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Quantum-like gravity waves and vortices in a classical fluid

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We have recently proposed a new general concept of macroscopic quantum-type experiment. It amounts to transform a classical fluid into a quantum-type fluid by the application of a quantum-like potential, either directly in a stationary configuration, or through a retro-active loop to simulate the time evolution. In this framework, the amplitude of the quantum potential depends on a macroscopic generalization of the Planck constant, which can be changed during the experiment, therefore simulating a quantum to classical transition. The experiment is exemplified here by an application of this concept to gravity waves at the surface of an incompressible liquid in a basin of finite height, with particular emphasis on the quantized vortex. We construct a complex wave function with the height of the fluid in the basin as its square modulus and the velocity potential as its phase. This wave function is solution of a nonlinear Schrodinger equation typical of superfluids. The quantum potential is therefore defined here in terms of the square root of the fluid height. We suggest two methods for applying this quantum-like potential to the fluid: (i) by the action of a force on the surface (wind, blower, pressure, field, etc...); (ii) by a curvature of the basin ground. In this last case the ground profile yields the quantum potential itself, while usually only the quantum force is accessible, so that such an experiment is expected to provide one with a macroscopic model of a quantum-type vacuum energy. These results may also be relevant to the study of freak waves, which have already been described by nonlinear Schrodinger equations.

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