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Institut für Physik
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INSTITUTSKOLLOQUIUM

Gemeinsames Kolloquium der Physik und Chemie

Am Dienstag, dem **12. Mai 2026**, spricht um **17:15 Uhr** im **Faraday-Hörsaal,**

Herr Ass.-Prof. Dr. Tomoki Yamagami

Saitama University, Japan

zum Thema:

"Quantum Walks: From Quantum Dynamics on Graphs to Search and Decision Making"

Abstract:

Random walks appear in many areas of physics, from diffusion and transport to stochastic dynamics in complex systems, and provide an intuitive starting point for exploration on graphs and networks. In microscopic physical systems, however, transport is not always governed by classical probabilities: particles can behave as waves, and probability amplitudes can superpose and interfere. This motivates quantum walks as mathematical models for quantum propagation on graphs and networks, where probability amplitudes evolve instead of classical probabilities, producing behavior, such as linear spreading and localization, that is difficult to capture with classical intuition alone.

In this talk, I will give an introductory overview of quantum walks as a simple yet versatile framework for describing quantum dynamics on graphs, and as a bridge between physical intuition, mathematical structure, and information-processing applications such as search and decision making. Physical realizations using photonic waveguide arrays, cold atoms, trapped ions, and superconducting qubits offer concrete illustrations of their time evolution. I will focus on the fundamental mathematical structure of quantum walks and emphasize how it gives rise to properties distinct from classical random walks.

I will discuss how quantum-walk probability distributions can be harnessed for search, enhancing the probability of finding desired states and sometimes outperforming classical random-walk approaches. I will then present my work applying quantum walks to the multi-armed bandit problem, illustrating how linear spreading and localization can support the trade-off between exploring uncertain options and exploiting promising ones.

Wir laden Sie zu diesem Kolloquium herzlich ein!

Die Hochschullehrer der Institute für Physik und Chemie