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Why the Long-term Charge Offset Drift in Si SET Transistors is Much Better than Metal-Based Ones: TLF Stability NEIL ZIMMERMAN, WILLIAM HUBER, STUART MARTIN, BRIAN SIMONDS, EMMANOUEL HOURDAKIS, AKIRA FUJIWARA, YUKINORI ONO, YASUO TAKAHASHI, HIROSHI INOKAWA, CHRISTIAN HOF, MIHA FURLAN, MARK KELLER, JOSE AUMENTADO — The charge offset drift is a long-standing problem in metal-based single-electron tunneling (SET) devices, manifesting as a time-dependent instability. Through a compendium of drift measurements on SET transistors fabricated in five different laboratories, we can show that the drift is endemic in metal- based devices, but is absent in Si-based devices. Given that it is well-known that two-level fluctuators (TLF's) exist in Si devices, the question naturally arises: why is the long-term drift so much better in the Si-based devices? Our answer: the TLF's in Si devices are stable over time, thermal cycling, etc., whereas the TLF's in the metal-based devices are unstable, and exist in interacting glass-like state. Following these observations, we have developed a model based on the theory of heat evolution in glasses that quantitatively agrees with the rate of charge offset drift in metal-based devices. Finally, we suggest some particular directions for future fabrication that may eliminate this problem.

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