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Quantum and classical surface acoustic wave induced magnetoresistance oscillations in a 2D electron gas MALCOLM KENNETT, University of Cambridge, JOHN ROBINSON, Lancaster University, NIGEL COOPER, University of Cambridge, VLADIMIR FAL'KO, Lancaster University — We study theoretically the geometrical and temporal commensurability oscillations induced in the resistivity of 2D electrons in a perpendicular magnetic field by surface acoustic waves (SAWs). We show that there is a positive anisotropic dynamical classical contribution and an isotropic non-equilibrium quantum contribution to the resistivity. We describe how the commensurability oscillations modulate the resonances in the SAW-induced resistivity at multiples of the cyclotron frequency. We study the effects of both short-range and long-range disorder on the resistivity corrections for both the classical and quantum non-equilibrium cases. We predict that the quantum correction will give rise to zero-resistance states with associated geometrical commensurability oscillations at large SAW amplitude for sufficiently large inelastic scattering times. These zero resistance states are qualitatively similar to those observed under microwave illumination, and their nature depends crucially on whether the disorder is short- or long-range. Finally, we discuss the implications of our results for current and future experiments on two dimensional electron gases.

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