Non-Abelian holonomy in Hermitian and non-Hermitian photonic systems

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Non-Abelian holonomy is a phenomenon that arises when a state of a quantum system is adiabatically transported around a closed loop in Hilbert space but fails to preserve its initial status due to the associated non-Abelian gauge fields. This effect shows great potential for applications such as topological quantum computing. Here, we present how we introduce the non-Abelian holonomy effect for integrated photonic systems. In Hermitian photonics systems, we construct a degenerate subspace in which the non-Abelian holonomy occurs, leading to applications including photonic non-Abelian braiding and photonic non-Abelian Thouless pumping. We also extend the concept to non-Hermitian photonic systems possessing degenerate exceptional points and associated degenerate energy topologies. We show that the concept and physical consequence of non-Abelian holonomy can be greatly enriched in degenerate non-Hermitian systems.

Short Bio:

Xulin Zhang received his PhD degree in Jilin University, China. He is a professor of Jilin University, China. His research interests include non-Hermitian physics, non-Abelian physics and integrated photonics.