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Ramsey Interferometry of a Spin-1 Bose-Einstein Condensate ALEXANDER WOOD, RUSSELL ANDERSON, LINCOLN TURNER, School of Physics, Monash University — Ramsey interferometry using ultracold atoms is a powerful technique in precision measurement. We report on using radiofrequency pulses to perform three-state Ramsey interferometry in a spin-1 Bose-Einstein condensate of ^{87}Rb. The ground state phase diagram and dynamics of a spinor condensate are determined by two parameters: the density dependent spin-exchange interaction and the quadratic Zeeman shift. Ramsey interferometry probes the phase evolution of the condensate, and is sensitive to the small energy shifts ($\sim 10\,\mathrm{Hz}$) resulting from these phenomena. The fidelity of the interferometer is dramatically improved by spin-echo pulses in the presence of parasitic noise and gradients of the background magnetic field. We demonstrate the high sensitivity of this method by measuring the influence of a microwave dressing field on the quadratic Zeeman shift, which we compare against a simple analytic model of the dressed system that accounts for the spin-exchange interaction. By varying the density of the condensate, the spin-exchange interaction may be measured precisely with our technique. We anticipate our results finding application in spinor collisional control studies and spatially resolved spin tomography of a spinor condensate.

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