Physical meaning of the radial index of Laguerre-Gauss beams
WILLIAM PLICK, University of Dayton, MARIO KRENN, Institute for Quantum Optics and Quantum Information — The Laguerre-Gauss modes are a class of fundamental and well-studied optical fields. These stable shape invariant photons, exhibiting circular-cylindrical symmetry, are familiar from laser optics, micromechanical manipulation, quantum optics, communication, and foundational studies in both classical optics and quantum physics. They are characterized, chiefly, by two mode numbers: the azimuthal index indicating the orbital angular momentum of the beam, which itself has spawned a burgeoning and vibrant subfield, and the radial index, which up until recently has largely been ignored. In this presentation we demonstrate a differential operator formalism for dealing with the radial modes in both the position and momentum representations and, more importantly, give the meaning of this quantum number in terms of a well-defined physical parameter: the intrinsic hyperbolic momentum charge.

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