universität innsbruck

Innsbruck Physics Colloquium

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A trapped-ion quantum architecture

Trapped ions give us a high degree of detailed control of their quantum degrees of freedom, which has enabled a large number of experiments in quantum optics, quantum computing, simulation and networking, as well as precision metrology and others.
We present a quantum architecture comprised of a linear chain of trapped 171Yb+ ions with individual laser beam addressing and readout. The collective modes of motion in the chain are used to efficiently produce entangling gates between any qubit pair. In combination with a classical software stack, this becomes in effect an arbitrarily programmable, fully connected quantum computer.
Over the past four years, we have employed this experiment to demonstrate a variety of quantum algorithms with the help of a community of academic partners, including cross-hardware comparisons with commercially developed systems. We also use the same level of control to study interesting quantum phenomena using the motional degrees of freedom directly, such has exotic para-particles and Hubbard-models of phonons. This talk will give recent highlights from both of these approaches and discuss improvements for scaling up as well as other ideas for the future.

Tuesday, 10.3.2020, at 17:15 h in lecture hall C

Innsbruck Physics Colloquium, Organisation: M. Beyer, H.-C. Nägerl, A. Reimer