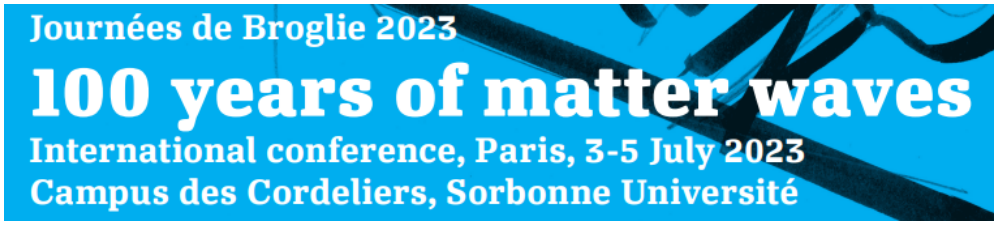

Quantum trajectories, quantum potential, superoscillations: Bohm, Madelung, de Broglie, Newton

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Abstract

Trajectories modified by the quantum potential are the wave counterparts of the classical paths of material particles and the rays of geometrical optics. As envisaged by Isaac Newton in his attempts to understand diffraction, such trajectories can undulate. They are strongly influenced by phase singularities. The local quantum velocity (proportional to the phase gradient, i.e. weak value of momentum with position postseelected), can be faster than the classically allowed speed. This happens in regions of superoscillation, containing the phase singularities; outside these regions, the quantum velocity is slower. The two regions are separated by manifolds where the quantum potential is zero. The quantum potential suggests a generalisation of quantum mechanics, applicable to classical curl forces, which are not derivable from a potential.