PHYSICAL MATHEMATICS SEMINAR

A particle and its pilot wave at macroscopic scale: the role of a path memory

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ABSTRACT:

The behavior of the fundamental objects of physics at quantum scale is dominated by the wave-particle duality. This characteristic is usually thought to have no equivalent in macroscopic physics where mass-like objects and waves are distinct entities. We have shown recently that a droplet bouncing on a vertically vibrated liquid interface can become dynamically coupled to the surface wave it excites. It thus becomes a self-propelled "walker", a symbiotic object formed by the droplet and its associated wave.

Through several experiments, we address one central question. How can a continuous and spatially extended wave have a common dynamics with a localized and discrete droplet? We will show that when its wave is split (diffraction, interference, tunneling etc…), one droplet has an apparently random response but that a deterministic behavior is statistically recovered when the experiment is repeated. The structure of the wave field is responsible for these properties as its interference structure contains what we have called a "path-memory". A remarkable effect of this memory is observed when the walker, submitted to a transverse force, has an orbiting motion. The measured orbit diameter, instead of varying continuously with the force can only take a discrete set of quantized values. The limits in which these results can be compared to those at quantum scale will be discussed.

TUESDAY, OCTOBER 12, 2010
2:30 PM
Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 290

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