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An assessment of memristor intrinsic fluctuations: a measurement of single atomic motion JULIEN BORGHETTI, J. JOSHUA YANG, GILBERTO MEDEIROS-RIBEIRO, R. STANLEY WILLIAMS, Hewlett Packard Laboratories — Memristors provides electrically tunable resistance for upcoming non-volatile memory and future neuromorphic computing. One of the key benefits of such a device is its scalability, which can be demonstrated from an architectural perspective as well as from a fundamental physics limit. 4D addressing schemes utilizing cross bar structures that can be stacked several layers high above the chip embodies unlimited addressing space. On the other limit, the basic operating principles of memristive devices allow one to reach storage of information in a single atom. In this report of nanoscale (sub 50nm) devices, we detect single atom fluctuations, which would then represent the ultimate limit for noise sources thus delineating the boundary conditions for circuit design. We show that electrically induced individual atom migrations do not affect the overall device atomic configuration until a critical bias where a single local fluctuation triggers a general atomic reconfiguration. This instability illustrates the robustness of the device non-volatility upon small electrical stress.

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