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Vortices in spin-orbit-coupled Bose-Einstein condensates JURAJ RADIC, TIGRAN A. SEDRAKYAN, Joint Quantum Institute, University of Maryland, College Park, IAN B. SPIELMAN, Joint Quantum Institute, University of Maryland, College Park and NIST, Gaithersburg, VICTOR GALITSKI, Joint Quantum Institute, University of Maryland, College Park — We discuss realistic methods to create vortices in spin-orbit-coupled Bose-Einstein condensates. We show that, contrary to common intuition, rotation of the trap containing a spin-orbit-coupled condensate does not lead to an equilibrium state with static vortex structures but gives rise instead to intrinsically time-dependent Hamiltonian. We propose alternative methods to create stable static vortex configurations: (1) to rotate both the lasers and the anisotropic trap; and (2) to impose a synthetic Abelian field on top of synthetic spin-orbit interactions. We derive the effective Hamiltonians for spin-orbit condensates under such perturbations for most currently known realistic laser schemes that induce synthetic spin-orbit couplings and we solve the Gross-Pitaevskii equation for several experimentally relevant regimes. The new interesting effects include spatial separation of left- and right-moving spin-orbit condensates and the appearance of unusual vortex arrangements.

Juraj Radic
Joint Quantum Institute, University of Maryland, College Park

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