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Creating arbitrary optical potentials to study and manipulate Bose-Einstein Condensates.[1] SERGIO MUNIZ, JQI/NIST, CHANDRA RAMAN, Georgia-Tech, KRISTIAN HELMERSON, WILLIAM PHILLIPS, National Institute of Standards and Technology — There is a lot of interest in studying degenerate quantum gases in various types of confining potentials, to explore effects ranging from quantum transport to quantum information. More recently, spatial light modulators have been proposed to produce generalized optical potentials. Here we present a particular kind of spatial-light modulation technique that we are investigating, based on acousto-optic devices, to produce arbitrary time-averaged optical potentials in 2D. This approach can be combined with other magnetic or optical confinement to create various trapping potentials in 3D as well. In particular, we will discuss the case of a Bose- Einstein condensate (BEC) in a toroidal trap in two different regimes: the quasi-2D and 3D limits. The approach proposed here allows for *in-situ* corrections of the desired potential, after diagnosing any imperfections or aberrations caused by the propagation of the beams through the optical system. In addition, it may be a very promising method to create dynamically varying potentials. We will also discuss the application of this method to the study of macroscopic persistent currents using sodium BEC.

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