Industry Day (WED-ID)

Rishabh Jha
University of Göttingen
Friedrich-Hund-Platz 1
37077 Göttingen, Germany
rishabh.jha@uni-goettingen.de

Wilhelm Kaenders
TOPTICA Photonics AG
Lochhamer Schlag 19
82166 Gräfelfing, Germany
Wilhelm.Kaenders@toptica.com

Overview of Invited Talks and Sessions

(Lecture halls ZHG011, ZHG001, ZHG006, ZHG007, ZHG101, ZHG104, and ZHG105)

Plenary Talk

WED-ID 1.1	Wed	14:05–14:35	ZHG011	**Quantum technologies roadmaps perspective and challenges** — •Olivier Ezratty

Invited Talks

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WED-ID 2.2	Wed	15:10–15:30	ZHG001	**Planck's Reluctant Constant and the Second Semiconductor Revolution** — •Mark Mattingley-Scott
WED-ID 2.3	Wed	15:35–15:55	ZHG001	**Quantencomputing: Von der universitären Forschung zum Startup neQxt** — •Ferdinand Schmidt-Kaler
WED-ID 2.4	Wed	16:00–16:20	ZHG001	**Building quantum computers, atom by atom** — •Alexander Glätzle
WED-ID 2.5	Wed	16:25–16:45	ZHG001	**Progress on superconducting quantum processors at IQM** — •Frank Deppe
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WED-ID 3.3	Wed	15:35–15:55	ZHG101	**Deterministic Photon-Emitter Interfaces for Quantum Technology** — •Peter Lodahl
WED-ID 3.4	Wed	16:00–16:20	ZHG101	**Entanglement-based Quantum Key Distribution** — •Sebastian Neumann
WED-ID 4.1	Wed	14:45–15:05	ZHG007	**Quantum magnetometers and the aspect of industrialisation** — •Thomas Strohm
WED-ID 4.2	Wed	15:10–15:30	ZHG007	**From Lab to Industry: Fiber Microcavities for Quantum Tech** — •Michael Förg, Jonathan Noé, Manuel Nutz, Thomas Hümmer
WED-ID 4.3	Wed	15:35–15:55	ZHG007	**Advance semiconductor chip analysis with quantum diamond magnetoemters** — •Nimba Oshnik
WED-ID 4.4	Wed	16:00–16:20	ZHG007	**A commercial optical frequency standard based on a single $^{171}Yb^{+}$ ion** — •Stephan Ritter
WED-ID 4.5	Wed	16:25–16:45	ZHG007	**Accelerating semiconductor developments with Quantum Metrology** — •Mathieu Munsch
WED-ID 5.1	Wed	14:45–15:05	ZHG105	**Pathways to Maturity for the Quantum Industry** — •Claudius Riek
WED-ID 5.2	Wed	15:10–15:30	ZHG105	**From Bottlenecks to Breakthroughs: Simplified & Scalable Cryogenics for the Quantum Age** — •Tomek Schulz
WED-ID 5.3	Wed	15:35–15:55	ZHG105	**Quantum technologies enabled by Photonic Integrated Circuits** — •Michael Geiselmann
WED-ID 5.4	Wed	16:00–16:20	ZHG105	**Light Modulators Driving Quantum Innovation** — •Enrico Vogt
WED-ID 5.5	Wed	16:25–16:45	ZHG105	**PicoQuant Insights: Precision and Innovation for Quantum Research and Industry** — •Uwe Ortmann, Andreas Lehr, Michael Wahl, Torsten Krause, Tino Röhlicke, Rainer Erdmann
WED-ID 6.3	Wed	16:00–16:20	ZHG006	**Driven by Quantum, empowered by Quandela** — •Thomas Volz

Sessions

WED-ID 1.1–1.1	Wed	14:00–14:35	ZHG011	**Plenary Talk**
WED-ID 2.1–2.5	Wed	14:45–16:45	ZHG001	**Quantum Computers & Simulators**
WED-ID 3.1–3.4	Wed	14:45–16:20	ZHG101	**Quantum Communication & Internet**
WED-ID 4.1–4.5	Wed	14:45–16:45	ZHG007	**Quantum Sensing & Metrology**
WED-ID 5.1–5.5	Wed	14:45–16:45	ZHG105	**Quantum Enabling I**
WED-ID 6.1–6.4	Wed	15:10–16:45	ZHG006	**Quantum Hardware, Software & Solutions**
WED-ID 7.1–7.4	Wed	15:10–16:45	ZHG104	**Quantum Enabling II**
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WED-ID 1: Plenary Talk

