THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON APPLIED MATHEMATICS

The unified theory of quantum mechanics and classical mechanics

By

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Abstract

The mathematician David Hilbert envisioned physics as a fully axiomatic system. Indeed, classical mechanics (CM) can be regarded as such a system, with Newton's three laws serving as its fundamental axioms. Following the spirit of non-Euclidean geometry, the Newton's second law is modified to state that force is the cause of deceleration. Together with the unchanged first and third laws, this new formulation yields a revised axiomatic structure for classical mechanics. In this talk, I will introduce an extended axiomatic framework unifying quantum mechanics (QM) and classical mechanics (CM) within a single system. The starting axiom is the Dirac equation (DE) of relativistic quantum mechanics. From the DE, one can derive both the Schrödinger equation (SE) and the decoupled positive-kinetic-energy (PKE) Klein–Gordon equation (KGE) for spin-0 particles. From the SE, Newton's three laws follow naturally, while the decoupled PKE KGE leads to Einstein's formulas of special relativity (SR) in the classical limit. In summary, starting from the DE, we can recover the entire theoretical content of both QM and CM describing the motion of matter with positive kinetic energy. The DE possesses two symmetric energy spectra, corresponding to positive and negative kinetic energy (NKE) states. From the DE, one can also derive the NKE Schrödinger equation, leading to the new set of Newton's laws described above, as well as the decoupled NKE KGE, from which the SR formulas for NKE bodies follow. Consequently, beginning from the DE, it is possible to obtain the full content of QM and CM that describe the motion of matter with either PKE or NKE. Both QM and CM thus exhibit a fundamental symmetry between PKE and NKE matter. Objects in PKE states are observable, whereas those in NKE states are not—they constitute dark matter. I will discuss why NKE matter is invisible to us and propose possible experimental approaches for detecting NKE electrons.

Date : **27 March 2026 (Friday)**
Time : **11:00a.m. - 12:00noon**
Venue : **Room 2463 (Lift 25/26)**

All are Welcome!