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**Creating spin Lissajous maps in a spinor Bose–Einstein condensate** MAITREYI JAYASEELAN, JUSTIN T. SCHULTZ, AZURE HANSEN, JOSEPH D. MURPHREE, NICHOLAS P. BIGELOW, University of Rochester — We explore the connections between optical polarization fields and atomic spin degrees of freedom in a 87Rb spinor Bose–Einstein condensate (BEC). The atomic Zeeman states and states of optical circular polarization are both eigenstates of spin angular momentum, allowing us to employ the language of optical polarization to describe the spatially patterned spin textures of a BEC. A pseudo-spin-1/2 BEC is the analog of a paraxial monochromatic optical field; we create spin ellipse maps of the cloud that correspond to the polarization ellipse maps describing optical fields. Here, we extend this atom-optic analogy to study atomic analogs of bichromatic and polychromatic optical fields. The electric field vector of polychromatic fields traces out generalised Lissajous figures that may possess higher order symmetries than the polarization ellipses of monochromatic fields. Atomic populations in two separate but coherent pseudo-spin-1/2 systems within a hyperfine manifold furnish the atomic analog of a bichromatic optical field, allowing us to create spin Lissajous maps of the cloud. We create a vortex in one spin component of the BEC using singular beams. This creates a rotation of the spin Lissajous figures around the singularity causing a knotted topology to appear in the system.

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