Time: Wednesday 14:00–14:35 Location: ZHG011

Welcome Address by Dr. Wilhelm Kaenders

Plenary Talk WED-ID 1.1 Wed 14:05 ZHG011
Quantum technologies roadmaps perspective and challenges — •Olivier Ezratty — EPITA, Quantum Energy Initiative

As quantum technologies are maturing in their respective computing, communications and sensing domains, the challenges ahead to deliver their full potential and promises remain significant. Olivier Ezratty will cast these with showing how science, engineering, economics, and geopolitics are intermingled in this innovation process with both virtuous and side effects. We are parallelizing our validation of the quantum theory at larger scales with scientific experiments, components manufacturing upscaling, stretching the capabilities of enabling technologies and building complex systems integration capabilities. We also start to look at the environmental footprint of these technologies in the making. It gives rise to new scientific disciplines, new interdisciplinarity challenges from physics to software, many interdependencies, a mix of scientific and experimental questions, engineering and technology development. There are still many unknowns and unknown unknowns. More theoretical and fundamental work is also needed at all layers of the stacks on top of engineering and technology developments. All this process may also lead to unexpected side innovation effects. What is the role of the various stakeholders in that ecosystem? How governments influence the landscape? How science and innovation get funded? How can we sustain a virtuous innovation cycle in the long run?

WED-ID 2: Quantum Computers & Simulators

Time: Wednesday 14:45–16:45 Location: ZHG001

Invited Talk WED-ID 2.1 Wed 14:45 ZHG001
Trapped-Ion Quantum Computing at Infineon — •Clemens Rössler — Infineon Technologies Austria AG, Villach, Austria

Quantum computing opens new ways of tackling computational challenges in areas such as healthcare, cybersecurity, finance or logistics. Infineon, a leading semiconductor manufacturer, drives the industrialization of quantum computing from fundamental research into application for industries and partners worldwide. I will introduce trapped-ion quantum computing, its status and challenges and present Infineon's activities in the field.

5 min. break

Invited Talk WED-ID 2.2 Wed 15:10 ZHG001
Planck's Reluctant Constant and the Second Semiconductor Revolution — •Mark Mattingley-Scott — Quantum Brilliance, Stuttgart, Germany

In 1900, Max Planck introduced his quantum hypothesis not as a revolutionary breakthrough, but as a "purely formal assumption" to resolve the ultraviolet catastrophe. Like many contemporaries, Planck himself was skeptical of quantization's physical reality. Yet this reluctant mathematical convenience would fundamentally reshape our understanding of nature and enable technologies that seemed like science fiction to early 20th-century physicists.

Today, we face remarkably similar skepticism about mass deployment of quantum technologies. Critics argue that quantum computing, sensing, and communications will remain confined to specialized laboratories, pointing to decoherence challenges, manufacturing complexities, and infrastructure requirements.

These concerns echo arguments once made against semiconductors, lasers, and the internet, technologies that seemed impractical for widespread adoption until suddenly they weren't.

Mass deployment is not a question of if, but when. The question is whether we - commercially, geopolitically, socially - will lead or follow in its development. I will talk about how we intend to bootstrap the quantum revolution by transforming the engineering challenges into processes - by taking technologies which have the capability for mass deployment and kick start the second Semiconductor Revolution.

5 min. break

Invited Talk WED-ID 2.3 Wed 15:35 ZHG001
Quantencomputing: Von der universitären Forschung zum Startup neQxt — •Ferdinand Schmidt-Kaler — neQxt GmbH — QUANTUM, Johannes Gutenberg Univ. Mainz

Die aktuellen politischen Weichenstellungen führen zu Restriktionen beim internationalen Austausch für Hochtechnologie. Ein moderner Industrie- und Forschungsstandort Deutschland ist aber undenkbar ohne die zukünftigen Anwendungen von Quantencomputern bei chemischer bzw. Materialforschung, bei Optimierungsaufgaben im Logistik- und Finanzbereich, AI-Sektor und für sicherheitsrelevanten Anwendungen. Daher muss Deutschland eigene Anstrengungen zum Bau eines Quantencomputers verfolgen. Auch die Entwicklung von passender Anwendungssoftware benötigt Tests auf eigener Quantenhardware, denn deren Imperfektionen müssen mitberücksichtigt werden. Angestoßen durch den Start des EU-Quantum flagship hat die Bundesregierung die Initiative ergriffen, um Quantencomputing in die Anwendung zu überführen. Ansätze basierend auf Atomen und Ionen profitieren von Traditionen universitärer Forschung und nutzen vor Ort vorhandene Kompetenzen der Technologiefirmen. Neugründungen wie neQxt stehen nun vor der Aufgabe, den Vorsprung großer US Hersteller aufzuholen. Die neQxt GmbH zielt neben dem Verkauf von Quantencomputern darauf darauf Rechenzeit anzubieten, die am deutschen Standort eine hohe Datensicherheit gewährleist - ein besonders wichtiges Gut für industrielle Anwender. Die zukünftigen Herausforderungen liegen bei der Hochskalierung auf tausende von qubits, Quantenfehlerkorrektur und Anbindung an klassische Rechenzentren.

