universität innsbruck

Fakultät für Mathematik, Informatik und Physik

BERUFUNGSVORTRÄGE: „Quanteninformatik“

Mittwoch, 4. Februar 2026 Institut für Informatik (ICT Gebäude) - Raum 3W03	
Jeanette Lorenz	
09:00-09:30	**Lehrevortrag und Diskussion: „Shors Primzahlzerlegungsalgorithmus“**
09:30-10:10	**Forschungsvortrag und Diskussion: „How applications can guide developments in quantum computing“** *Recent years have seen significant progress towards error-corrected qubits, but presently available quantum computers remain limited in their number of qubits and quality. In parallel, significant efforts were put into exploring applications of quantum computing, but without resulting in any practical, industrially relevant quantum advantage yet. In principle, quantum computing is expected to lead to disruptive changes in a variety of different industries and data science tasks, ranging, e.g. from speeding up drug development to accelerating simulations in astrophysics.* *Still, investigating applications of quantum computing has already provided us with very important, although mostly theoretical insights. For example, investigating variational quantum algorithms pointed us to the difficulties of controlling their sampling overhead and their stability in general. We also realized that quantum computers are likely to work synergistically as quantum accelerators alongside classical computers, putting us into the situation that we need to control, optimize and improve their interplay. We are also required to understand when and how a prospective quantum advantage will result in an overall benefit for quantum-classical algorithms. This includes topics such as generalization properties of quantum-classical algorithms and how properties of the data will influence the overall performance of a quantum algorithm. Eventually, these findings guide us to both the necessity to advance quantum algorithms and software, as well as to advance quantum hardware beyond realizing logical qubits.* *This talk will expand on these aspects and will additionally bring forward the idea of systematic benchmarks at all layers of the quantum software stack to be able to also quantify prospective benefits of quantum computing practically.*

*) Die Veröffentlichung von Namen und Titel erfolgt nur auf Zustimmung der Vortragenden. Stellungnahmen zu den Vorträgen der Hearing-TeilnehmerInnen richten Sie bitte bis längstens 15:00 Uhr des letzten Vortragstages an Fakultaet-MIP@uibk.ac.at.

Mittwoch, 4. Februar 2026 Institut für Informatik (ICT Gebäude) - Raum 3W03	
Jakob Kottmann	
14:00-14:30	**Lehrevortrag und Diskussion:** **„Shors Primzahlzerlegungsalgorithmus“**
14:30-15:10	**Forschungsvortrag und Diskussion:** **„Holistic Approaches to Quantum Computation: Software and Algorithmics”** *Quantum computation is currently at a stage where the applicability of quantum algorithms appears imminent, but their full potential remains an open question. A significant fraction of present-day quantum algorithmic research relies on numerical procedures to gain further insights and explore new applications. Here, one typically deals with numerous interconnected classical and quantum algorithmic components. In this talk, I will illustrate how quantum algorithmics and scientific software development can form a powerful symbiosis to tackle problems in electronic structure and other potential applications of quantum computers.*
Donnerstag, 5. Februar 2026 **Institut für Informatik (ICT Gebäude) - Raum 3W03**	
Wolfgang Mauerer	
09:00-09:30	**Lehrevortrag und Diskussion:** **„Shors Primzahlzerlegungsalgorithmus“**
09:30-10:10	**Forschungsvortrag und Diskussion:** **„Quantum Informatics: Bridging Theory and Application in Computer Science and Physics“** *Although the principal computational advantages of quantum over classical systems have been firmly established in a range of contexts, it is now widely recognised that contributions to solving industrial and scientific computational challenges depend upon a complex interplay of factors. These span fundamental conceptual questions, algorithmic design, systems architecture, and deep engineering challenges. Crucially, many of these issues lie beyond the traditional disciplinary boundaries of physics, engineering, or computer science.* *In our talk, we argue that addressing these challenges demands a vertically integrated, systems-oriented, and intrinsically interdisciplinary perspective that is provided by the nascent field of quantum computer science. Drawing on existing work that deploys quantum and quantum-inspired methods in domains such as databases, software engineering or industrial production, we identify principled pathways towards systematic and credible quantum advantage.* *We show how one may progress from early-stage heuristics to mature, verifiable algorithms, but also demonstrate how engagement with concrete, real-world problems can refine and deepen our fundamental understanding of quantum computational paradigms.* *We conclude by outlining current research efforts aimed at achieving credible advantage in quantum simulation, quantum systems integration, and fault-tolerant quantum optimisation, and by presenting a coherent programme of future research in these areas.*

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Donnerstag, 5. Februar 2026 Institut für Informatik (ICT Gebäude) - Raum 3W03	
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13:30 – 14:00	**Lehrevortrag und Diskussion:** **„Shors Primzahlzerlegungsalgorithmus“**
14:00 – 14:40	**Forschungsvortrag und Diskussion:** **„From Noisy Experiments to Rigorous Quantum Algorithms”** *In this talk, I will present an overview of my research journey in quantum computing, beginning with the design of algorithms for pre-fault-tolerant quantum hardware and the development of scalable protocols for mitigating noise. I will discuss how the study of open quantum systems and noise dynamics has informed the creation of error mitigation techniques such as zero-noise extrapolation and probabilistic error cancellation, which enable accurate computations on imperfect devices. I will then explore questions in quantum learning theory, focusing on quantum kernel methods and their connection to group-theoretic structures. The core of the talk will highlight my current interest in the formal development of quantum algorithms, emphasizing rigorous performance guarantees and complexity-theoretic insights. I will conclude with a forward-looking perspective on emerging directions in quantum algorithm design and the theoretical challenges that lie ahead.*

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