

Coping with Errors in Scalable Quantum Computing Systems

778. WE-Heraeus-Seminar

**08 Jan - 11 Jan 2023
at the Physikzentrum Bad Honnef/Germany**

The WE-Heraeus Foundation supports research and education in science, especially in physics.
The Foundation is Germany's most important private institution funding physics.

**WILHELM UND ELSE
HERAEUS-STIFTUNG**



Program

Sunday, 8 January 2023

17:00 – 21:00	Registration and mount Posters	
From 18:30	<i>BUFFETT SUPPER / Informal get together</i>	
20:00	Organizers	Kick-Off Scientific Program
20:15	Daniel Gottesman	Opportunities and Challenges in Fault-Tolerant Quantum Computation
21:00	Discussions at the Posters	

Monday, 9 January 2023

07:30 – 08:45	<i>BREAKFAST</i>	
08:45 – 09:00	Organizers	Organizational notes
Ion Traps		
09:00 – 09:45	Ciaran Ryan-Anderson	Implementing Fault-tolerant Entangling Gates on the Five-qubit Code and the Color Code
09:45 – 10:30	Tracy Northup	Coping with errors in trapped-ion quantum networks
10:30 – 11:00	<i>COFFEE BREAK</i>	
Spin Qubits		
11:00 – 11:45	Seigo Tarucha	High-fidelity quantum gates and quantum phase error correction in silicon
11:45 – 12:30	Stefano Bosco	Sweet spots for charge and hyperfine noise in hole spin qubits
12:30 – 14:00	<i>LUNCH</i>	

Program

Monday, 9 January 2023

Error Correction and Error Mitigation – Theory and Algorithms

14:00 – 14:45	Barbara Terhal & Jorge Marques	Hardware-Efficient Leakage Reduction For Superconducting Transmon Qubits
14:45 – 15:30	Michael Hartmann	Quantum Convolutional Neural Networks
15:30 – 16:15	Abhinav Kandala	Error mitigation for noisy quantum processors: a path to quantum advantage
16:15 – 16:45	<i>COFFEE BREAK</i>	

Superconducting Qubits

16:45 – 17:30	James Robin Wootton	Quantum Error Correction Experiments at IBM Quantum
17:30 – 18:15	Simone Gasparinetti	Coherent-state process tomography of continuous-variable quantum gates
18:30	<i>HERAEUS DINNER at the Physikzentrum (cold and warm buffet, with complimentary drinks)</i>	

Program

Tuesday, 10 January 2023

07:30 – 08:30 *BREAKFAST*

Superconducting Qubits

08:30 – 09:15 Kevin Satzinger **Suppressing quantum errors by scaling a surface code logical qubit**

09:15 – 10:00 Andreas Wallraff **A Distance-Three Surface Code Realized in Superconducting Circuits**

10:00 – 10:30 *COFFEE BREAK*

10:30 – 11:15 Max Werninghaus **Black box optimization of computational gates for superconducting qubits**

Ion Traps

11:15 – 12:30 Jonathan Home **Quantum error correction with motional states of trapped ions**

12:30 – 14:00 *LUNCH*

14:00 – 14:15 Stefan Jorda **About the Wilhelm and Else Heraeus Foundation**

Neutral Atoms

14:15 – 15:00 Alexandre Dureau **Quantum Computing with Neutral Atoms: an Experimenter's Perspective**

15:00 – 15:45 Wenchao Xu **Quantum science with Rydberg ensembles: from one to many**

15:45 – 16:00 *COFFEE BREAK*

Program

Tuesday, 10 January 2023

- 16:00 – 17:00 **Podiumsdiskussion**
« **Der Weg zum Quantenvorteil** »
- Braucht es die Quantenfehlerkorrektur für praxistaugliche Anwendungen von Quantencomputern?
 - Wo sind die Grenzen bezüglich Verbesserungen in der Kohärenz von Qubits?
 - Welche Anwendungen eignen sich für NISQ Systeme?
 - Können wir mit NISQ Systemen einen praxistauglichen Quantenvorteil zeigen?
 - Wie können wir die extrem kleinen Fehlerraten erreichen, welche gewisse Simulationsaufgaben benötigen?
 - Wie steht Europa im Vergleich zu anderen Ländern auf dem Weg von NISQ Systemen zu universellen Quantenrechnern?
- 17:00 – 18:30 **Flash Poster Session**
- 18:30 – 19:30 *DINNER*
- 19:30 **Poster Session continued**

Program

Wednesday, 11 January 2023

07:30 – 08:30 *BREAKFAST*

Spin Qubits

08:30 – 09:15 Natalia Ares **Machine learning for tackling quantum device variability**

09:15 – 10:00 Menno Veldhorst **Quantum computing with germanium**

10:00 – 10:30 *COFFEE BREAK*

10:30 – 11:15 Yann-Michel Niquet **Engineering sweet spots in hole spin qubits**

Error Correction and Error Mitigation – Theory and Algorithms

11:15 – 12:00 Markus Müller **Fault-Tolerant QEC: From Disordered Spin Models to First Universal Logical Gates**

12:00 – 12:45 Guillermo García Perez **Mitigating noise on and with informationally complete measurements**

12:45 – 14:15 *LUNCH*

14:15 – 15:00 Balint Koczor **Will (near-term) quantum computers deliver real advantage?**

15:00 – 15:30 Organizers **Poster Award and Closing Session**

15:30 – 18:00 **Walk to local sight-seeing spot**

18:30 *DINNER*

Program

Thursday, 12 January 2023

07:30 – 08:30 *BREAKFAST*

End of seminar and departure