Marie-Skłodowska-Curie Actions – Postdoctoral Fellowships 2025

INL Expression of Interest

Research Group Leader /Research Group name:	
Jana Nieder/Nieder group on Ultrafast Bio- and Nanophotonics	
Scientist in charge:	
Name & surname	Jana Nieder
Contact email	Jana.Nieder@inl.int

Short description of the research group, including URL if applicable *(Strengths and scientific achievements (publications, patents, etc.), important infrastructure (up to 2000 characters with spaces)):*

Nieder's group explores light-matter interactions and control within three primary domains. Firstly, ***advanced bioimaging and sensing*** involves the use of nanofunctionalised surfaces and particles with ultrafast laser technology to achieve innovative imaging and sensing capabilities in terms of resolution and multi-parameter functional imaging. The group collaborates with researchers and innovators to apply novel techniques for therapeutic advancements or enhanced diagnostic tools. Secondly, in ***quantum photonics***, the focus is on comprehending and using the emission of single quantum emitters in 2D materials or 3D crystals. These emitters could play a pivotal role if seamlessly integrated into controllable photonic platforms. Finally, the emphasis in ***photonic integrated devices*** is on developing photonic integrated chips and advanced characterisation tools to provide new paradigms in neuromorphic and quantum computation, while also enabling nanotechnologies for biosensing and quantum information technologies.

Project title:

Quantum sensing applications

Project description *(up to 2000 characters with spaces):*

We have custom developed setups for cw and pulsed ODMR in widefield and confocal modes and are soon installing a low temperature confocal ODMR optical setup. These enable quantum sensing using point defects in diamond and related materials, e.g. 2D and 3D crystals of hBN or other point defects.

The candidate can explore these advanced tools and new quantum magnetometry applications. We are open for quantum sensing projects based on point emitters in 2D and 3D crystals in material sciences, in devices, or biological systems.

Further our group developed protocols for nanodiamond functionalization and placement on polymeric structures and uses nanodiamonds as seniors for intracellular sensing applications.

Collaboration with external groups is encouraged e. g., with groups focused on 2D materials and single emitters in hBN or on magnetic devices, also nanofabrication of photonic chiplets that might act as quantum sensing chips.

Based on the background and interest of the candidate we are eager to co-develop a winning MSCA application, that meets the candidate's strength as well as opportunity in career growth.

Related references by the research group and in collaboration with INL internal and external researchers:- B. N. L. Costa, A. Marote, C. Barbosa, J. Campos, A. J. Salgado, J. B. Nieder, Smart Polymeric 3D Microscaffolds Hosting Spheroids for Neuronal Research via Quantum Metrology. *Adv. Healthcare Mater.* **2025**, 14, 2403875. https://doi.org/10.1002/adhm.202403875

- B. N. L. Costa, F. Camarneiro, …. and J. B. Nieder, "Functionalized Nanodiamonds for Targeted Neuronal Electromagnetic Signal Detection", ACS Applied Materials & Interfaces **2024,** 16 (44), 60828-60841. https://doi.org/10.1021/acsami.4c12462

- Fernandes, J., Queirós, T., Rodrigues, J., Nemala, S. S., LaGrow, A. P., Placidi, E., … Capasso, A. "Room-temperature emitters in wafer-scale few-layer hBN by atmospheric pressure CVD". *FlatChem*. **2022**, 33, 100366. http://doi.org/10.1016/j.flatc.2022.100366

- F. Camarneiro, J. Bocquel, J. Gallo, M. Bañobre-López, K. Berg-Sørensen, U. L. Andersen, A. Huck, J. B. Nieder, "Magnetic Field Mapping Around Individual Magnetic Nanoparticle Agglomerates Using Nitrogen-Vacancy Centers in Diamond." *Part. Part. Syst. Charact.* **2021**, 38, 2100011. https://doi.org/10.1002/ppsc.202100011

Research fields *(You may choose more than one)*			
Chemistry (CHE)	x	Life Sciences (LIF)	x
Economic Sciences (ECO)		Mathematics (MAT)	
Environment and Geosciences (ENV)		Physics (PHY)	x
Information Science and Engineering (ENG)	x	Social Sciences and Humanities (SOC)	

Expiration date for Expressions of Interest from postdoctoral fellows:	4 weeks before the MSCA application deadline

Necessary documents to be submitted (in addition to the required CV and motivation letter):
A research statement that connects the candidate's expertise with a "quantum sensing applications" related project.