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Understanding the angular momentum of light in the presence of structured darkness[1] SAMUEL ALPERIN, MARK SIEMENS, Univ of Denver — It is well known that passing a Gaussian beam through a 2πm helical phase optic imparts the beam with an orbital angular momentum (OAM) of m$\hbar$ when m is an integer. However, this linear relationship between the topological charge of the generating phase optic and the OAM of the generated beam does not in general hold for non-integer m. We explain this apparent discrepancy between the topology of the optic and the OAM of the generated mode. First, we show that the fundamental action of a spiral phase optic is to impart the transmitted beam with m$\hbar$ of intrinsic OAM, the component of the OAM that is invariant on translation. We then investigate the structure and origin of the other component of the fractional vortex mode, the extrinsic AM carrying component which we call structured darkness. It is shown that the structured darkness found in fractional vortex beams is the effect of evanescent structure at the surface of the phase optic upon the propagating mode. It is concluded that the extrinsic angular momentum of fractional vortex beams, as well as their rich topological structure, can be explained by the form of the evanescent structure at the surface of the associated phase optic.

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Samuel Alperin
Univ of Denver

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