SEMINARIO

Prof. Jean Pierre Gazeau

Université Paris Diderot and Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro

From classical to quantum models: the regularising role of integrals, symmetry and probabilities

Abstract: In Physics, one is often misled in thinking that the mathematical model of a system is part of or is that system itself. Think of expressions commonly used in physics like « point» particle, motion «on the line» «smooth» observables, wave function, and even «going to infinity» , without forgetting perplexing phrases like «classical world» versus «quantum world» ... On the other hand, when a mathematical model becomes really inoperative in regard with correct predictions, one is forced to replace it with a new one. It is precisely what happened with the emergence of quantum physics. Classical models were (progressively) superseded by quantum ones through quantization prescriptions. These procedures appear often as ad hoc recipes. I will describe well defined quantizations, based on integral calculus and Weyl-Heisenberg symmetry. They are described in simple terms through one of the most basic examples of mechanics. Starting from probability distribution(s) on the Euclidean plane viewed as the phase space for the motion of a point particle on the line, i.e., its classical model, I will show how to build corresponding quantum model(s) and associated probabilities (e.g. Husimi) or quasi-probabilities (e.g. Wigner) distributions. I will highlight the regularizing role of such procedures with the familiar example of the motion of a particle with a variable mass and submitted to a step potential.

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