Quantum Science with Interacting Arrays of Rydberg Atoms and Molecules

837. WE-Heraeus-Seminar

27 Jul - 01 Aug 2025
at the Physikzentrum Bad Honnef/Germany

WILHELM UND ELSE HERAEUS-STIFTUNG

Program

Sunday, July 27, 2025

17:00 – 20:00   Registration

18:30   *BUFFET SUPPER and informal get-together*

19:30   Scientific organizers   **Opening and Welcome**

19:45   **Discussion**

Program

Monday, July 28, 2025

07:30	*BREAKFAST*	
08:45 – 09:00	Scientific organizers	**Opening Remarks**
09:00 – 09:45	Rosario González-Férez	**Ultralong-range Rydberg molecules: Rotational hybridization, Rydberg blockade, and resonant energy transfer**
09:45 – 10:30	Sylvain de Léséleuc	**Ultrafast Rydberg experiments with ultracold atoms**
10:30 – 11:00	*COFFEE BREAK*	
11:00 – 11:45	**Hot Topic Talks**	
	Lukas Sturm	**Scalable Microlens-Based Integration of Rydberg-Interacting Quantum Arrays**
	Einius Pultinevičius	**Long-lived and trapped Circular Rydberg states of alkaline-earth atoms at room-temperature**
11:45 – 12:30	Oscar Herrera Sancho	**A High-Resolution Ion Microscope to Spatially Observe Ion-Rydberg Interactions**
12:30	*LUNCH*	
14:00 – 14:45	Monika Aidelsburger	**State-dependent potentials and clock-sideband cooling with neutral Yb atoms**
14:45 – 15:30	Huanqian Loh	**Hilbert Space Fragmentation in a Rydberg Quantum Simulator**
15:30 – 16:15	Zoe Yan	**New opportunities in quantum simulation with ultrapolar molecules**

Program

16:15 – 16:45	*COFFEE BREAK*	
16:45 – 17:45	Mikhail Lukin	**Exploring quantum computing frontier with programmable neutral atom systems**
17:45 – 18:30	**Hot Topic Talks**	
	David Petrosyan	**Two- and multiqubit quantum gates between distant atoms mediated by a Rydberg excitation antiferromagnet**
	Adrien Bouscal	**A neutral atom array in an optical cavity for quantum computing**
18:30	*DINNER*	
19:30	**Discussion**	

Program

Tuesday, July 29, 2025

07:30	*BREAKFAST*	
08:45 – 09:45	Tommaso Calarco	**Quantum control for atom-based quantum technologies**
09:45 – 10:30	Daniel Ruttley	**Long-lived entanglement of molecules in magic-wavelength optical tweezers**
10:30 – 11:00	*COFFEE BREAK*	
11:00 – 11:45	**Hot Topic Talks**	
	Daniel Schneider Grün	**Rydberg excitations of single atoms of erbium**
	Etienne Walraven	**Loading molecules... [■ ■ ■ ⬚ 80%] - Scheme for Deterministic Loading of Laser-Cooled Molecules into Optical Tweezers**
11:45 – 12:30	Matthew Eiles	**Electron-mediated interactions in Rydberg tweezers**
12:30	*LUNCH*	
14:00 – 14:45	Lawrence Cheuk	**Quantum Many-Body Physics with Molecular Tweezer Arrays: From Magnon Dynamics to Spin-Squeezing**
14:45 – 15:30	Lysander Christakis	**New directions for dipolar physics with atoms and molecules in tweezer arrays**
15:30 – 16:15	**Hot Topic Talks**	
	Valentin Walther	**Rydberg Macrodimers: From Polariton Decay to Molecular Interactions**
	Alejandro Saenz	**Confinement-induced resonances: control option or nuisance?**
16:15 – 16:45	*COFFEE BREAK*	
16:45– 18:30	**Poster Session**	
18:30	*DINNER*	
19:30	**Discussion**	

Program

Wednesday, July 30, 2025

07:30	*BREAKFAST*	
08:45 – 09:45	Adam Kaufman	**Programmable optical clocks for quantum-enhanced sensing**
09:45 – 10:30	Guido Pupillo	**Towards efficient quantum error correction with neutral atoms**
10:30 – 11:00	*COFFEE BREAK*	
11:00 – 12:00	Antoine Browaeys	**Realization of doped magnets in dipolar Rydberg atom arrays**
12:00 – 12:22	**Hot Topic Talk**	
	Giuliano Giudici	**Steering Rydberg atom arrays: from high-fidelity gate design to many-body state preparation**
12:25	**Conference Photo**	
12:40	*LUNCH*	
14:00 – 14:45	Jaewook Ahn	**Rydberg atom collisions and prospects for flying atomic qubits**
14:45 – 15:30	Servaas Kokkelmans	**Experimental Validation of Control Noise - Fidelity relations in a Neutral Atom Quantum Computer**
15:30 – 16:15	Jonathan Pritchard	**Cryogenic Dual-Species Atom Arrays**
16:15 – 16:45	*COFFEE BREAK*	
16:45 – 18:30	**Time for Excursion and Discussion**	
18:30	*HERAEUS DINNER at the Physikzentrum* *(cold and warm buffet, with complimentary drinks)*	
19:30	***Discussion***	

Program

07:30	*BREAKFAST*	
08:45 – 09:00		**The WEH Foundation**
09:00 – 09:45	Ohad Lib	**Universal Gate Operations and Erasure Conversion in a Metastable Fine-Structure Qubit of Bosonic Strontium-88**
09:45 – 10:30	Michael Fleischhauer	**Many-body dynamics of interacting, dissipative spin systems and the Truncated Wigner Approximation for Spins**
10:30 – 11:00	*COFFEE BREAK*	
11:00 – 11:45	**Hot Topic Talks**	
	Daniel González-Cuadra	**Observation of string breaking on a (2+1)D Rydberg quantum simulator**
	Riccardo Panza	**Fast number-resolved detection of ytterbum arrays**
11:45 – 12:30	Hans Peter Büchler	**Topological order in symmetric blockade structures**
12:30	*LUNCH*	
14:00 – 14:45	Dieter Jaksch	**Stationary states and dynamical quantum phase transitions on random networks**
14:45 – 15:30	Thomas Pohl	**Quantum continuous time crystals in dissipative Rydberg-atom arrays**
15:30 – 16:15	Christian Gross	**Cluster nucleation dynamics in Rydberg arrays**
16:15 – 16:45	*COFFEE BREAK*	
16:45 – 18:30	**Poster Session**	
18:30	*DINNER*	
19:30	**Discussion**	

Program

Friday, August 1, 2025

07:30	*BREAKFAST*	
08:45 – 09:45	Manuel Endres	**Quantum Science with Tweezer Arrays**
09:45 – 10:30	Cindy Regal	**A Cryogenic System for Rydberg Atom Arrays**
10:30 – 11:00	*COFFEE BREAK*	
11:00 – 11:45	**Hot Topic Talks**	
	Adam Shaw	**Cavity array microscopes for quantum science**
	Ofer Firstenberg	**Quantum Vortices of Photons**
11:45 – 12:00	**Poster Prize**	
12:00 – 12:30	Scientific organizers	**Future Directions & Closing Remarks**
12:30	*LUNCH*	

End of seminar and departure