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Twisted vortex beams for tailored topological spin textures in spinor Bose–Einstein condensates MAITREYI JAYASEELAN, JUSTIN T. SCHULTZ, JOSEPH D. MURPHREE, ZEKAI CHEN, NICHOLAS P. BIGELOW, University of Rochester — Optical imprinting techniques have proven useful for creating interesting topological spin textures such as skyrmions, half-quantum vortices, spin monopoles, and non-Abelian vortices in spinor condensates. These protocols manipulate the populations and phases of the atomic spin states via multiphoton Raman processes. However, the AC Stark shift from the radially varying intensities of the optical beams causes an undesirable intensity-dependent phase across the cloud, creating a non-uniform twist of the spin texture. One protocol used to correct for this phase twist has used additional optical pulses of a single laser beam with power and detuning set to unwind this extra radial phase. Instead, we investigate singular beams with an additional radial phase profile to compensate for the AC Stark shift that the atomic states accrue during a Raman process. These beams can be created with spatial light modulators, which allow for the control of the azimuthal and radial phase and intensity profiles of optical beams. The intensity-dependent phase for the atoms and radial phase of the optical beam can cancel during the Raman process, creating a non-twisted spin texture.

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