

# Effect of optical aberration on Gaussian laser speckle

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**Abstract:** Optical aberration effects up to the second moment of Gaussian laser speckle are theoretically investigated for both partially and fully developed speckle. In the development, a plane-wave illuminated diffuser generates a phase-perturbed random field in the object plane that creates speckle in the image plane. Theoretical derivations show that image field statistics are generally non-circular Gaussian due to aberrations. Speckle statistics are not affected by odd-functional aberrations, such as coma, and dependency of aberrations is asymptotically ignorable for very weak or strong diffusers. Furthermore, Gaussian speckle contrast as a functional of optical aberrations exhibits a stationary point for the aberration free condition, where apparently contrast does not achieve a local maximum. Calculations of speckle contrast for several aberration conditions are also presented.

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