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Observing the quantum topology of light

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Topological photonics provides a powerful platform to explore topological physics beyond traditional electronic materials and shows promising applications in light transport and lasers. Classical degrees of freedom are routinely used to construct topological light modes in real or synthetic dimensions. Beyond the classical topology, the inherent quantum nature of light provides a wealth of fundamentally distinct topological states. In this talk I will introduce the experiment on topological states of quantized light in a superconducting circuit, with which one- and two-dimensional Fock-state lattices are constructed. We realize rich topological physics including topological zero-energy states of the Su-Schrieffer-Heeger model, strain-induced pseudo-Landau levels, valley Hall effect, and Haldane chiral edge currents. Our study extends the topological states of light to the quantum regime, bridging topological phases of condensed-matter physics with circuit quantum electrodynamics, and offers a freedom in controlling the quantum states of multiple resonators.

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