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BEC manipulation with fictitious magnetic fields and Feshbach resonances[1] JEFFREY HEWARD, Georgia Southern University, MARK EDWARDS, Georgia Southern University and NIST, CHARLES W. CLARK, NIST — The interaction of Bose-Einstein condensate (BEC) atoms with counterpropagating laser beams can often be represented by fictitious magnetic fields [1]. These fictitious fields can be combined with ordinary magnetic fields to produce total fields whose amplitudes vary in space on the scale of the laser wavelength. When the strengths of such magnetic fields are positioned in the neighborhood of a Feshbach resonance, it can produce a spatial variation of the binary scattering length of the condensate atoms. We have studied how these fields can be used to engineer the shape and behavior of BEC's for typical experimental arrangements. We present results for ^{87}Rb condensate shapes for BEC that can be formed when condensates are formed in the presence of spatially varying scattering lengths as well as the effects of turning on and off the fictitious magnetic fields in the presence of expanding condensates. All of the behaviors presented represent solutions of the time–independent and time–dependent Gross–Pitaevskii (GP) equation. Finally we comment briefly on cases where the GP equation breaks down.

[1] I. Deutsch and P. Jessen, **57**, 1972 (1998).

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