2}(\mathbf{p}-\mathbf{q})|t|\frac{1}{2}(\mathbf{k}-\mathbf{k}')\rangle\langle\frac{1}{2}(\mathbf{k}-\mathbf{k}')|t|\frac{1}{2}(\mathbf{q}-\mathbf{p})\rangle}{\epsilon_p+\epsilon_q-\mathbf{p}\cdot\mathbf{q}/m-\epsilon_k-\epsilon_{k'}+\mathbf{k}\cdot\mathbf{k}'/m}.\tag{3}$$

Combining[4] (1) and (3) with (2) leads to a complete cancellation of off-shell contributions to $\hat{\Sigma}$. We stress that this cancellation is exact in the low-density limit.

We agree that parametrizing the actual diffusion coefficients in terms of a collision time τ and a diffusion constant D_0 for the unpolarized sample is in general quite arbitrary. The proper procedure is to solve an integral equation obtained from the steady-state Boltzmann equation. A detailed derivation of the spin dynamics which in small magnetic field confirms the Boltzmann picture[5] will be published shortly.[2]

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