5 min. break

Invited Talk WED-ID 2.4 Wed 16:00 ZHG001
Building quantum computers, atom by atom — •Alexander Glätzle — planqc GmbH, Garching, Germany

This presentation introduces planqc, a quantum computing startup founded out of the Max Planck Institute of Quantum Optics. I will outline the company's origin story and share why we believe Germany provides a uniquely strong foundation - both scientifically and strategically - for building a globally competitive quantum technology venture. The talk will include a brief technical overview of neutral atom quantum computing, highlighting its key principles, current challenges, and opportunities. I will conclude with an outlook on planqc's development roadmap and our vision for advancing scalable quantum computing based on neutral atom platforms.

5 min. break

Invited Talk WED-ID 2.5 Wed 16:25 ZHG001
Progress on superconducting quantum processors at IQM — •Frank Deppe — IQM Quantum Computers, Georg-Brauchle-Ring 23-25, 80992 München, Germany

IQM is a European VC-funded company developing quantum computers based on superconducting circuits. Being part of a highly dynamic and competitive field, one faces significant entrepreneurial and technological challenges. In this context, a suitable balance between innovation and engineering is key. Currently, IQM supports two architectures, both based on transmon qubits and flux-tunable couplers. These are the square lattice with nearest neighbor configuration and the resonator-star with effective all-to-all connectivity. In this presentation, I will give an overview about the latest progress in these two directions.

WED-ID 3: Quantum Communication & Internet

Time: Wednesday 14:45–16:20 Location: ZHG101

Invited Talk WED-ID 3.1 Wed 14:45 ZHG101
Quantum Internet: Technologies & Applications — •Imran Khan — KEEQuant GmbH, Gebhardtstr. 28, 90762 Fürth

We live in an era where the precise control and engineering of quantum states enables new technologies, like quantum computing, quantum communication or quantum sensing. Emerging from the combination of all of these, is the concept of a quantum internet, allowing for unprecedented use cases of such technology. In this talk we will discuss the state of the art and explore what this interplay could look like in the future.

5 min. break

Invited Talk WED-ID 3.2 Wed 15:10 ZHG101
From Promise to Practice: The Challenges in Finding Quantum Computing Applications — •Nicole Holzmann — PsiQuantum, Palo Alto

Quantum computing has long been heralded as a revolutionary force poised to transform numerous industries. Early predictions by consulting firms such as McKinsey and BCG suggested significant impacts across pharma, chemistry, materials science, and related sectors. In pharmaceuticals specifically, quantum computing was expected to revolutionise drug discovery and enhance molecular simulations, substantially reducing R&D timelines and associated costs. Yet, despite considerable investment, these optimistic forecasts have not yet materialised into tangible industrial benefits. Quantum algorithms such as Quantum Phase Estimation (QPE) theoretically offer groundbreaking capabilities, enabling calculations beyond classical limits. However, practical industrial applications remain elusive. Accurate quantum calculations alone do not automatically accelerate drug discovery or improve material designs. Industries require clear, substantial, and cost-effective quantum computing advantages to justify significant investments and organisational changes*a challenge further heightened by continuous improvements in classical computing methods and artificial intelligence. Bridging this gap demands sustained collaboration, realistic expectation setting, and integrated end-to-end methodologies delivering genuinely beneficial outcomes.

5 min. break

Invited Talk WED-ID 3.3 Wed 15:35 ZHG101
Deterministic Photon-Emitter Interfaces for Quantum Technology — •Peter Lodahl — Sparrow Quantum and Niels Bohr Institute, University of Copenhagen, Denmark

Quantum physics is transitioning from an area of fundamental research to the realm of technology. 100 years after Niels Bohr and colleagues unraveled the mind-boggling nature of quantum systems, it is today realized that transformative new technology is possible when exploiting intrinsic quantum phenomena, such as quantum superposition and quantum entanglement. A fundamental challenge has been how to deterministically interface light and matter to create on-demand photon sources. I will discuss how the merger of nanophotonics and atomic physics has bridged that gap, and that we today can construct deterministic photon-emitter interfaces based on solid state quantum emitters (quantum dots). We will discuss the fundamental operational principle, the relevant figures-of-merit, and the routes for implementing these novel foundational building blocks in scalable fault-tolerant quantum computing or a quantum network [1,2].

