Speaker: **Saud Cindrak, TU Ilmenau**

Title: **Quantum Reservoir Computing maps Data onto the Krylov space & More**

Date: **Tuesday, July 08th, 12:00 o'clock noon (s.t.)**

Place: **Seminar room 915**

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My talk will focus on Krylov state spaces and Krylov operator spaces, Krylov complexity, and two new measures we introduce: Krylov expressivity and Krylov observability. I will discuss the insights these concepts offer and how they can be used to optimize the performance of quantum reservoir computing. We will show that Krylov observability and data expressivity in reservoir computing closely mirror each other.

The talk will primarily be based on the following works:

•https://link.springer.com/article/10.1007/JHEP10(2024)083

•https://arxiv.org/abs/2409.12079

•https://arxiv.org/abs/2502.12157

I intend to emphasize the quantum mechanics aspects more than the quantum reservoir computing side. In addition to the content in these works, we have included some new results.

Toward the end of the talk, I would like to outline the next steps I plan to take in my research and hopefully receive some insights, feedback, or suggestions. I have some preliminary results on Krylov complexity, where numerical analysis shows that the widely held assumption that Krylov complexity minimizes spread complexity does not hold. This disproves one of the main motivations behind the usage of the Krylov basis and Theorem 1 of the article introducing Krylov spread complexity (doi.org/10.1103/PhysRevD.106.046007). I will also present some early results on the behavior of Krylov spread complexity behavior in many-body localization and thermalization.