PHYSICAL MATHEMATICS SEMINAR

Eigenstates generated by a moving wave source

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ABSTRACT:

This work was carried out with a number of colleagues, chief among whom Yves Couder, Matthieu Labousse, Marc Miskin & Stéphane Perrard.

We have recently discovered a macroscopic object composed of a material particle dynamically coupled to a wave packet. The particle is a droplet bouncing on the surface of a vertically vibrated liquid bath; its pilot-wave is the result of the superposition of the surface waves it excites. Above an excitation threshold, this symbiotic object, designated as a "walker" becomes self-propelled.

Such a walker exhibits several features previously thought to be specific to the microscopic realm. The unexpected appearance of both uncertainty and quantization behaviors at the macroscopic scale lies in the essence of its "classical" duality. The dynamics of the droplet depends on previously visited spots along its trajectory through the surface waves emitted during each bounce. Although based on fundamental concepts, commonly found in living systems, this path-memory driven dynamics is still unexplored in physics elementary objects. This new class of memory-encoded systems which possess a spatiotemporal nonlocality shakes the frontiers between macroscopic and microscopic world.

In this talk, I will focus on recent results obtained when a central force is applied to the droplet using ferrofluids and magnetic fields. In particular, I will discuss the emergence of eigenstates with dual nature combining specific trajectories and a global eigenmode of the wave field. I will also discuss an alternative hypothesis for the wave generation in a thought experiment and show the possibility of resonant wave field modes for orbits satisfying the Bohr-Sommerfeld relation.

THURSDAY, May 16, 2013
2:30 PM
Building 4, Room 237

Reception following in Building 2, Room 290
(Math Dept. Common Room)

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