Physical Sciences Seminar

Quantum simulation with tunable multi-body interactions in periodically driven Rydberg atom arrays

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Host: Maksym Serbyn and Jean Yves-Desaules

Neutral atom arrays driven into Rydberg states are a promising approach for realizing programmable quantum systems, where strong interactions associated with Rydberg blockade allow for simulation of complex spin models. In this talk, I will discuss a Floquet engineering technique that extends the capabilities of Rydberg quantum simulators and enables control over new forms of interactions. Our approach is based on time-dependent modulation of Rydberg laser detuning and leverages controlled deviations from periodic many-body trajectories as a resource for operator spreading. Such time-evolved operators provide a basis for engineering effective Hamiltonians with strong, non-perturbative multi-body interactions and we develop an optimization procedure for the time-dependent detuning in order to realize specific many-body models. As applications, we show how to engineer spin chains that dynamically generate large-scale multi-partite entanglement from simple initial states, and how to simulate dynamics of certain two-dimensional lattice gauge theories in previously inaccessible regimes. I will discuss a first experimental implementation of our approach on a Rydberg quantum simulator and give an outlook on promising future directions.

Tuesday, October 22, 2024 11:00am - 12:00pm
Office Bldg West / Ground floor / Heinzel Seminar Room

This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station.
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https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.