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(G*) POS-F41 – A Study of Silicon Dangling Bond Pairs in Search of a True Random Number Generator

Wednesday 9 June 2021 13:45 (2 minutes)

Hydrogen terminated silicon has seen a recent resurgence in popularity due to several works demonstrating its use for ultra-dense memory, atomic electronics, and quantum devices. On this surface, individual hydrogen atoms can be removed with atomic precision through STM pulses, leaving a dangling bond (DB) behind. DBs are quantum dot-like entities that can hold either 0, 1, or 2 electrons, with their discrete energy levels in the bandgap. We are studying DBs to achieve true random number generators (RNG) on the atomic scale. Two DBs patterned in close proximity to each other on a highly n-doped crystal host a net extra electron, which can quantum mechanically tunnel to reside on either side. Through measurement of the extra electrons'spatial location in the pair, it is expected that the electron will be found on either side with equal probability in the absence of any biasing effects. This opens the possibility of using the system as a true RNG, where the bits are generated by probing the electrons'spatial location. Quantum processes are most desired for RNG because the randomness can be such that no common naturally occurring or imposed noise will alter the number generation. We study these DB pairs by DFT methods to establish the effect of geometry, external fields, and nearby dopants on charge localization and consequent RNG bit generation.

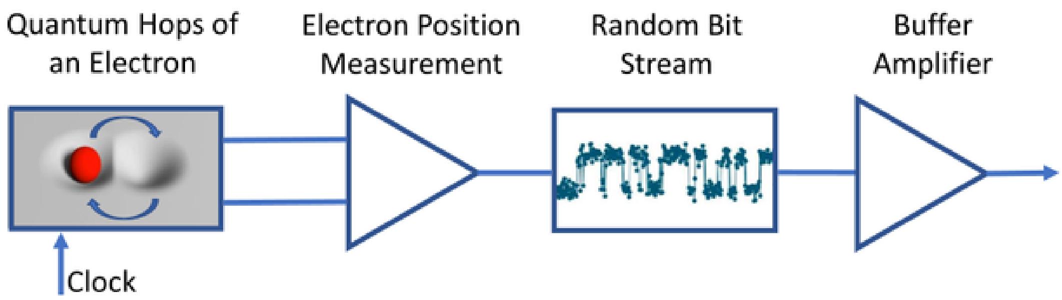

Figure 1: Image abstract.

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