JOHANNES KEPLER
UNIVERSITÄT LINZ

PHYSIKKOLLOQUIUM
Fachbereich für Physik

Im Rahmen des Physikkolloquiums spricht

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über

The quest for rigorous advantages with near-term quantum computing devices

Abstract:
Large-scale quantum computing and simulation experiments require substantial classical computing power to control the experiment and process the results. This necessarily creates information-transmission bottlenecks at the interface of quantum and classical realms, thus preventing us from using existing architectures to the best of their capabilities.

In the talk it will be explained how to take into account both, quantum *and* classical computing resources, to develop scalable quantum-to-classical converters. Dubbed "*classical shadows*", they are simple enough to execute on current quantum hardware and come with rigorous performance guarantees. Applications abound and range from estimating quantum properties [1] to new synergies with machine learning [2] and even new types of quantum advantage [3].

[1] H-Y. Huang, R. Kueng, J. Preskill, Nature Physics, Jun 2020, DOI 10.1038/s41567-020-0932-7

[2] H-Y. Huang, R. Kueng, G. Torlai, V.V. Albert, J. Preskill, Science **377**, Sep 2022, DOI: 10.1126/science.abk3333

[3] H-Y. Huang, M. Boughton *et al.*, Science **376**, Jun 2022, DOI: 10.1126/science.abn7293

For those who want to know more about R. Kueng's collaboration with Austrian physicists:

[4] A. Elben, R. Kueng *et al.*, Phys. Rev. Lett. **125**, 200501, Nov 2020, DOI: 10.1103/PhysRevLett.125.200501

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