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Generating spin dependent synthetic electric and magnetic fields in BECs ROBERT NIFFENEGGER, ABRAHAM OLSON, YONG CHEN, Purdue University — We report experiments aimed to generate spin dependent synthetic electromagnetic fields in ^{87}Rb BECs subject to optical Raman fields that couple different hyperfine spin and momentum states to create dressed state energy bands with synthetic gauge fields and spin orbit interactions. In one set of experiments, we adiabatically load an optically-trapped ^{87}Rb BEC into the single ground state minimum of the dressed state band with strong Raman coupling. This starts the BEC as a superposition between two spin states ($|F = 1, m_F = -1 >$ and $|F = 1, m_F = 0 >$) with opposite momenta. We have observed that dynamically lowering the Raman coupling strength into the spin-orbit regime can actuate opposite oscillations of the two trapped spin components about their new vector potential minima, giving rise to an alternating (AC) spin current. We interpret this as due to spin dependent synthetic electric fields generated by dynamically splitting the dressed state band minimum into two. We have studied the oscillating spin current and its damping on the rate of change in vector potential, the spin populations, initial and final Raman coupling, and Raman detuning. We are also developing techniques to produce spin dependent magnetic fields in spatially varying Raman coupling.

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