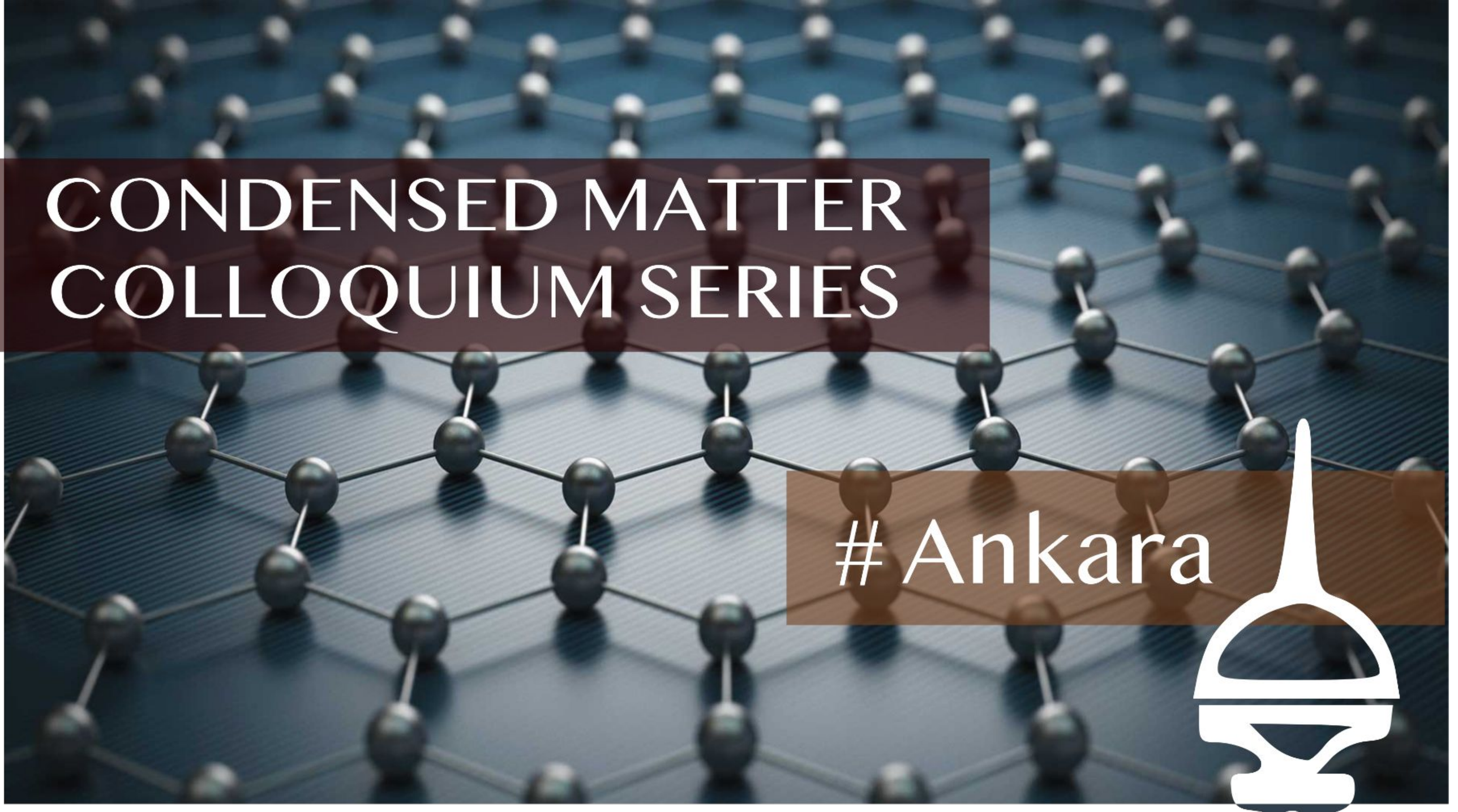

Sumilan Banerjee

Indian Institute of Science

Measurements and feedback induced phase transitions in quantum many-body systems

Quantum computers, for example, made of many superconducting qubits, are also complex quantum many-body systems. However, unlike conventional solid-state systems, these many-body assemblies, while evolving under various unitary gate operations, can also be frequently monitored by an external observer through repeated quantum measurements and feedback. Thus, quantum computers are specific types of open quantum systems, where repeated monitoring can be used as an engineered bath. How does such an 'observer bath' differ from a usual equilibrium thermal or quantum bath, and can this bath induce interesting non-equilibrium steady states and phase transitions between them? After an introduction, I will discuss two examples. In the first part, I will discuss a model of continuously monitored or weakly measured Josephson junction arrays (JJAs) with feedback and show that it undergoes an unusual inverse superconductor-insulator transition. If time permits, in the second part, I will discuss a similar measurement model for a chain of coupled anharmonic oscillators. I will show that such interacting systems, in the semiclassical limit, generically undergo a measurement-induced phase transition analogous to the well-known stochastic synchronization transition.

1. P. Das and S. Banerjee, arXiv:2412.04556.
2. S. Ruidas and S. Banerjee, Phys. Rev. Lett. 132, 030402 (2024).

Sep, 30, 2025
Tuesday

19:00, (Ankara Time)

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DSumilan Banerjee obtained his PhD degree from the Indian Institute of Science, Bangalore, in 2012. He subsequently worked at The Ohio State University, USA, and Weizmann Institute of Science, Israel, before joining the Indian Institute of Science in 2017. His current research interests include monitored quantum systems, quantum entanglement in interacting systems, non-Fermi liquids, thermalization, many-body localization, many-body quantum chaos, and strongly correlated electronic systems such as twisted bilayer graphene.

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