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Quantum-analogy-based solutions for robust photonics

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The equations describing the evolution dynamics of coupled few levels quantum system bear direct analogy with those describing several processes in classical wave optics, including the cases of evanescently coupled waveguides, polarization transformation optics, and nonlinear optical frequency conversion. This allows to exploit the same kind of robust approaches used in the quantum field in order to reach a specific target state. This talk will summarize some of our recent works in this context. The examples will involve adiabatic approaches for light transfer, mode conversion or broadband polarization selective beam splitting in waveguide optics, a simple and robust composite optical rotator for polarization optics, and composite approaches for broadband nonlinear optical frequency conversion based on segmented crystals. The usefulness of employing non-Hermitian systems involving dissipation for specific purposes will also be discussed.

Primary author: MONTEMEZZANI, Germano (Université de Lorraine, CentraleSupélec, LMOPS)

Presenter: MONTEMEZZANI, Germano (Université de Lorraine, CentraleSupélec, LMOPS)

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