# Symposium SAMOP Dissertation Prize 2026 (SYAD)

jointly organised by all divisions of the section AMOP

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The topical divisions within SAMOP jointly award a PhD prize 2026. The prize acknowledges outstanding research from a PhD work and its excellent written and oral presentation. Eligible for nomination were outstanding PhD theses from the research fields of SAMOP completed in 2024 or 2025. Based on the nominations and independent reviewing, a jury of SAMOP representatives selected four finalists for presentation of their research in the framework of this dissertation prize symposium. Right after the symposium, the awardee will be selected by the prize committee. The winner will be announced in the course of the DPG Ceremonial Session.

# Overview of Invited Talks and Sessions

(Lecture hall RW 1)

## Invited Talks

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| SYAD 1.1 | Mon | 14:30–15:00 | RW 1 | **What graphs can tell us about quantum information** — •Kiara Hansenne |
| SYAD 1.2 | Mon | 15:00–15:30 | RW 1 | **Realization of alkaline-earth circular Rydberg qubits in optical tweezer arrays** — •Christian Hölzl |
| SYAD 1.3 | Mon | 15:30–16:00 | RW 1 | **Pattern Formation and Supersolid-like Sound Modes in a Driven Superfluid** — •Nikolas Liebster |
| SYAD 1.4 | Mon | 16:00–16:30 | RW 1 | **Harnessing time-frequency qudits using integrated nonlinear processes** — •Laura Serino |

## Sessions

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| SYAD 1.1–1.4 | Mon | 14:30–16:30 | RW 1 | **SAMOP Dissertation Prize Symposium** |

# SYAD 1: SAMOP Dissertation Prize Symposium

Time: Monday 14:30–16:30 Location: RW 1

**Invited Talk** SYAD 1.1 Mon 14:30 RW 1

**What graphs can tell us about quantum information** — •Kiara Hansenne — Université Paris-Saclay, CEA, CNRS, Institut de Physique Théorique, 91191 Gif-sur-Yvette, France — Naturwissenschaftlich-Technische Fakultät, Universität Siegen, Walter-Flex-Straße 3, 57068 Siegen, Germany

Quantum information theory is rich in problems that are simple to state but surprisingly hard to solve. In this talk, we show how tools from graph theory provide a unifying framework to address such questions, both at a foundational level and for practical characterisation tasks. First, we discuss uncertainty relations for multiple quantum observables. By encoding their commutation relations in a graph, we show how a well known quantity in graph theory, the Lovász number, yields general bounds on expectation values, leading to uncertainty relations with applications to entanglement detection. Second, we turn to quantum marginal state tomography. We show how the problem of optimally scheduling measurements can be mapped to a graph-theoretic covering problem, resulting in measurement schemes with provable efficiency gains that have been demonstrated experimentally. These examples highlight how graph-theoretic tools can bridge abstract structures and experimentally relevant protocols in quantum information.

**Invited Talk** SYAD 1.2 Mon 15:00 RW 1

**Realization of alkaline-earth circular Rydberg qubits in optical tweezer arrays** — •Christian Hölzl — 5th Institute of Physics, University of Stuttgart, Germany

Circular Rydberg states, which have been key to Nobel Prize-winning experiments in the past, promise orders of magnitude longer lifetimes compared to their low-L counterparts. This allows for overcoming fundamental limitations in the coherence properties of Rydberg-based quantum simulators and computers. In this talk, I will report on the design and setup of a novel room-temperature simulator based on individually trapped circular Rydberg states of strontium atoms in an optical tweezer array. By placing the atoms in a capacitor made from indium tin oxide to suppress detrimental black-body radiation, we demonstrated for the first time circular Rydberg lifetimes of several milliseconds in a room-temperature setup. Together with the optically active second valence electron of strontium, this enables novel qubit, cooling, and mid-circuit readout schemes, paving the way for the next generation of Rydberg-based quantum simulators and computers.

**Invited Talk** SYAD 1.3 Mon 15:30 RW 1

**Pattern Formation and Supersolid-like Sound Modes in a Driven Superfluid** — •Nikolas Liebster — Kirchhoff-Institut für Physik, Universität Heidelberg, Im Neuenheimer Feld 227, 69120 Heidelberg, Germany

Driven systems are of fundamental scientific interest, as they can exhibit properties distinct from the same system at equilibrium. Although driving generically introduces heating and therefore disorder, certain classes of driven systems can instead support long-lived states with emergent material properties. In this talk, we discuss the emergence of self-stabilized square lattice patterns in a superfluid with periodically modulated interactions. We then show that these patterned states share key physical properties to a seemingly different equilibrium system, namely supersolids. To demonstrate this correspondence, we probe the excitation spectrum of such a patterned state, identifying two distinct sound modes associated with spontaneously broken U(1) and translational symmetries. A third sound mode, the transverse lattice mode, is found to be diffusive. We apply a hydrodynamic theory of superfluid smectics, enabling the extraction of the lattice compressibility as well as the superfluid fraction. These results demonstrate how the conceptual framework of supersolidity can be used to characterize dynamic and far-from-equilibrium states.

**Invited Talk** SYAD 1.4 Mon 16:00 RW 1

**Harnessing time-frequency qudits using integrated nonlinear processes** — •Laura Serino — Paderborn University, Integrated Quantum Optics, Institute for Photonic Quantum Systems (PhoQS), Paderborn, Germany — Quantum Technology Laboratory, University of Queensland, Brisbane, Australia

High-dimensional quantum systems, or qudits, offer significant advantages over qubits, from increased information capacity to enhanced noise resilience and security in quantum communication. While the time-frequency degree of freedom of photons offers large, fiber-compatible quantum states that are ideal for these systems, practical progress has been limited by the lack of an experimental framework that can flexibly generate, manipulate, and measure these states.

In this talk, we present a scalable and reconfigurable experimental framework for qudit processing in the time-frequency domain. At its core is the multi-output quantum pulse gate (mQPG), a programmable decoder based on dispersion-engineered sum-frequency generation in an integrated nonlinear waveguide. The mQPG can be programmed in real time to perform parallel projective measurements of a quantum state onto a complete, arbitrary basis of temporal modes. Using this capability, we experimentally realize high-dimensional quantum key distribution, achieve precise quantum state characterization, and test quantum complementarity in large Hilbert spaces. These results establish the mQPG as a versatile tool for applications ranging from practical quantum technologies to fundamental science, harnessing the full potential of time-frequency qudits.