[1] Uppu et al., Nature Nano. 16, 1308 (2021). [2] Lodahl, Ludwig and Warburton, Phys. Today 75, 3-44 (2022).

5 min. break

Invited Talk WED-ID 3.4 Wed 16:00 ZHG101
Entanglement-based Quantum Key Distribution — •Sebastian Neumann — zerothird/Quantum Industries GmbH, Clemens-Holzmeister-Str. 6/6, 1100 Wien

Online security faces a fundamental threat: With the advent of quantum computing, the main encryption techniques used today will become vulnerable to attacks using Shor's algorithm. Quantum Key Distribution (QKD) is the only technology that can protect internet traffic in a future-proof way. Based on the no-cloning theorem, QKD allows for the creation of physically secure keys for unhackable secret communication. The gold standard of QKD are implementations based on entanglement (eQKD), since monogamy of entanglement intrinsically prevents any information leakage of the quantum state to other degrees of freedom. In my talk, I will introduce the concept of entanglement in a QKD context and present scientific publications whose findings are now being commercialized by zerothird. Special emphasis will be put on the challenges to be overcome for long-distance connections, for creating high key rates over short distances, and for connecting many users in a quantum network. I will also give an outlook regarding future technologies which rely heavily on entanglement, such as quantum repeaters and connections between quantum computers.

WED-ID 4: Quantum Sensing & Metrology

Time: Wednesday 14:45–16:45 Location: ZHG007

Invited Talk WED-ID 4.1 Wed 14:45 ZHG007
Quantum magnetometers and the aspect of industrialisation — •Thomas Strohm — Robert Bosch GmbH, Robert-Bosch-Campus 1, 71272 Renningen

One of the more prominent quantum sensors is the quantum magnetometer based on color centers (NV) in diamond. We present the basic principles of the technology, possible applications and technological as well as industrialisation challenges.

5 min. break

Invited Talk WED-ID 4.2 Wed 15:10 ZHG007
From Lab to Industry: Fiber Microcavities for Quantum Tech — •Michael Förg, Jonathan Noé, Manuel Nutz, and Thomas Hümmer — Qlibri GmbH, Karlsplatz 3, 80335 Munich, Germany

One hundred years after the birth of quantum physics, we are witnessing a new era where quantum technologies are moving from the lab into the real world. At Qlibri, we develop miniature optical devices called fiber-based microcavities that can trap and control light with extreme precision. These tiny structures make it possible to study materials at the nanoscale, detect subtle signals, and even interface with single atoms. Originally used only in fundamental research, our goal is to bring this powerful technology into practical applications - from next-generation sensors to building blocks for quantum devices.

5 min. break

Invited Talk WED-ID 4.3 Wed 15:35 ZHG007
Advance semiconductor chip analysis with quantum diamond magnetoemters — •Nimba Oshnik — QuantumDiamonds GmbH Friedenstraße 18 81671 Munich, Germany

The innovative application of nitrogen-vacancy (NV) centers in diamond-based sensing technology for the analysis of semiconductor chips is explored, focusing on their potential to enhance advanced packaging techniques. NV centers, known for their exceptional sensitivity to magnetic and electric fields, enable precise detection of defects and characterization of materials at wide-field scale. We demonstrate the effectiveness of quantum diamond magnetometers in semiconductor analysis, and highlight the implications for improving packaging processes and failure analysis. This approach promises to lead to more reliable and efficient electronic devices, paving the way for advancements in the semiconductor industry.

5 min. break

Invited Talk WED-ID 4.4 Wed 16:00 ZHG007
A commercial optical frequency standard based on a single $^{171}Yb^{+}$ ion — •Stephan Ritter — TOPTICA Photonics AG, Lochhamer Schlag 19, 82166 Graefelfing / Munich, Germany

Decades of persistent research on frequency standards with optical transitions is paying off. These optical frequency standards (OFS) now surpass current cesium primary frequency standards by two orders of magnitude. Consequently, plans for a redefinition of the second are being pursued. The spectacularly low uncertainties are, however, often achieved at the expense of reliability of these research-type setups, as is manifest in limited uptime and availability. Suitable OFS with laser-cooled reference atoms have until recently also not been available commercially. Here, we report on tackling both issues with a commercial single-ion optical frequency standard housed in two standard 19-inch racks that are transportable. It features a single $^{171}Yb^{+}$ ion trapped in ultra-high vacuum. Five diode lasers are employed for loading of the ion, laser cooling, state preparation and readout, and interrogation of the clock transition. The system builds on the results of a funded project coordinated by TOPTICA and the National Metrology Institute PTB, in which ten German partners, experts in very different domains, joined forces. The presentation will illustrate how this continued collaboration between a privately held, commercial entity and a federal institute was subsequently turned into a commercial solution, will give an overview over the system design of the OFS, and report on the status of the characterization of its metrological performance.

