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Theory of scanned-gate microscopy of carbon nanotubes and nanowires MATTHEW ZHANG, MISHA FOGLER, UCSD — We model theoretically a scanned-gate microscopy experiment where a Coulomb-blockaded metallic carbon nanotube (nanowire) is probed by an AFM tip. The tip modifies the charge of the nanotube via an electrostatic coupling. The amount of induced charge can have a complicated dependence on the position and the voltage of the tip in a realistic experimental situation where several screening gates and nearby stray charges may be present, which may obscure the interpretation of the results. We demonstrate that such difficulties can be significantly reduced in the geometry where a nearby backgate screens the electrostatic interactions making them short-range. We show that it is then possible to calculate and simply distinguish among different contributions to the induced charge. Combining the above electrostatic modelling with many-body bosonization methods we demonstrate that the presence of the tip causes an oscillatory shift in the Coulomb blockade peak positions. We show that the amplitude and the phase of this shift can be used to study the spin-charge separation and Luttinger-liquid effects in one-dimensional wires.

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