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Topological physics: from photons to electrons

Abstract: There are many intriguing physical phenomena that are associated with topological features --- global properties that are not discernible locally. The best-known examples are quantum Hall effects in electronic systems, where insensitivity to local properties manifests itself as conductance through edge states which are insensitive to defects and disorder. In the talk, we first discuss how similar physics can be explored with photons; specifically, how various topological models can be simulated in various photonics systems, from ring resonators to photonic crystals. We then discuss that the integration of strong optical nonlinearity can lead to unique bosonic phenomena, such as a topological source of quantum light and chiral quantum optics. These results may enable the development of classical and quantum optical devices with built-in protection for next-generation optoelectronic and quantum technologies. (For a review of early works: Rev. Mod. Phys. 91, 015006 (2019))

Bio: Mohammad Hafezi is an Associate Professor with a joint appointment in the Physics and Electrical and Computer Engineering Departments at the University of Maryland and a fellow of the Joint Quantum Institute. He studied at Sharif University before completing his undergraduate degree in École Polytechnique. He received his Ph.D. in Physics from Harvard University in 2009. His research interest includes quantum optics, topological physics, condensed matter, and quantum information sciences. He is the recipient of several awards including the Sloan Fellowship, the Young Investigator Award of the US Naval Research Office, and the Simons Foundation Investigator.