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 **Date & Time:**  
25<sup>th</sup> July, 2025 @ 3:00 PM IST

 **Venue:**  
Classroom-4, TCG CREST

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## **Title – The classical limit of quantum mechanics through coarse-grained measurements**

### **Abstract**

We address the classical limit of quantum mechanics, focusing on its emergence through coarse-grained measurements when multiple outcomes are conflated into slots. We rigorously derive effective classical kinematics under such measurements, demonstrating that when the volume of the coarse-grained slot in phase space significantly exceeds Planck's constant, quantum states can be effectively described by classical probability distributions. Furthermore, we show that the dynamics, derived under coarse-grained observations and the linear approximation of the quantum Hamiltonian around its classical values within the slots, is effectively described by a classical Hamiltonian following Liouville dynamics. The classical Hamiltonian obtained through this process is equivalent to the one from which the underlying quantum Hamiltonian is derived via the (Dirac) quantization procedure, completing the quantization-classical limit loop. The Ehrenfest time, marking the duration within which classical behavior remains valid, is analyzed for various physical systems. The implications of these findings are discussed in the context of both macroscopic and microscopic systems, revealing the mechanisms behind their observed classicality. This work provides a comprehensive framework for understanding the quantum-to-classical transition and addresses foundational questions about the consistency of the quantization-classical limit cycle.

### **Organized by:**

**CQuERE (Centre for Quantum Engineering, Research and Education), TCG CREST, Kolkata, INDIA**

For more details, please visit the website: <http://www.tgccrest.org/iyq2025>

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