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Angular Momentum of a Bose-Einstein Condensate in a Synthetic Rotational Field CHUNLEI QU, JILA and Department of Physics, University of Colorado, Boulder, SANDRO STRINGARI, INO-CNR BEC Center and Dipartimento di Fisica, Universita di Trento — By applying a position-dependent detuning to a spin-orbit-coupled Hamiltonian with equal Rashba and Dresselhaus coupling, we exploit the behavior of the angular momentum of a harmonically trapped Bose-Einstein condensed atomic gas and discuss the distinctive role of its canonical and spin components. By developing the formalism of spinor hydrodynamics we predict the precession of the dipole oscillation caused by the synthetic rotational field, in analogy with the precession of the Foucault pendulum, the excitation of the scissors mode, following the sudden switching off of the detuning, and the occurrence of Hall-like effects. When the detuning exceeds a critical value we observe a transition from a vortex free, rigidly rotating quantum gas to a gas containing vortices with negative circulation which results in a significant reduction of the total angular momentum.

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