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**Study of Wavefront Aberrations for MAGIS-100 Laser Beam Delivery System** YIPING WANG, NATASHA SACHDEVA, JONAH GLICK, TIMOTHY KOVACHY, Northwestern University — The MAGIS-100 experiment is a 100-m tall atom interferometer being built at Fermilab with a goal to measure gravitational waves in the mid-band frequency range of 0.1–10 Hz which is between the band for LIGO and LISA. For atom interferometry, pulses of light are used to create the atom optics equivalents of beam-splitters and mirrors. Laser wavefront aberrations cause phase distortions across the Sr atom cloud and result in loss of contrast and systematic errors in the interferometer phase. In this talk, we present simulation studies of the propagation of laser beam perturbations through the MAGIS-100 laser beam delivery system in order to determine the beam aberrations at the locations of the atoms. The effect of these aberrations are simulated by numerically evaluating the Rayleigh-Sommerfeld diffraction integral using the FFT convolution theorem. We studied spatial filtering of the beam by free-space propagation in the MAGIS-100 beam delivery system and the effects of specific aberrations such as localized defects and spherical aberrations in optical components. These simulations informed a design of the beam delivery system that minimizes the aberrations experienced by the atoms.

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