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Spin diffusion and instabilities in a nondegenerate Bose gas

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Coherence and quantum symmetries can lead to non-classical diffusion in ultra-cold gases. I will present results from studies of longitudinal spin diffusion of two pseudo-spin domains in a trapped ^{87}Rb sample above quantum degeneracy, including investigations of the effect of coherence in the domain wall on the dynamics of the system. Coherence in the domain wall leads to transverse-spin-mediated longitudinal spin diffusion that is slower than classical predictions, as well as altering the domains' oscillation frequency. This spin system also shows an instability in the longitudinal spin dynamics as the longitudinal and transverse spin components couple, and a conversion of longitudinal spin to transverse spin is observed, resulting in an increase in the total amount of coherence in the system.