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Beyond doughnuts and mugs, tying photons together

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Entanglement between photons has been a source of great interest in the past few decades being the catalyst for fundamental tests of quantum mechanics and offering a plethora of applications from ghost imaging to quantum key distribution. However, these entangled photon states are highly susceptible to environmental disturbances, thus requiring mechanisms for robustness in harsher environments. Topology is capable of providing these mechanisms, rejecting such disturbances entirely by characterizing systems according to an invariant property of the system, universally named its topological charge. An interesting topology is that of the skyrmion which has proven to be highly versatile, manifesting in spintronics, condensed matter physics and more recently optics. Here we report the first non-local quantum skyrmion whose topology can be controlled directly through control of its non-separable, biphoton wavefunction. We discuss a new classification mechanism where wavefunctions are distinguished according to their topology. We further demonstrate that the topology of the wavefunction persists even when entanglement is fragile.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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