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Single spins in diamond: scalable quantum registers and nanoscale sensors

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Ability to detect single atoms is a key element of several key technologies of including quantum information processing, communications as well as nanoscale imaging and sensing. Usually single atom control techniques are limited to low temperature operation. In this talk we will show that single spins associated with nitrogen-vacancy defects diamond (NV centers) can be used as nanoscale magnetic field sensor allowing detecting magnetic moment associated with single electrons under ambient conditions. We also show that coupled arrays of spins can be used as building blocks for scalable quantum registers.