

**ICTS**

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TATA INSTITUTE OF FUNDAMENTAL RESEARCH

ICTS String Seminar

Title : Entanglement inequalities, black holes and the architecture of typical states

Speaker : Ayan Mukhopadhyay (Pontificia Universidad Catolica de Valparaiso, Chile)

Date : Monday, 24 November 2025

Time : 3:30 PM (IST)

Abstract : Using holographic realizations of the Araki-Lieb (AL) inequality, we show that typical pure states in large N holographic CFTs possess two characteristic length scales determined solely by energy and conserved charges: a microscopic L_{UV} and an infrared $L_{IR} > L_{UV}$. Degrees of freedom between these scales effectively factorize — one purifying the ultraviolet (scales $< L_{UV}$) and the other the infrared sector (scales $> L_{IR}$). Remarkably, the pure state factor including the ultraviolet sector is determined only by the energy and conserved charges up to exponentially suppressed corrections. Our results imply that all black holes in anti-de Sitter space can be isolated from an asymptotic region, the corona, that is formed by the inclusion of entanglement wedges of microscopic intervals for which the AL inequality is saturated, and an effective factorization emerges in the buffer region between the corona and the outer horizon. For any non-extremal black hole microstate, the corona can only receive exponentially suppressed state dependent corrections in the large N limit. This realizes and also generalizes statistical features of the Eigenstate Thermalization Hypothesis (ETH).

Venue : Online

Zoom Link: <https://icts-res-in.zoom.us/j/88092766911?pwd=R3ZrVk9yeW96ZmQ4ZG9KRzVhenRKZz09>

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