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Direct measurement of quantum capacitance transition with variable tunneling barriers BERNAT OLIVERA, BENJAMIN HAMMANN, University of Alicante, JOAQUIN FERNANDEZ-ROSSIER, University of Alicante and International Iberian Nanotechnology Laboratory, CARLOS UNTIEDT, University of Alicante — Electrical current measurements on atomic-size systems accessed with Scanning Tunneling Microscope (STM) or Mechanically Controllable Break Junction (MCBJ) techniques¹ are commonly studied considering only electrical conductance. Fully impedance (or admittance) measurements on such systems would provide greater understanding and new physical phenomena to be studied. In the present work we show simultaneous conductance-capacitance measurements at variable tunneling junctions. We use STM technique under cryogenic conditions, where vacuum acts as the barrier, and tip and sample consist of faced-sharpened tips made out of the very same pure metal. With a four-probe AC Lock-In technique we provide direct measurements of the quantum transition² from the purely geometrical capacitance (very long distances) to the leak of capacitance when tunneling regime is accessed³.

¹N. Agraït, A. Levy-Yeyati and J.M. van Ruitenbeek. Phys. Rep. 377 (2003), 81.

²T. Christen and M. Büttiker. Phys. Rev. Letters 77 (1996), 1.

³X. Zhao *et al.* Phys. Rev. B 60 (1999), 24.

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