

Geometrical dependence of decoherence by electronic interactions in a GaAs/GaAlAs square network

M. Ferrier¹, A. C. H. Rowe² and S. Guéron¹, H. Bouchiat¹, C. Texier^{1,3}, G. Montambaux¹

¹ Laboratoire de Physique des Solides, Associé au CNRS, Université Paris-Sud, F-91405 Orsay, France.

² Laboratoire de Physique de la Matière Condensée, Associé au CNRS, École Polytechnique, F-91128 Palaiseau.

³ Laboratoire de Physique Théorique et Modèles Statistiques, Associé au CNRS, Université Paris-Sud.

We measure the weak localization in large metallic networks etched at a GaAs/GaAlAs interface, in a temperature range 25 mK–750 mK where electron-electron interaction is the dominant phase breaking mechanism. We show that, at the highest temperatures, contributions of trajectories that wind around rings and contributions of trajectories that do not wind, are governed by two different length scales. This is achieved by analyzing separately the envelope and the oscillating part of the magnetoconductance. For $T \gtrsim 0.3$ K we find $\propto T^{-1/3}$ for the envelope, and $\propto T^{-1/2}$ for the oscillations, in agreement with theoretical predictions for a single ring. This confirms experimentally that decoherence due to electron-electron depends on the geometry.