Dissipative diffraction in time and early-arrival in continuous quantum-classical transition

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Abstract

Diffraction in time and early-arrival phenomena will be studied in the context of dissipative systems. This theoretical consideration is done by using the linear scaled wave equation proposed in the framework of Caldirola-Kanai theory for the continuous quantum-classical transition. Two simple but physically important and interesting examples are studied, sudden release from a shutter where transient behaviors (diffraction in time) are seen; and also transmission through a time-dependent parabolic barrier where early-arrival is seen. Calculations show that diffraction in time is a non-classical effect and temporary behaviors are gradually suppressed as the friction increases. Furthermore, early-arrival is seen even in the classical regime. This means that early-arrival is not a non-classical phenomenon. This behavior will be explained by means of scaled trajectories which are just Bohmian trajectories in the quantum regime.

Keywords: dissipation, Caldirola-Kanai equation, quantum-classical transition, scaled wave equation, diffraction in time, early-arrival, scaled trajectories

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