筑波大学
University of Tsukuba

Condensed Matter Seminar
物性論セミナー

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15:00-16:00
自然系学系棟D棟3階: D301号室

Topological edge modes unique to nonlinear systems

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Abstract:
Topological insulators have attracted much interest due to their unique properties that originate from gapless localized modes. Recent studies have explored such topological edge modes in various experimental setups, including photonics, fluids, and cold atoms, whose dynamics are often written by nonlinear equations (cf. Navier-Stokes, Gross-Pitaevskii). Despite the ubiquity of nonlinear systems, however, it is still unclear whether or not the notion of topology can be extended to such nonlinear systems.

In our works, we explore the topological edge modes and invariants unique to nonlinear systems. Specifically, we first reveal that topological edge modes can affect the synchronization of nonlinear oscillators [1]. Secondly, we propose a nonlinear extension of the Chern number and analyze its bulk-boundary correspondence to topological edge modes [2]. Thirdly, we reveal that the bulk-boundary correspondence can be broken in nonlinear systems due to chaos transitions of zero modes [3]. These results can provide insights to fully elucidate the bulk-boundary correspondence in nonlinear systems.
[1] K. Sone, Y. Ashida, T. Sagawa, Phys. Rev. Research. 4, 023211 (2020).
[2] K. Sone, M. Ezawa, Y. Ashida, N. Yoshioka, T. Sagawa arXiv:2307.16827 (2023). (To appear in Nat. Phys.) [3] K. Sone, M. Ezawa, Z. Gong, T. Sawada N. Yoshioka, T. Sagawa arXiv:2403.03038 (2024).

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