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Wavefunction dynamics in a quantum-dot electron pump under a high magnetic field SUNGGUEN RYU, KAIST, MASAYA KATAOKA, NPL, United Kingdom, HEUNG-SUN SIM, KAIST — A quantum-dot electron pump, formed and operated by applying time-dependent potential barriers to a two dimensional electron gas system, provides a promising redefinition of ampere. The pump operation consists of capturing an electron from a reservoir into a quantum dot and ejecting it to another reservoir. The capturing process has been theoretically understood by a semi-classical treatment of the tunneling between the dot and reservoir.[1] But the dynamics of the wavefunction of the captured electron in the ejection process has not been theoretically addressed, although it is useful for enhancing pump accuracy and for utilizing the pump as a single-electron source for mesoscopic quantum electron devices. We study the dynamics under a strong magnetic field that leads to magnetic confinement of the captured electron, which dominates over the electrostatic confinement of the dot. We find that the wave packet of the captured electron has the Gaussian form with the width determined by the strength of the magnetic field, and that the time evolution of the packet follows the classical drift motion, with maintaining the Gaussian form. We discuss the possible signatures of the wave packet dynamics in experiments.

[1]V. Kashcheyevs, B. Kaestner, PRL **104**, 186805 (2010)

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