Dynamic Photonic Topology for Reconfigurable Routing

Scientific Achievement

A new theoretical framework enables the discovery of reconfigurable topology in nonlinear driven and dissipative systems.

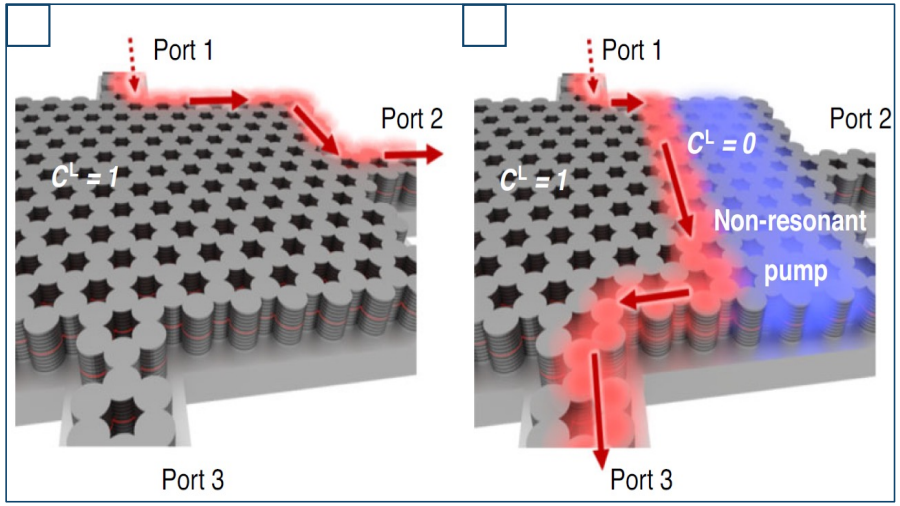

Figure: Scheme for dynamical control over the topological mode's propagation path. (left) Schematic of an exciton-polariton topological Chern insulator. Energy is injected into the chiral edge mode (red) with a resonant laser and propagates along the boundary of the lattice to the output Port 2. (right) Illuminating the same nonlinear lattice with a non-resonant pump (blue) renders the lattice locally topologically trivial and leads to a different path of propagation for the topological mode.

Significance and Impact

The ability to dynamically alter a topological interface without changing the underlying physical structure is a necessary feature of any photonic system seeking to use protected, non-reciprocal edge states to route information. Here, a CINT User team provides the first framework capable of rigorously predicting such phenomena.

Research Details

- Classification is performed in real-space, not wavevector-space, enabling the direct identification of topological domains within a system due to changes in the system's occupation, which sets the nonlinearity.
- Sub-ns reconfigurable routing predicted in polariton lattices at optical frequencies.

Wong, S.; Betzold, S.; Höfling, S.; Cerjan, A. Dynamically reconfigurable topological routing in nonlinear photonic systems. *Light: Science & Applications.* 2026.

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