Quantum hybrids of superconductivity and magnetism via topological solitons

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Topological solitons and quantum mechanics have been intertwined for the past 60 years. Even before the term soliton had been coined, Abrikosov theory predicted the formation of vortices in the phase field of superconductors, an exemplar exposition of macroscopic quantum coherence. Recent work shows that solitons are in fact a timely and promising platform for quantum operations. I will demonstrate the viability of using spin topology to influence a superconductor at selective length scales through a completely new material architecture namely, a stack of magnets and a superconductor that shows stable vortices above elongated chiral spin textures, as well as isolated skyrmions. This is an ideal geometry for fluxonics and chiral superconductivity, as well as quantum processes such as non perturbative, non-contact Majorana braiding.