Measuring electron correlations with a quantum sensor

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Correlated electron materials host a variety of intriguing physical phenomena, like superconductivity, magnetic order of topological conductivity. Often these properties occur in competition, boasting a highly complex electronic ground state. Novel methods, like single spin NV quantum sensors promise to achieve entirely new insights. In the talk I will demonstrate how to measure the electronic properties of 2D superconducting materials or analyse order parameters in complex magnetic materials [1]. Often multiqubit sensors achieve better performance [2] and even running few qubit algorithms can improve sensor properties [3].

[1] Y.P. Zhu et al. Observation of plaid-like spin splitting in a noncoplanar antiferromagnet,. 626, 7999 (2024)

[2] J. Meinel et al. Quantum nonlinear spectroscopy of single nuclear spins, Nature Comm. 13, 5318 (2022)

[3] V. Vorobyov et al. Quantum Fourier transform for nanoscale quantum sensing, njp Quantum Information, 7, 124 (2021)