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Random Telegraph Signal in a Metallic Double-Dot System[1] YUVAL VARDI, AVRAHAM GUTTMAN, ISRAEL BAR-JOSEPH, Department of Condensed Matter Physics, Weizmann Institute of Science, Rehovot 76100, Israel — Double quantum dot systems offer a unique opportunity for studying the world of quantum transport. This stems from the ability to localize an electron in a limited region in space on the dot, and monitor its presence and properties. Another system, in which electrons can be stored and measured, is an electronic trap in solid. The electrons in such a trap are better isolated from the environment. However, their measurement and control are more difficult. Here we demonstrate how these two systems, metallic double-dots and electronic traps, are combined to yield a hybrid structure in which an electron can be stored for long durations and can be easily detected and measured. We investigate the dynamics of a single electron surface trap, embedded in a self-assembly metallic double-dot system. The charging and discharging of the trap by a single electron is manifested as a random telegraph signal of the current through the double-dot device. We find that we can control the duration that an electron resides in the trap through the current, varying it between fractions of a second to more than an hour, at the Coulomb blockade region. We suggest that the observed switching is the electrical manifestation of the optical blinking phenomenon, commonly observed in semiconductor quantum dots.

[1]Y. Vardi, A. Guttman, and I. Bar-Joseph, Nano Letters 14 (5), pp 2794-2799 (2014). [DOI: 10.1021/nl500803p]

Yuval Vardi
Department of Condensed Matter Physics,
Weizmann Institute of Science, Rehovot 76100, Israel

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