

THE OPTICS OF THE SPATIAL COHERENCE WAVELETS

Prof. Dr. Román Castañeda

GENERAL DESCRIPTION

This is a course on the fundamentals and principles of the optical spatial coherence, in the modern framework named the phase-space representations of optical fields or Wigner optics. The properties of the main quantities (i.e. the spatial coherence wavelets, the marginal power spectrum and the structured coherence support) are discussed in detail. The phase-space diagrams are also interpreted as a maps of interfering rays, which allows implementing numerical algorithms to simulate (or to calculate) the behaviour of optical fields in any state of spatial coherence under specific conditions. Thereafter, applications in interference, diffraction, holography, imaging and field modulation are described.

Bibliography

- Born, M and E. Wolf. *Principles of Optics*. 6th. ed. Pergamon Press, Oxford, 1993.
- Mandel, L. and E. Wolf. *Optical Coherence and Quantum Optics*. Cambridge University Press, 1995.
- Marathay, A., *Elements of Optical Coherence Theory*, John Wiley & Sons, New York, 1982.
- Betancur, Rafael, John Restrepo and Roman Castaneda. *Beam shaping by spatial coherence modulation based on spatial coherence wavelets*. *Opt. Las. Eng.* **47** (2009) 1340–1347.
- Betancur, Rafael and Roman Castañeda. *Spatial coherence modulation*. *J. Opt. Soc. Am. A* **26** (2009) 147-155.
- Castaneda, Roman, Rafael Betancur and John F. Restrepo. *Interference in phase-space*. *J. Opt. Soc. Am. A* **25** (2008) 2518-2527.
- Castaneda, Roman, Rafael Betancur and Diego Hincapie. *Holographic features of spatial coherence wavelets*. *J. Opt. Soc. Am. A* **25** (2008) 1894-1901.
- Castaneda, Roman. *Phase space representation of spatially partially coherent imaging*. *Appl. Opt.* **47** (2008) E53-E62.
- Castañeda, Román and Juan Carrasquilla. *Spatial coherence wavelets and phase-space representation of diffraction*. *Appl. Opt.* **47** (2008) E76-E87.
- Castaneda, R., M. Usuga-Castaneda and J. Herrera-Ramirez. *Experimental evidence of the spatial coherence moiré and the filtering of classes of radiator pairs*. *Appl. Opt.* **46** (2007) 5321-5328.
- Castañeda, R. and J. García. *Spatial coherence wavelets: mathematical properties and physical features*. *J. Mod. Opt.* **50** (2003) 2741-2753.
- Castañeda, R. and J. García. *Spatial coherence wavelets*. *J. Mod. Opt.* **50** (2003) 1259-1275.

Lecture co-financed by the European Union in scope of the European Social Fund