# Implementation of a simultaneous message-passing protocol using optical vortices

M. Szatkowski[1], J. Koechlin[2]; Jan Masajada[1]; Dorilian Lopez-Mago[3]

[1]*Wrocław University of Science and Technology, Department of Optics and Photonics, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland;*
[2]*University of Basel, Department of Physics, 4056 Basel, Switzerland*
[3]*Tecnologico de Monterrey, Escuela de Ingenieria y Ciencias Ave. Eugenio Garza Sada 2501, Monterrey, N.L. 64849, Mexico*

Beams carrying orbital angular momentum became an interesting solution for many application related to optical communication and information technologies. In this talk, the method to calculate similarities between two signals through Laguerre-Gaussian modes will be proposed.

Laguerre-Gaussian modes are generated by the Digital Micromirror Device (DMD), which simultaneously shape two separate beams, coming from the common laser source. To encode information, each of the Laguerre-Gaussian mode is shifted in phase, constructing signals that have to be compared. Polarization controlled SWAP gate exchanges information between two input signals, at the same time preventing them from being revealed. Detected intensity is proportional to the overlap of signals. Taking the advantage of a high frequency modulation offered by the DMD and integral nature of the used power meter, presented system is capable to directly provide the overlap factor represented as a single power value. Normalization procedure, implemented in the measurement itself, does not require further data post processing and offers an instant signal comparison without the access to encoded information.

This work, which uses classical light to realize a concept arising from the world of quanta, is another example of quantum-inspired analogy, easier to implement and offering more degrees of freedom. It could be applied directly in the classical world or serving as a prototype for quantum application.