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Single-beam, dark toroidal optical traps for cold atoms SPENCER OLSON, MATTHEW TERRACIANO, MARK BASHKANSKY, ZACHARY DUTTON, FREDRIK FATEMI, Naval Research Laboratory — Toroidal atom confinement has received significant attention for both fundamental and applied research. We demonstrate single-beam, blue-detuned, toroidal optical traps for cold atoms. These are created by modifying the phase of a Gaussian laser beam with a spatial light modulator (SLM). By combining a radial phase discontinuity with an azimuthal phase variation $n\phi$, where n is an integer, we produce a beam containing a ring-shaped intensity null surrounded harmonically in all directions by high intensity. The SLM is used to control and optimize the propagation and trapping characteristics of these toroidal beams, which we analyze both numerically and experimentally. Finally, we demonstrate confinement of cold Rb atoms in these traps using light that is blue-detuned by ~ 5 nm from the D2 line.

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