Contribution ID: **69** Type: **Invited talk**

Tweezers, trapped ions, and Rydbergs: a quantum simulation zoo

Monday 2 September 2024 14:00 (40 minutes)

Trapped-ions are one of the most mature platforms for quantum computation and quantum simulation. In this talk I will show that by adding other ingredients, such as optical tweezers, neutral atoms, and Rydberg atoms, we can engineer more flexible quantum simulation platforms, as well as new quantum computation architectures.

In trapped-ion quantum simulators the spin-spin interactions mediated by the collective motion of the ions in the crystal (phonons) are tunable range power law interactions. I will show that additional optical tweezer potentials can be used to engineer the phonon spectrum, and thus tune the interactions and connectivity of the ion qubits beyond the power-law interactions accessible in current setups.

Next, I will show that optical tweezers delivering qubit state-dependent local potentials allow us to create a new scalable architecture for trapped-ion quantum computing. Finally, I will discuss how adding one more ingredient, a gas of neutral atoms, allows us to explore ultracold chemistry and exploit ion mediated interactions for infinite range Rydberg blockade and facilitation.

References

Short bio (50 words) or link to website

Arghavan Safavi-Naini is an associate professor at the university of Amsterdam and a member of QuSoft at the Centrum Wiskunde and Informatica. She runs a joint experimental-theory group (hyqs.nl) focused on hybrid quantum simulation platforms, quantum algorithms, and numerical methods for open quantum systems.

Relevant publications (optional)

Career stage

Professor

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Track Classification: FINESS