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(Mallory Kertzmann V)

DEVELOPING HIGH-FINESSE CAVITIES FOR PHASE CONTRAST ELECTRON MICROSCOPY



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GRIN Verlag Sep 2015, 2015. Taschenbuch. Book Condition: Neu. 211x146x7 mm. Neuware - Research Paper from the year 2014 in the subject Physics - Optics, University of California, Berkeley , language: English, abstract: The transmission electron microscope is an indispensable tool in science, with applications across medicine, materials science, and geology, among others. However, it is limited in its ability to operate with Zernike phase contrast, a technology commonplace in light microscopy. Zernike phase contrast can be obtained, but only by using carbon-film phase plates or similar methods, all of which are short-lived. Electrons moving close to the speed of light cause damage as they bombard the phase plates. The phase plates need to be replaced frequently, which introduces inconsistencies due to variations between the plates as they are replaced. The purpose of this paper is to demonstrate the plausibility of utilizing ponderomotive forces within an optical cavity to achieve phase contrast, creating a laser-based phase plate, thereby replacing the carbon films and eliminating swapping. We approach this problem by using a Fabry-Perot to concentrate the laser power to be able to achieve the necessary electron phase shift with conventional CO₂ lasers. We demonstrate a cavity with finesse of ~24000 and numerical aperture of ~.016, and calculate the laser power needed to be supplied to be ~19W, well within the state of art. These results demonstrate the practicality of laser-based electron microscope phase plates. 28 pp. Englisch.



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