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A focused CO_2 laser beam for phase contrast electron microscopy
MICHELLE XU, ERIN SOHR, HOLGER MUELLER, University of California, Berkeley — Phase contrast electron microscopy, in analogy to the Zernike microscopy, enables imaging of previously elusive organic or nonorganic specimens [1]. While existing physical phase plates degrade due to electron charging effects, a laser phase plate (LPP) utilizes the pondermotive potential to shift the electron phase and should offer reusability and improved longevity. The un-diffracted electrons travel through the laser beam (150 W, Apollo 150 CO_2 laser), which produces the ponderomotive potential. To increase the phase shift with the same amount of laser power, we use axicon lenses to generate Laguerre-Gaussian mode, which can be optimally focused by the parabolic mirror. To further enhance the focal intensity, we place a partial reflector at the opening of the parabolic mirror to form an optical resonator. This scheme will offer $\pi/2$ electron phase shift [1], and will enable phase contrast imaging. We present experimental demonstration of the parabolic-mirror cavity (the LPP) and the resulting electron phase shift.

[1] Mueller et al., New J. Phys. 12 (2010) 073011.

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