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Invariance to Randomness Using the Topology of Light

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The topology of light and its robustness to noise has garnered significant interest over the last few years as a promising means of information transfer. Light's topology, more specifically the Skymion topology, describes the correlation between light's position and polarization. Skymions have been shown to be invariant to isotropic noise; whether topology is invariant to random media is investigated. In this work, we investigate classical vector beams and spatially and polarisation entangled photons' reaction to random media. We used digital phase screens to simulate the random media before using real and biological cell samples. We successfully showed that light's Skyrme number was invariant to all three kinds of random media investigated. For classical vector beams topology was conserved for random media varying in scattering strength. Our work demonstrates topologies robustness to random media and shows exciting promise for its use in real-world information transfer.

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