Ferromagnetism of spinor atomic condensates in the double well

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The ^{87}Rb gas comes as the first example of the ferromagnetic (FM) Bose system, thus it provides an opportunity to study the itinerant-boson ferromagnetism. It is already suggested that the spinor Bose gas with FM couplings undergoes a FM transition with the critical temperature never below the Bose-Einstein condensation temperature, regardless of the magnitude of the coupling.[1] Nevertheless, the FM transition can not occur in the Fermi gas unless the FM coupling exceeds the Stoner point. We explore the manifestation of distinct magnetic phenomena of spin-1 Bose condensates in a symmetric double-well. We show that the condensate may not exhibit ferromagnetic behaviors unless the effective FM coupling is stronger than a critical value which is determined by the tunneling coupling. This feature is analogous to the Fermi gas. The ferromagnetic condensate displays strong symmetry-breaking dynamics,[2] with the amplitude evolving exponentially from an almost negligible distortion of the original symmetric spin configuration. On the contrary, the distortion just results in a mild oscillation in the antiferromagnetic condensate. This phenomenon is relevant to the domain formation inside a single-well FM condensate.[3]

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[3]Q. Gu and H. Qiu, Phys. Rev. Lett **98**, 200401 (2007).