QuanTalks

IISc Quantum Technology Initiative (IQTI) Seminar Series

Abstract: Trapped and laser cooled ions provide a pristine environment to initialize, control and measure quantum states with extreme high precision. Over the last couple of decades, our ability to control quantum states progressed rapidly giving rise to new quantum technology applications in computation, simulation and metrology/sensing. Although, metrology and machine learning may seem to be distant field of research, but I will show how an ion trap-based quantum processor is able to contribute to both fields. The former is achieved owing to our ability to perform fast feedback on a quantum state in real-time while the later takes advantage of the inherent non-linearity of the qubit space by successively uploading classical data. In addition, I will cover some of the other applications related to quantum simulation of engines operating at quantum limit, and other quantum models. The current quantum processors implementing quantum machine learning tasks are limited to only non-trivial but small parameter space. To perform scalable computing tasks, various approaches are being currently explored but it remains an open challenge in the field. We will be discussing the challenges and provide my perspective on dealing with it.

Biography: Prof. Dr. Manas Mukherjee is a Director of National Quantum Fabless Foundry, Singapore. He is the Head of Department of Quantum Technologies for Engineering (QTE) Department, IMRE, A*star, Singapore and Principal Investigator of Centre for Quantum Technologies, NUS, Singapore.His research and innovation interest lies in the implementation of quantum protocols for quantum computing and metrology. His team works on implementation of quantum machine learning (QML) algorithms in an ion trap-based quantum processors, which they develop at the CQT-NUS laboratories. They innovated a novel quantum protocol to perform electrical noise measurements beyond the quantum limit and showed for the first time how quantum effects can play a major role in heat engines that are microscopic in nature. The engine, which they implemented, had only one atom.

He completed his undergraduate Physics studies at the Indian Institute of Technologies, Kharagpur, India and graduated from the University of Heidelberg, Germany with PhD in Natural Sciences (Physics) working on precision measurements using ion traps. Thereafter, he continued his quest to develop tools for quantum entanglement between atoms and photons as a Lise-Meitner Fellow at the University of Innsbruck, Austria. The outcome of that project within the group of Prof. Rainer Blatt holds some of the key elements currently used for distributed computing. Since 2012, he is heading a research group at the Centre for Quantum Technologies, NUS focussing on practical implementation of quantum computers to real life problems. Since 2022, they are pursuing an island wide effort to consolidate quantum device fabrication and speeding up quantum system building in the form of a R&D foundry for quantum devices now known as National Quantum Fabless Foundry (NQFF). **Website** : https://www.a-star.edu.sg/imre/research-departments/national-quantum-fabless-foundry).

Title

Metrology to machine learning – a trapped ion multi-purpose quantum processor

Speaker

Prof. Dr. Manas Mukherjee,
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Date & Time

Monday, 12th December 2022,
2.30 PM (IST)

Meeting Link

Click here to join the webinar

Venue

Multimedia Room, Physics Department, IISc