

Boosting quantum performances of NV centers in phosphorus-doped diamond

M2 internship position with opportunity of PhD at University Paris-Saclay.

The GEMaC laboratory (CNRS - UVSQ) and HiQUTE Diamond company (<https://hiqute-diamond.com/>) are pleased to invite applications for a master internship. This joint academic-industrial program aims to develop phosphorus-doped NV⁻ centers in diamond for next-generation quantum chips, combining HiQUTE Diamond's expertise in diamond microfabrication with GEMaC's ones in phosphorus doping and spectroscopy of defects.

The negatively charged nitrogen-vacancy (NV⁻) center in diamond is a robust solid-state qubit operable at room temperature. Today's quantum protocols require an additional "charge-pump" laser to convert the neutral NV⁰ into NV⁻, which increases system complexity and power consumption. n-type doping with phosphorus offers a game-changing alternative by providing free electrons at 300 K, stabilizing the NV⁻ charge state without extra photonic excitation.

The successful candidate will optimize CVD growth recipes — varying phosphorus and nitrogen partial pressures in isotopically purified methane—to achieve $\geq 95\%$ NV⁻ for nitrogen doping in the ppm range. He/she will quantify spin-coherence improvements (T_1 , T_2 , T_2^*) via continuous-wave and pulsed ODMR, characterize dopant levels with cathodoluminescence, and assess crystal quality through birefringence and stress mapping.

During the first months, the focus will be on CVD growth at GEMaC and initial spectroscopic characterization. Building on optimized material, the PhD candidate will then perform electron-irradiation followed by thermal annealing at HiQUTE Diamond to convert nitrogen to NV, then laser-micromachine and polish substrates to quantum grade.

Applicants should be about to complete a Master 2 (or equivalent) in Physics, Materials Science, Electrical Engineering, or a related discipline. Prior experience with CVD growth or solid-state material synthesis, optical spectroscopy (PL, ODMR), microfabrication (laser machining, lithography), and programming for data acquisition (Python, LabVIEW, MATLAB) is highly desirable. Strong analytical skills, experimental rigor, and collaborative spirit are essential.

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