PhD Position in solid state quantum technologies:

Highly Entangled Dicke States with Diamond Spin Qubits in Cavities

Nitrogen-Vacancy (NV) center in diamond, Quantum Electrodynamics in cavity (Cavity QED), Dicke States, Quantum Metrology

Institution:	Research institute FEMTO-ST Departement of optics	Start Date:	As soon as possible
		Duration:	3 years
Location:	Besançon, France		
Supervision:	Mayeul CHIPAUX		

Project Description

At the cutting edge of the Second Quantum Revolution, the scaling of entanglement schemes has become a central challenge in Quantum Sciences and Technologies (QSTs) in general and in quantum information processing and quantum metrology in particular.

The goals of this PhD project are to prepare and stabilize highly entangled Dicke states in a large ensembles of NV centers placed in microwave cavities and to explore their utilization as an entanglement source for quantum information processing tasks or for quantum metrology. This involves triggering and controlling superradiance (SR) in the microwave domain (~3 GHz) and quantifying the collective quantum properties using dispersive measurements.

The outcomes will advance our understanding of quantum coherence in solid-state systems, contribute to the development of scalable quantum technologies and provide innovative tool for exploring collective effect in Cavity QED.

Key Responsibilities:

- **Simulation and Optimization:** Design optimize microwave resonator able to trigger the superradiance of NV centers.
- **Experimentation:** Develop the experimental setup and protocols to trigger and stabilize collective superradiance in NV centers within diamond cavities.
- **Quantum Characterization:** Quantifying the Dicke states properties by mean of both local measurements and advanced dispersive measurements techniques.
- **Theoretical Collaboration:** Collaborate with theorists to model the dynamics of superradiance.
- **Team Collaboration:** Work with the rest of the team to investigate applications in quantum metrology and quantum information processing.
- **Dissemination:** Publish your findings in high-impact journals and present your work at international conferences.

Sought Qualifications:

- **Educational background:** A Master or an engineering in physics is required with some of the following specialties: Cavity quantum electrodynamics in cavity (cavity QED), microwave physics, optics, solid state quantum technologies, quantum metrology.

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- **Technical expertise:** Experience with laboratory experiment interfacing (Labview, Matlab or Python), and with numerical simulation (Comsol or Ansys HFSS) are desired.
- **Soft skills:** Team work, and communication skills (oral or written) are expected.
- **Motivation:** A passion for quantum research and an eagerness to solve complex scientific problems in a fast-paced, collaborative environment.

What We Offer:

- A fully funded 3years PhD position with a competitive salary, allowing you to focus fully on your research.
- Access to cutting-edge facilities and experimental setups, including microwave and optical instrumentation.
- A dynamic and supportive research environment.
- Opportunities for international collaborations.

Research environment:

The project will take place at the Department of optics (https://www.femto-st.fr/en/Research-departments/OPTICS/Presentation) of Institute FEMTO-ST (https://www.femto-st.fr/en/The-Institute/introduction). See also the MIMENTO technology center (https://www.femto-st.fr/en/Platforms/MIMENTO-Presentation)

How to Apply:

Please submit the following documents to mayeul.chipaux@femto-st.fr:

1. A detailed CV
2. A cover letter that outlines your motivations and relevant experience.
3. One or two reference letters (or contact information).
4. Transcripts from your Bachelor's and Master's degrees.

Contact Information:

For more information about the position or the project, please contact Mayeul CHIPAUX at mayeul.chipaux@femto-st.fr.