PHYSICAL MATHEMATICS SEMINAR

Droplets in the Zero-Point Ocean: Towards a Superclassical Account of an Emergent Quantum Mechanics

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ABSTRACT:

Our approach of an ”Emergent Quantum Mechanics” is presented which assumes the existence of a deeper level theory such that quantum mechanics (QM) must be seen as only an approximation to a more complex subquantum mechanics. We associate the latter with a combination of non-equilibrium thermodynamics and pilot-wave hydrodynamics. More specifically, we consider ”particles” as steady-state oscillations dynamically coupled to the undulations of a zero-point vacuum, in some ways similar to the bouncing droplets on a vibrating liquid known from experiments first performed by the Couder/Fort group in Paris.

With our approach, we are able to describe and explain various features of QM (such as the exact Schrödinger equation, *n*-slit interference, the deBroglie-Bohm guiding equation, the behavior of Bohmian trajectories, etc.). These are characterized as ”superclassical” emergent phenomena, i.e. as arising from the interplay between classical boundary conditions and an assumed classical subquantum domain. Based on our approach, simple computer simulation tools were developed which serve to illustrate many of the thus explained features with much less effort than with analytical calculations. In this way, also a new, so-called “quantum sweeper” effect was recently discovered.

After a demonstration of some of our superclassical simulations, we turn to the most burning issue w.r.t. hydrodynamical-like models of quantum phenomena: how can any nonlocal dynamics be accommodated by such models? Some preliminary ideas and results will be presented.

TUESDAY, MAY 12, 2015
2:30 PM
Building E18, Room 466A

Reception following in Building E17, Room 401A
(Math Dept. Common Room)

http://www-math.mit.edu/pms/spring15/

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