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Dynamics of a spin-orbit coupled Bose-Einstein condensate in the presence of a moving barrier[1] MAREN MOSSMAN, PETER ENGELS, Washington State University — The possibility to explore quantum hydrodynamics has been greatly expanded with the application of ultracold atomic gases in the lab. Bose-Einstein condensates have been shown to exhibit both nonviscous and effectively viscous properties depending on the parameters of the experiment. For instance, when a repulsive impenetrable barrier is driven through an elongated BEC, aspects of the dynamics resemble the behavior of a classical viscous fluid. This concept lays the groundwork for our current experiment, where spin-orbit coupling has been introduced in the system. We perform a similar experiment with a modified dispersion relation and observe spin-flip dynamics even when using a spin-independent barrier. We show that these spin dynamics only occur within a finite range of barrier velocities, and that at large barrier speeds, the SOC BEC remains in the ground state of the system, unperturbed by the moving barrier. This work is in loose analogy to spin-orbit qubits in condensed matter systems where qubit manipulation is affected by coupling to the orbital part of the wavefunction. The current status and future directions of this work are discussed.

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