5 min. break

Invited Talk WED-ID 4.5 Wed 16:25 ZHG007
Accelerating semiconductor developments with Quantum Metrology — •Mathieu Munsch — Qnami, Basel, Switzerland

The rapid advancement of generative AI is driving unprecedented demand for high-performance, energy-efficient semiconductor devices. This shift places enormous pressure on both memory and compute technologies, exacerbating challenges such as the memory wall and pushing the limits of conventional architectures. Emerging solutions including 2D materials, neuromorphic processing units, and quantum processing units are now being explored alongside traditional CPUs and GPUs to meet these requirements.

In this evolving landscape, the need for precise, high-resolution data to guide and accelerate development is more critical than ever. Conventional test tools are reaching their limits in sensitivity and spatial resolution, especially in heterogeneous and quantum-class devices. To address this, we introduce a new class of test solutions based on quantum sensors. These tools offer unprecedented precision and are compatible with a wide range of operating environments, from cryogenic conditions to ambient settings.

Our presentation will demonstrate how quantum metrology enables deeper insights into device behavior at the nanoscale, delivering actionable information that helps our customers explore the cutting edge of science and accelerate R&D cycles. We will highlight case studies where quantum sensing provided a unique advantage, paving the way for the next era of semiconductor innovation

WED-ID 5: Quantum Enabling I

Time: Wednesday 14:45–16:45 Location: ZHG105

Invited Talk WED-ID 5.1 Wed 14:45 ZHG105
Pathways to Maturity for the Quantum Industry — •Claudius Riek — Zurich Instruments Germany, Munich, Germany

Quantum technologies are currently transitioning from lab experiments to systems and components useful for society.

A quantum industry supporting this maturation process relies on both an evolution of enabling technologies and a supportive ecosystem: Technological readiness of quantum technologies can only be enhanced when sufficient funding in research and development is leveraged by cross-disciplinary collaboration.

This talk offers a comprehensive overview of pivotal technologies, such as refrigeration, signal delivery, and quantum control systems for optical and electronic control, highlighting their role in driving quantum advancements. These technologies are vital for addressing core challenges like scalability, coherence preservation, and reliable system integration.

Together, we will explore the technological and strategic pathways necessary for quantum technologies from an emerging field to an mature industry, potentially shaping the future of industrial transformation in the coming decades.

5 min. break

Invited Talk WED-ID 5.2 Wed 15:10 ZHG105
From Bottlenecks to Breakthroughs: Simplified & Scalable Cryogenics for the Quantum Age — •Tomek Schulz — kiutra GmbH, Munich, Germany

As quantum technologies mature, testing at cryogenic temperatures is becoming a crucial bottleneck limiting the speed, scale, and cost-efficiency of innovation. At kiutra, we address this barrier by offering fast characterization solutions, giving quantum scientists and engineers a speed and cost advantage. Our unique, helium-3-free continuous adiabatic demagnetization refrigeration (cADR) technology enables modular, scalable platforms that support the long-term industrialization of quantum technologies sustainably. This talk will reflect on our journey from academic research to building a globally active hardware startup. It will highlight some of the challenges such as IP transfer, acquiring funding, managing investor expectations, securing first customers, and building a first-of-its-kind production facility. These milestones have helped us define our niche and illustrate what it takes to build a tech champion in quantum. The presentation will conclude with a call to action: To unlock the full potential of quantum, it will require not only scientific progress but also a joint effort from various actors to build better funding instruments, support industry knowledge transfer, as well as removing political barriers.

5 min. break

Invited Talk WED-ID 5.3 Wed 15:35 ZHG105
Quantum technologies enabled by Photonic Integrated Circuits — •Michael Geiselmann — LIGENTEC AG, Lausanne, Switzerland

Photonisches Quantencomputing, Quantenkommunikation und Quantensensorik profitieren maßgeblich von photonisch integrierten Schaltkreisen (PICs). Erste Quantencomputer-Prototypen nutzen bereits diese Technologie, die hohe Stabilität, Skalierbarkeit und geringe optische Verluste vereint. In diesem Vortrag gebe ich einen Überblick über aktuelle Fortschritte in der Fertigung photonischer Chips mit besonderem Fokus auf Materialien wie Siliziumnitrid und Lithiumniobat, die sich durch exzellente optische Eigenschaften auszeichnen.

