

Statistical properties of speckle patterns optimized by tailoring the image acquisition setup

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Speckle is an optical artifact of coherent waves interfering with each other that is often undesired in imaging systems. On the other hand, the spatial correlations present in the speckle pattern contain relevant information, which can be used for imaging, e.g., to reconstruct the object that generates the speckle. Wavelength-dependent speckle patterns can also be exploited for realizing a spectrometer. In this contribution we study experimentally how the statistical properties of the speckle pattern depend on the coherence of the light source, the intensity of the illumination, and the exposure time of the CCD camera. Using the speckle contrast measure, $C = \langle I \rangle / \sigma$ (with $\langle I \rangle$ being the mean intensity of the pattern and σ its standard deviation), we find optimal conditions for either minimizing or maximizing speckle.

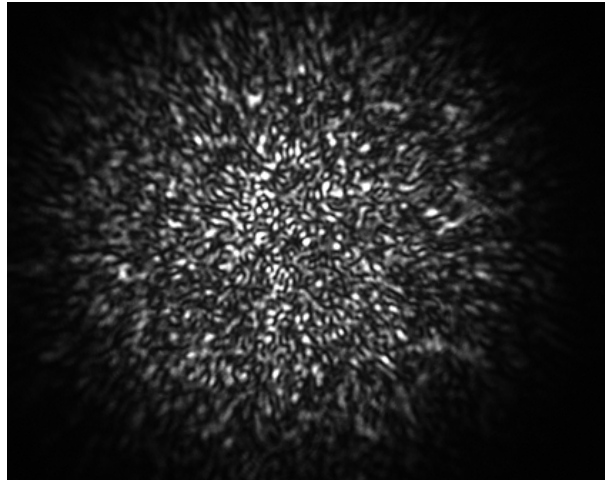


Fig. 1. Example of speckle pattern acquired with a multimode optical fiber, a laser beam (operated well above the threshold) and 6 ms exposure time of the CCD camera.