# THEORY LECTURE SERIES: Phases of open quantum systems

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May 26, 2025 to June 03, 2025
10:00 to 12:00
Blue Lecture Room

**Abstract:**
These lectures will survey recent progress in realizing and characterizing nontrivial many-body phases of open quantum systems. In the first lecture I will discuss how to define steady-state phases of open systems [1], and introduce concepts that are distinctive to open systems, such as strong and weak symmetries and spontaneous strong-to-weak symmetry breaking [2]. In the second lecture I will introduce cavity QED as a setting in which phases such as a nonequilibrium quantum spin glass can be realized [3]. Building on this example, in the second and third lectures I will introduce a dual perspective on open quantum systems focusing on the classical and quantum information that they leak into the environment. As will discuss, this emitted information can be used to witness steady-state phase transition [3], and also underlies a new family of "learnability" transitions [4].

[1] Rakovszky, SG, von Keyserlingk, Phys. Rev. **14**, 041031 (2024)
[2] Sala, SG, Oshikawa, You, Phys. Rev. B **110**, 155150 (2024)
[3] SG, Lev, Goldbart, Phys. Rev. Lett. **107**, 277201 (2011); Marsh et al., Phys. Rev. X **14**, 011026 (2024); Kroeze et al., arxiv:2311.04216
[4] Barratt et al., Phys. Rev. Lett. **129**, 200602 (2022); Agrawal et al., Phys. Rev. X **14**, 041012 (2024); SG, J. Phys. A: Math. Theor. **58** 055301 (2025)

**Prof. Sarang Gopalakrishnan's Biography:**
SG received his PhD from the University of Illinois at Urbana-Champaign in 2012. Since then he has worked as a postdoc at Harvard (2012-2015) and Caltech (2015-2016); and taught at the City University of New York (2016-2020), Penn State University (2021-2022), and Princeton (2022-present). He has worked on various aspects of quantum dynamics in many-body systems, including the phenomena of thermalization and many-body localization, generalized hydrodynamics of integrable systems, and the dynamics of open and monitored quantum systems.?

Participation is open to all ICFOnians.
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