LIGENTEC entwickelt und liefert Siliziumnitrid-basierte PICs für Industrie, Start-ups und akademische Partner weltweit. Gemeinsam mit einem starken europäischen Ökosystem ermöglichen wir nicht nur die Herstellung, sondern auch die Simulation und Integration der Chips zu kompletten Modulen. Auf diese Weise sichern wir eine zuverlässige europäische Lieferkette von Prototypen bis zur Serienfertigung und leisten einen Beitrag zur technologischen Unabhängigkeit Europas in der Quantentechnologie.

5 min. break

Invited Talk WED-ID 5.4 Wed 16:00 ZHG105
Light Modulators Driving Quantum Innovation — •Enrico Vogt — QUBIG GmbH, Grillparzerstr. 6, 81675 Munich, Germany

Quantum technologies are rapidly advancing, with the potential to revolutionize fields such as secure communication, high-precision sensing, and quantum computing. A key enabler of this transformation is the ability to precisely control laser light using electro-optic (EOM) and acousto-optic modulators (AOM), which manipulate the frequency, amplitude, polarisation and phase of laser beams with high speed and accuracy. Traditionally reliant on bulky, alignment-sensitive setups, these modulators have now been redefined by a breakthrough

at QUBIG that makes them compatible with surface-mount device (SMD) technology. This innovation dramatically reduces the size, complexity, and cost of advanced laser systems - paving the way for mass-producible, ultra-compact quantum devices. By bridging cutting-edge photonics with modern manufacturing, this innovation unlocks new opportunities for industrial deployment, global competitiveness, and strategic investment in the rapidly growing quantum economy. In this talk, the policy framework conditions that could promote the successful implementation of this technology in Germany are also mentioned.

5 min. break

Invited Talk WED-ID 5.5 Wed 16:25 ZHG105
PicoQuant Insights: Precision and Innovation for Quantum Research and Industry — •Uwe Ortmann, Andreas Lehr, Michael Wahl, Torsten Krause, Tino Röhlicke, and Rainer Erdmann — PicoQuant GmbH, 12157 Berlin, Deutschland

PicoQuant, a Berlin-based company with nearly 30 years of expertise, is a pioneer in precision timing solutions for quantum research. Our latest FPGA-based time taggers achieve 1 ps digital resolution, 2 ps rms timing uncertainty, and ultra-low dead time across multiple input channels. Flexible trigger methods, including constant fraction discriminators, ensure compatibility with detectors like SNSPDs. A high-bandwidth FPGA interface enables pre-processing of time tags, while White Rabbit synchronization guarantees precise timing over long distances. Our intuitive GUI and Python API support real-time data visualization and analysis.

Beyond time taggers, we offer complete, application-driven solutions for setups like Hanbury Brown and Twiss, Hong-Ou-Mandel effect, quantum key distribution, and quantum sensing. PicoQuant drives innovation in photonics, shaping the future of quantum technologies and positioning itself as a leading partner for talent, thought leadership, and investment in the quantum industry.

WED-ID 6: Quantum Hardware, Software & Solutions

Time: Wednesday 15:10–16:45 Location: ZHG006

WED-ID 6.1 Wed 15:10 ZHG006
Evaluating Useful Quantum Advantage in the Calculation of Molecular NMR Spectra — •Keith Fratus, Nicklas Enenkel, Peter Schmitteckert, Andisheh Khedri, Juha Leppäkangas, Michael Marthaler, and Jan Reiner — HQS Quantum Simulations GmbH, Karlsruhe, Germany

An important question facing potential industrial applications of quantum computing is that of use case evaluation in the context of possible quantum advantage, or in other words, the question of whether simulating certain problems using a quantum computer would be worthwhile, or whether it would be sufficient to use traditional classical computers. Key to answering such a question is the ability to estimate the accuracy and performance of competing classical approximation methods when exact classical solutions are not available. In this talk we report on our efforts to develop and understand the behaviour of various classical approximation methods which aim to solve a specific class of chemical simulation problems. In particular, we develop classical simulation methods designed to predict molecular NMR spectra, with the aim of being able to quantify the accuracy and computational requirements of performing these simulations, even for parameter regimes which we do not directly simulate. Using such methods, we work towards a framework for predicting in which parameter regimes, system sizes, and target accuracies one can expect the failure of classical methods for this class of systems, thus allowing for an understanding of when quantum computation would be advantageous.

5 min. break

WED-ID 6.2 Wed 15:35 ZHG006
Security evaluation and certification of QKD devices — •Marc Wehling — TÜV Informationstechnik GmbH

The threat posed by quantum computers requires a new approach to cryptographic security. Although post-quantum cryptography (PQC) offers short- and medium-term security, its underlying mathematical structure could be susceptible to future attacks. Relying on fundamental physical laws, quantum key distribution (QKD) uses photons to encode secret data. Although the security proof provides security at the protocol level, the physical implementation can be targeted in numerous ways by an eavesdropper. Security at the implementation level remains to be evaluated. However, a certification scheme approved by a national certification body is a missing cornerstone. The QuNET+BlueCert initiative aims to fill this crucial gap by developing a blueprint for QKD security evaluation.

