FONDAZIONE BRUNO KESSLER

ECT*
EUROPEAN CENTRE
FOR THEORETICAL STUDIES
IN NUCLEAR PHYSICS AND RELATED AREAS

Q@TN

UNIVERSITÀ DI TRENTO
Dipartimento di Fisica

JOINT PHD SEMINAR



30 OCTOBER 2026, AT 11.00 AM

ECT* - VILLA TAMBOSI, VILLAZZANO

DIAGNOSING HOLOGRAPHIC QUANTUM MATTER: MEASURABLE SIGNATURES AND DISSIPATION IN THE YUKAWA–SYK MODEL

Alex Windey

Università degli Studi di Trento, Dipartimento di Fisica

Holographic quantum matter provides a remarkable connection between strongly interacting many-body systems and quantum gravity, bringing together phenomena such as quantum chaos, information scrambling, and the breakdown of the conventional quasiparticle picture. The Sachdev–Ye–Kitaev (SYK) model offers a paradigmatic setting in which to explore these connections, but realizing its characteristic physics in the laboratory remains an outstanding challenge. Making progress towards this goal requires not only identifying suitable experimental platforms, but also determining which signatures of holographic behavior are measurable and how robust they are to unavoidable dissipation. In this seminar, I will discuss the Yukawa–SYK model, in which fermions interact with bosons through random couplings, with an interaction vertex of the same form as the light–matter coupling in cavity-QED platforms. Remarkably, these interactions can dynamically drive the bosons to criticality without fine-tuning, a mechanism known as self-tuned criticality. Using the Schwinger–Keldysh formalism, I will map out the model's phase diagram, including previously unexplored regimes in which an essentially free boson generates Floquet-like sidebands in the fermionic spectrum. I will then present experimentally accessible signatures, based on two-point correlation functions and the quantum Fisher information, that distinguish the different regimes without requiring a direct fit of conformal scaling laws. Finally, I will show how dissipation limits self-tuned criticality through a finite “criticality budget”, constraining the temperatures and loss rates compatible with the strongly correlated regime. These results establish a framework for diagnosing holographic quantum matter and assessing its prospects for realization in realistic open quantum systems

Please, facilitate the organization of the seminar and coffee break by registering via the QR code. Thank you.

ECT* Director: Prof. Ubirajara van Kolck

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For the organization please contact: Barbara Gazzolii – ECT* Secretariat - Villa Tambosi - Strada delle Tabarelle 286 | 38123 Villazzano (Trento) – Italy Tel.:(+39-0461) 314763, E-mail: gazzoli@ectstar.eu or visit http://www.ectstar.eu