World Quantum Day 2025: From Quantum Dots to Scalable Control Systems – April 25, 2025

Venue: Block-III, CARE, Committee Room, IIT Delhi
Time: 10:00 am – 12:30 pm
Organized by: Prof. Samaresh Das, IIT Delhi
Speakers: Prof. Santanu Manna, Prof. N. K. Kundu (IIT Delhi), Dr. A. Soltamova, and Dr. W. Uilhoorn (Qblox)
Theme: Advancing Quantum Technology and Control Systems

Introduction

In celebration of *World Quantum Day* (14th April), IIT Delhi hosted a thought-provoking and technologically rich seminar on April 25, 2025, focusing on the intersection of cutting-edge quantum physics and scalable control systems. The event, held at the CARE Committee Room, was organized by Prof. Samaresh Das and brought together academia and industry through two academic lectures and a hands-on product demonstration from Qblox, a global leader in quantum control hardware.

Prof. Rajendra Singh, Director of the QMD Foundation, opened the seminar with inspiring remarks on the future of quantum technology and the power of global collaboration. His words set the tone for a day of groundbreaking insights—from quantum dots to scalable control systems.

Session Highlights

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1. Talk by Prof. Santanu Manna: “One Photon at a Time: Quantum Dots Illuminating the Future”

Prof. Santanu Manna from IIT Delhi delivered an engaging lecture focusing on the emerging role of quantum dots in shaping the future of quantum optics and photonics. His talk delved into the photophysical properties of quantum dots, especially in the context of single-photon emission—a key element in quantum communication and cryptography.

He elaborated on how these nanoscale semiconductors, when engineered at the atomic level, can act as reliable sources of single photons. Such precision and control are crucial for building secure quantum communication channels and quantum computing architectures. His talk also covered the material synthesis techniques, quantum confinement effects, and the practical challenges in integrating quantum dots into optoelectronic circuits. Prof. Manna’s contribution reinforced the notion that fundamental advancements in nanomaterials science directly impact the scalability and efficiency of quantum technologies.

2. Talk by Prof. N. K. Kundu: “Quantum Technology Enhanced Future Communication Networks”

Prof. N. K. Kundu’s presentation focused on the transformative potential of quantum technology in the domain of communication networks. He contextualized the limitations of classical communication protocols and highlighted how quantum-enhanced systems, such as quantum key distribution (QKD) and quantum repeaters, can overcome current barriers in data security and transmission speed.

The talk emphasized the integration of quantum communication modules with classical internet infrastructure and the need for hybrid systems during this transitional era. Prof. Kundu discussed potential deployment strategies for quantum nodes across India and drew comparisons with global initiatives in Europe and North America.

Particularly notable was his discussion on the synergy between quantum photonics, entanglement distribution, and low-latency communication—paving the way for ultra-secure, long-distance communication systems.

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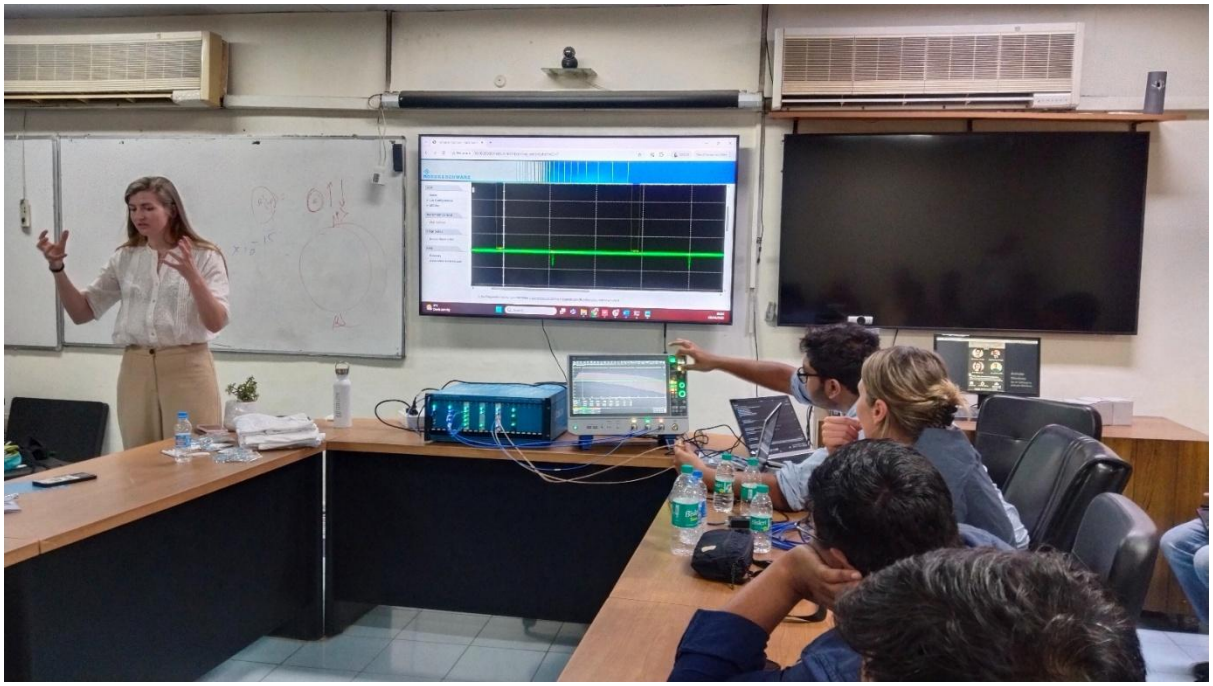
3. Live Demonstration by Qblox: “Demonstration of Qblox Control System for Scalable Quantum Device”

The event reached its technological apex with a live demonstration by **Dr. A. Soltamova** and **Dr. W. Uilhoorn**, representatives from Qblox, an internationally recognized company specializing in control hardware for quantum systems.



Their demonstration showcased the functionality of the **Qblox Quantum Control Stack**, a modular and scalable system designed for high-fidelity control of superconducting and spin-qubit devices. The Qblox team explained how their instruments enable real-time signal generation, acquisition, and low-latency feedback—an essential aspect for the manipulation and readout of quantum bits (qubits).

The demonstration involved a real-time interface between their control modules and simulated quantum systems, allowing the audience to understand how pulse sequencing, error correction, and qubit calibration are executed. They also highlighted how their system supports Python-based programming environments, making it accessible to research labs and developers worldwide.

The Qblox team emphasized the importance of synchronization across multiple channels and scalable integration—features that are critical as quantum processors grow in size and complexity.

Conclusion and Reflections

The World Quantum Day celebration at IIT Delhi served as an excellent platform for fostering dialogue between fundamental science and practical engineering. Prof. Rajendra Singh, Director of the QMD Foundation, delivered an inspiring introduction highlighting the transformative potential of quantum technologies and the importance of global collaboration. His opening remarks set a powerful stage for a day exploring advances from quantum dots to scalable control systems. The talks by Prof. Manna and Prof. Kundu provided deep insights into the foundational and infrastructural aspects of quantum technologies, while the demonstration by Qblox translated theory into tangible, applicable systems.
Events like this underscore India's growing engagement with global quantum research and highlight the importance of interdisciplinary collaboration. With academic research pushing boundaries and companies like Qblox providing enabling technologies, the roadmap toward quantum supremacy and practical applications seems more defined than ever.