TÜV Informationstechnik GmbH (TÜVIT) is collaborating with partners from academia and industry to take a leading role in building a test laboratory for the security evaluation of various QKD components. The aim is to develop a certification scheme that will enable industry partners to protect their products against threats.

This talk covers threats to the implementation of QKD systems, as well as the current state of QKD certification, and provides an analysis of the elements missing on the way to a complete certification scheme.

5 min. break

Invited Talk WED-ID 6.3 Wed 16:00 ZHG006
Driven by Quantum, empowered by Quandela — •Thomas Volz — Quandela GmbH, Munich, Germany

Quandela is a world-leading full-stack photonic quantum computing provider. The company develops hardware, middleware, and software for a range of industrial applications, including energy, cybersecurity, and finance, showcasing the versatility of its unique technology.

The core of Quandela's innovation is its cutting-edge quantum-dot single-photon source technology that effectively eliminates barriers to the scalable manipulation of single-photon qubits. Featuring a modular, scalable, upgradeable, and energy efficient architecture, Quandela's mission is to deliver the first useful quantum computer to drive the quantum transformation to industry and society.

In this talk, I will give a brief intro into Quandela's technology, discuss the current state of development with a focus on real-world applications, and highlight some opportunities for joining Quandela's mission at its German subsidiary.

5 min. break

WED-ID 6.4 Wed 16:25 ZHG006
Provable Exponentially Enhanced QAOA on NISQ Hardware — •Chinonso Onah[1,2] and Kristel Michielsen[2,3] — [1]Volkswagen Group, Germany — [2]Department of Physics, RWTH Aachen, Germany — [3]Forschungszentrum Jülich, Germany

Industrial routing, scheduling and matching problems consume disproportionate compute budgets, yet their feasible solutions typically lie on a low-dimensional algebraic manifold (for example, subspaces with fixed Hamming-weight patterns). Vanilla QAOA must explore the full Hilbert space, diluting amplitude on invalid states and succumbing to barren plateaus. Consequently, we introduce Constraint-Enhanced QAOA (CE-QAOA), which starts and stays inside the exponentially smaller one-hot subspace of size n. A depth-optimal, ancilla-free encoder prepares a uniform superposition of single-excitation states per block, while a block-wise XY mixer preserves feasibility and is native to several hardware platforms. Circuit overhead is minimal: CE-QAOA adds at most the depth of a single XY block beyond vanilla QAOA.

Three exponential advantages compound from:

(i) Feasibility concentration. (ii) Exponential parameter-transfer amplification. (iii) Depth-robust exponential separation.

The framework extends to the traveling-salesman problem (TSP), the capacitated vehicle-routing problem (CVRP), graph matching, flow-shop scheduling, graph colouring, and more.

WED-ID 7: Quantum Enabling II

Time: Wednesday 15:10–16:45 Location: ZHG104

WED-ID 7.1 Wed 15:10 ZHG104

Enabling Robust Quantum Technologies - Compact Fiber Optics With Highest Thermal Stability — •Tobias Kroker — Schäfter + Kirchhoff GmbH, Hamburg, Germany

Quantum technologies are on the cusp of moving from laboratory experiments to commercial applications. This poses new requirements on the scalability, thermal stability, and wavelength range of fiber optic systems used to transport, distribute, and modulate laser light.

As an experienced manufacturer in the field, Schäfter + Kirchhoff GmbH develops and produces fiber optic solutions ranging from specialty fiber cables and fiber couplers to complex optomechanical light distribution and modulation units.

Here we report on new developments in compact fiber-coupled optomechanical systems for light distribution and modulation. These systems exhibit such high thermal stability that they can be reliably used in an un-climatized environment, which is tested by harsh thermal cycles in a climatic chamber. This is a crucial step for quantum technologies to leave the optical laboratory.

In addition, active components such as acousto-optic modulators are gradually increasing the functionality of these devices. As a result, they enable the miniaturization and scalability of complex optical systems, making them attractive for quantum computers and technologies being built around the world.

