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Atomic scale electronics: from classical kilobytes to quantum bits

Miniaturization has now reached the limit where the functionality of laboratory prototypes depends on the physical state of a single atom [1]. Examples of these single dopant devices include quantum sensors based on NV point defects in diamond [2] and single dopant transistors [3]. In this talk I will provide a theoretical perspective of the exciting prospects in this research front, focusing on two aspects. First, the challenges and the potential to upscale single atom devices, illustrated with our recent demonstration [4] of a kilobyte where every bit is encoded in a single atomic vacancy on 2D square lattice of Chlorine atoms self assembled on the (100) surface of Cu (see Figure). Second, the electric manipulation of individual of both the electronic and nuclear spin of individual magnetic magnetic atoms and point defects on surfaces [5,6], and their potential as quantum bits.

References

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Figures