| **Special Session GEEF 2025**  **Yonsei’s Past, Present, and Future  (2. Yonsei University's Quantum Technology for the SDGs)** |
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| Date: March 13, 2025  Place: Millenium Hall, Sinchon Campus |

**CONCEPT NOTE**

**1. Forum Outline**

| **Session** | Special Session: Yonsei’s Past, Present, and Future (2. Yonsei University’s Quantum Technology for the SDGs) | |
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| **Speakers** | Prof. Jae-Ho Cheong, M.D. Ph.D  (Professor, College of Medicine, Yonsei University,  Director, Yonsei Science Park) | |
| **Date** | March 13, 2025, Special Session (KST 10:30am –11:15am) | |
| **Venue** | Yonsei University (Sinchon Campus, Seoul, Korea) & Online | |
| **Audience** | Approximately 2,000 attendees from 26 countries (2025) | |
| **On-Air** | [IGEE at Yonsei University Official YouTube Channel](https://www.youtube.com/@IGEEyonsei) | |
| **Language** | Korean/English (Interpretation services provided for all sessions) | |

**2. Background & Rationale:**

| A fully operational, error-correcting, and commercially viable quantum computer has the potential to revolutionize research and business operations, particularly in achieving key Sustainable Development Goals (SDGs) such as SDG 3 (Good Health and Well-Being), SDG 7 (Affordable and Clean Energy), and SDG 9 (Industry, Innovation, and Infrastructure). By leveraging quantum mechanics, quantum computers can process massive datasets, optimize complex systems, and simulate molecular interactions with unprecedented speed and precision, driving breakthroughs in these critical areas.  In the domain of health and well-being (SDG 3), quantum computing can transform the pharmaceutical industry and medical research. Quantum algorithms excel in simulating molecular interactions, allowing researchers to analyze drug-protein binding at an atomic level. This capability can accelerate drug discovery by identifying promising candidates far faster than classical methods, reducing development timelines from decades to mere years. Moreover, quantum-enhanced machine learning can analyze large-scale genomic data, enabling the development of personalized medicine tailored to individual genetic profiles. It can also improve early disease detection by analyzing patterns in medical imaging or sensor data with extreme accuracy, supporting more effective and timely interventions.  For affordable and clean energy (SDG 7), quantum computers can play a pivotal role in advancing renewable energy technologies and optimizing energy systems. They can model and identify novel materials for high-efficiency solar panels or next-generation batteries, such as solid-state or quantum dot-based designs. These materials have complex properties that are difficult to simulate using classical computers, but quantum systems can handle their intricacies with ease. Additionally, quantum optimization algorithms can enhance the efficiency of power grids, balancing supply and demand dynamically in systems increasingly reliant on intermittent renewable energy sources like wind and solar. This optimization minimizes energy wastage, reduces costs, and supports the transition to cleaner energy systems. Quantum solutions can also streamline logistics for fuel supply chains, ensuring that clean energy reaches underserved areas efficiently.  In the realm of industry, innovation, and infrastructure (SDG 9), quantum computing can redefine how businesses and governments design and manage infrastructure. For example, quantum-enabled optimization can streamline logistics and transportation systems, identifying the most efficient routes and reducing emissions and costs in global supply chains. Quantum simulations can also aid in the development of stronger, lighter, and more sustainable materials for construction, aerospace, and automotive industries. Furthermore, quantum-enhanced artificial intelligence can optimize manufacturing processes, leading to smarter factories that consume fewer resources and produce less waste. These advancements align with the goals of building resilient infrastructure and fostering sustainable industrialization.  In summary, quantum computers hold immense promise for addressing some of humanity's most pressing challenges. Their ability to solve complex problems faster and more effectively than classical computers can accelerate progress toward achieving SDG 3, SDG 7, and SDG 9. By driving innovation in health, energy, and industrial systems, quantum technology can contribute to a sustainable, equitable, and prosperous future. Collaboration between governments, industries, and academia will be critical in harnessing this transformative technology for maximum societal impact. |
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**3. Session Objectives:**

| The *Quantum Technology for SDGs* session at the upcoming forum aims to explore the transformative potential of quantum technologies in addressing global challenges aligned with the Sustainable Development Goals (SDGs). The session will provide a forward-looking perspective on how fully operational, error-correcting quantum computers could revolutionize research and business operations in critical areas such as health, energy, and infrastructure.  Key objectives include examining quantum computing’s capacity to accelerate drug discovery, personalized medicine research, and enhance early disease detection, aligning with **SDG 3 (Good Health and Well-Being)**. The session will also delve into how quantum algorithms can drive advancements in renewable energy systems, optimize power grids, and discover novel materials for energy storage and generation, contributing to **SDG 7 (Affordable and Clean Energy)**. Furthermore, participants will discuss how quantum optimization and simulation can reshape industries, streamline global supply chains, and foster sustainable infrastructure development, supporting **SDG 9 (Industry, Innovation, and Infrastructure)**.  This session will foster interdisciplinary dialogue among researchers, policymakers, and industry leaders, highlighting the importance of collaboration in harnessing quantum computing's transformative potential. Attendees will gain insights into emerging breakthroughs, ethical considerations, and the roadmap for realizing quantum technologies' vast societal benefits. |
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