5 min. break

WED-ID 7.2 Wed 15:35 ZHG104

Enabling optical quantum characterization with Photonic Sources — •Ole Peters[1], Hoon Jang[2], Enkeleda Balliu[2], and Korbinian Hens[1] — [1]HÜBNER GmbH & Co. KG, Division HÜBNER Photonics, Kassel, Germany — [2]Cobolt AB, Division HÜBNER Photonics, Solna, Sweden

Within the scope of the second quantum revolution, laboratories and companies around the world focus on the search for the perfect quantum system suitable for applications of 'quantum technology 2.0'. Those applications range from quantum sensing, via quantum communication to quantum simulation and computing using Qubits opening up a vibrant research field to unveil materials with the perfect properties meeting the various requirements has evolved.

In this work, we discuss the optical setup and performance characteristics of commercially available Watt level, narrow linewidth Optical Parametric Oscillators (OPOs), tunable across the visible spectrum. We show several tuning mechanisms based on internal and external frequency stabilization and illustrate their deployment in quantum research applications. We also present a concept for compact laser systems, with narrower tunability, that can be tailored in wavelength to the desired application, as well as an extremely low-noise fiber amplifier platform, dedicated to quantum research. Experimental datasets from a selection of recently published studies on single-photon emitters of various types are presented.

5 min. break

WED-ID 7.3 Wed 16:00 ZHG104

Squeezed Light for Quantum Sensing — •Axel Schönbeck[1], Jan Südbeck[1], Jascha Zander[1], and Roman Schnabel[2] — [1]Noisy Labs GmbH, Luruper Hauptstrasse 1, 22547 Hamburg — [2]Universität Hamburg, Institut für Quantenphysik, Luruper Chaussee 149, 22761 Hamburg

High-precision laser-based measurements are often limited by photon shot noise across various power levels (mW to kW). Conventionally, the signal-to-noise ratio has been enhanced by increasing the optical power.

However, this approach can introduce undesirable side effects. Biological samples may be damaged or exhibit photo-bleaching and delicate mechanical devices may experience thermal effects. Thermal lensing, induced by high power, can misalign measurement devices. Moreover, exceeding eye-safe laser power levels necessitates additional laser safety measures. Economic considerations, including development and energy costs, can also limit the feasibility of power increases.

Squeezed light offers an alternative solution by reducing photon shot noise without significantly increasing the optical power. Noise reductions exceeding a factor of 10 are achievable when detecting most of the light. Gravitational-wave detection is a prominent example for the application of squeezed light.

This presentation will discuss squeezed light technology and its applications in high-precision quantum sensing.

5 min. break

WED-ID 7.4 Wed 16:25 ZHG104

Automated cryogenic test platform for benchmarking superconducting quantum processors — •Thorsten Last, Adam Lawrence, Koushik Kumaran, Gerben Erens, Kelvin Loh, Garrelt Alberts, and Adriaan Rol — Orange Quantum Systems B.V., Elektronicaweg 2, 2628 XG Delft, The Netherlands

Scaling transmon-based quantum processors beyond 100 qubits remains a challenge, especially as traditional R&D methods struggle to keep pace due to scalability limits. Achieving this demands improvements in reproducibility, yield, and low component variability. To support these process aspects, an industry-grade qubit manufacturing cycle must be paired with high-throughput testing and metrology to maintain a high development cadence. Here we introduce an automated cryogenic test system designed for high-throughput characterization of superconducting quantum processors and which can test 150-qubit devices within a 10-day cycle. Its fully integrated cryogenic and quantum control hardware enables advanced diagnostics and feedback. Critical device parameters are automatically extracted across multiple domains such as readout circuits, properties of transmons and tunable couplers, crosstalk, and qubit fidelities, using a graph-based automation protocol that dynamically sequences tests and extracts key metrics. In addition, the system can also provide thermometric analysis of qubits to assess environmental interactions and cryogenic scalability because as system complexity grows, identifying and mitigating thermal decoherence becomes critical.

WED-ID 8: Panel Discussion

Time: Wednesday 17:00–17:30 Location: ZHG011

Discussion WED-ID 8.1 Wed 17:00 ZHG011

Quantum technology at the inflection point? — •Wilhelm Kaenders[1], Olivier Ezratty[2], Emily Meads[3], Peter Soldan[4], Alexander Glätzle[5], and Johannes Otterbach[6] — [1]TOPTICA Photonics AG, Gräfelfing, Germany — [2]Quantum Energy Initiative, Grenoble, France — [3]Quantonation, Paris, France — [4]VDI Technologiezentrum GmbH, Düsseldorf, Germany — [5]planqc GmbH, Garching, Germany — [6]Sprin-D (Bundesagentur für Sprunginnovation), Leipzig, Germany

After multibillion dollars and about a decade of intense research spent by public and private investors, we still have no breakthrough for quantum computing in sight. Quantum sensing for volume markets is struggling, while meteorology pushes boundaries again and again. Where is the future between hype, FOMO and uncharted potential really?