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Study the Effects of Gaussian distribution of coherence length of the source on the diffraction from single slit and circular aperture using Monte Carlo simulation

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Abstract
We study the Fraunhofer diffraction from a single slit as well as a circular aperture in a situation where the light source is monochromatic but partially coherent. In this paper, we try to bring the problem closer to reality and do not fix the coherence length and consider a Gaussian distribution function for it. Numerical study of the effects of coherence parameters with Gaussian distribution on a far field diffraction pattern is performed. In the case of a single slit, as the coherence length decreases, no significant deviation occurs at its central peak, but at higher diffraction levels, a decrease is apparent, depending on the Gaussian distribution of the coherence length. For circular apertures, the parameters of the coherence length distribution function affect the shape of the light intensity distribution and the first-order diffraction pattern decreases, and with a relative decrease in coherence length, the first-order circular diffraction pattern gradually disappears.

Keywords: Monte Carlo method, partial temporal coherence, single slit, circular aperture, Gaussian distribution

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