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Scanning gate microscopy on Aharonov-Bohm rings in a magnetic field : experiments and simulations B. HACKENS, F. MARTINS, T. OUISSE, J.F. MOTTE, M. STARK, H. SELLIER, J. CHEVRIER, S. HUANT, CNRS, UJF, Grenoble, France, V. BAYOT, CERMIN, UCL Belgium, S. BOLLAERT , X. WALLART, A. CAPPY , IEMN, France — We use low temperature scanning gate microscopy to study the electron dynamics inside Aharonov-Bohm (AB) rings in the phase-coherent regime. Our samples are prepared by etching from high-mobility two-dimensional electron systems 25 nm below the surface (B. Hackens et al., Phys. Rev. Lett. 94, 146802 (2005)). The bias applied on the AFM tip, as it is scanned over the AB ring, induces a local perturbation of the electric potential experienced by the electrons, thereby affecting the ring resistance. In particular, we observe in detail the effect of small variations of the perpendicular magnetic field in different regimes (up to B=6 T). As we plot these resistance variations as a function of the AFM tip position, we observe resistance modulations which have the spatial symmetry of the ring, and an amplitude equal to that of the AB oscillations. This strongly suggests that our resistance maps are closely linked to the periodic modulations of the electron probability density. Finally, we also performed simulations of the electron wavefunctions in AB rings, as well as of the electron transmission through the AB rings. Including the effect of the perturbating potential of the tip in such simulations, we get valuable informations which help to explain our experimental results.

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