

3-year fully funded PhD position for *international student* on:



2D Materials for Next-Generation Quantum Sensing

Department of Materials Science and Nanotechnology

University of Milano-Bicocca (Italy).

Keywords: spin qubits, 2D semiconducting materials, Optically Detected Magnetic Resonance.

Quantum sensing technologies exploit uniquely quantum phenomena—such as coherence, superposition, and entanglement—to measure physical quantities with sensitivities unattainable by classical sensors. To date, diamond nitrogen-vacancy (NV) color centers represent the benchmark material platform for quantum sensing. However, limitations related to surface noise, readout efficiency, and device integration significantly constrain their scalability and practical deployment.

This PhD project aims to explore an alternative and potentially transformative platform: **spin qubits in two-dimensional (2D) semiconducting materials**, which may overcome the limitations of diamond-based systems and enable flexible, scalable, and integrable quantum sensors.

Main Objectives

- Identification and engineering of color-center spin qubits in 2D materials by Optically Detected Magnetic Resonance (ODMR) Spectroscopy and Microscopy.
- Investigation of spin coherence properties and development of sensing protocols for magnetic and electric fields detection as well as temperature sensing.
- Establishment of design rules for optimal quantum sensing performance in 2D semiconductors.

Expected Impact

- Realization of the first quantum sensors based on 2D wide-bandgap semiconductor materials.
- Advancement of fundamental understanding of spin coherence in van der Waals materials.
- Development of scalable and flexible quantum sensors transferable to arbitrary substrates and compatible with photonic and electronic integration platforms.

International co-tutoring: there will be a possibility to activate a jointly supervised theses with an European University and to obtain two *Research Doctorate diplomas*.

Eligibility: international students-only (*i.e.* no Italian residents).

Call dates: opening date 17 March – closing date 17 April

Application website: <https://www.unimib.it/studiare/dottorato-ricerca/accedere-al-dottorato>

Starting date: 1st November 2026

Duration: 3 years

Period abroad: from 6 to 12 months (from 12 to 18 months in case of International co-tutoring)

Studentship: ~ 1200 euros/month increased by 50% for the period abroad.

Budget: 10% of the studentship for laboratory consumables, participation to conferences etc..

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