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Imaging electron local density of states inside mesoscopic quantum rings B. HACKENS, V. BAYOT, CERMIN, DICE Lab, Universite Catholique de Louvain, MARCO PALA, IMEP-MINATEC, Grenoble, X. WALLART, S. BOLLAERT, A. CAPPY, IEMN, Villeneuve d Ascq, F. MARTINS, T. OUISSE, H. SELLIER, J. CHEVRIER, S. HUANT, Institut Neel, CNRS et UJF, Grenoble — We combine scanning gate microscopy (SGM) experiments and simulations to demonstrate imaging of the electron local density of states within open quantum rings (QRs). SGM is based on a weak electrostatic perturbation of the electron system by a charged tip, which alters the transmission of electrons through the system. When the QRs are in the ballistic and coherent regime of transport, conductance fringes are observed in SGM images when the tip scans over the QR area as well as in its vicinity. Comparing our results to quantum mechanical simulations of transport in realistic QRs, we demonstrate that the fringes observed over the QR area are directly connected to the local density of states inside the QR [1]. Moreover, the magnetic field dependence of the fringes observed in the vicinity of the QRs indicates that they originate from the electrostatic Aharonov-Bohm effect, and correspond to iso-phase lines for electrons [2]. From these results, one can expect to design new kinds of quantum nanodevices based on a precise spatial control of electron interferences and trajectories. [1] F. Martins et al., PRL 99,136807 (2007). [2] B. Hackens et al., Nat. Phys. 2, 826 (2006).

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