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Electrical detection and imaging of individual phosphorus and silicon-dangling bonds states at the crystalline silicon to silicon dioxide interface KAPILDEB AMBAL, Univ of Utah, PHILIPP RAHE, University of Nottingham, ADAM PAYNE, Univ of Utah, JAMES SLINKMAN, RFSOI Technology Development, IBM Microelectronics, CLAYTON C WILLIAMS, CHRISTOPH BOEHME, Univ of Utah — Nuclear spins of phosphorus [P] donor atoms in crystalline silicon are promising qubit candidates, but utilizing these systems for scalable quantum devices will require the ability to probe individual donors on atomic length scales and address these systems by application of well-controlled electric fields[1]. In this talk we focus on identifying individual P donor and P_b (dangling bond) states by measuring electric current through a crystalline silicon (100) - SiO_2 interface, observing charge flow through individual pairs of P donors and highly localized (Å-range) silicon dangling bond states. The experiments were conducted with neutral P donor states using a low-temperature (T = 4.3K) ultra-high vacuum scanning probe microscope with a quartz tuning fork sensor that allows simultaneous AFM and local current measurements in complete darkness. This so called conduction-atomic force microscopy experiment[2] yields images of the dangling bond states coupled to individual phosphorus donors. I-V responses on these isolated highly localized charge percolation paths further support the hypothesis that individual P-donor - P_b states are being addressed, and that spin-states may be probed using spin-dependent charge-carrier recombination current between ^{31}P and the interface defects. [1] B. E. Kane, Nature **393**, 133 (1998); [2] S. Kremmer et, al., Surf. Interface Anal. **33**, 168 (2002).

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