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Logarithmic time response of carbon nanotube field-effect transistors ANDREW TUNNELL, University of Maryland, VINCE BALLAROTTO, Laboratory for Physical Sciences, MERIJNTJE BRONSGEEST, JOHN CUMINGS, University of Maryland — When observing the source-drain current of a carbon nanotube field effect transistor (FET) held at constant bias, several different processes can produce a time response of the current, including fluctuations due to current noise, heating of contacts, and releasing of trapped charges in the gate dielectric. This third phenomenon is investigated by pulsing voltages on the gate and observing the source-drain current over time. Instead of a typical exponential decay with one or a few time constants, the current was observed to decrease linearly with the logarithm of time, possibly indicating exponential decay with multiple time constants. This trend was seen to continue for over 20 hours, which spans five orders of magnitude in time with respect to the measurement resolution. This trend of scaling logarithmically with time is also seen with the rate of current change with respect to a gate voltage pulse width. This behavior has been investigated in various FET geometries and different materials, all with comparable results. These measurements may be a new way to investigate and characterize the hysteresis in carbon nanotube FETs and the materials used in their fabrication.

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