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DI TECNOLOGIA



proposta.xlsx

PhD Program in Physics and Nanosciences

Curriculum Bio-NanoSciences

Nanoscopy Research Themes – cycle XXXVII

1. Development of a Multimodal Optical Microscopy Image Correlation Sensing - MOMIX (tm) -e super resolution microscope to study cellular systems at the nanoscale..... 2
2. Label-free optical microscopy, using circular intensity differential scattering (CIDS) and non linear processes (multiphoton and second harmonic generation), towards nanoscale biophysics applications.



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1. Development of a Multimodal Optical Microscopy Image Correlation Sensing - MOMIX (tm) -e super resolution microscope to study cellular systems at the nanoscale.

Investigating life at the cellular and molecular level demands for super-resolution (<200nm) imaging techniques capable of providing three-dimensional access to structural and functional information. The research project deals with the development of an innovative super-resolution optical microscope (MOMIX) capable of combining spatial super-resolution (e.g. confocal and STED microscopy) with spectroscopic approaches (e.g. FLIM imaging, CIDS imaging). Strong interest will be dedicated to the creation of a software platform capable of integrating and properly merging the vast amount of data collected by the instrument, eventually including big-data and/or machine learning approaches. Successful implementation of the MOMIX microscope will result in an innovative quantitative imaging approach in nanoscale biophysics and bioengineering.

The ideal candidate holds a Master Degree in a technical or scientific field (e.g. Physics, Engineering, Computer Science). Knowledge in scientific programming with Matlab, Labview or Python is desirable.

Applicants will be part of an international group and an English-speaking environment. Our labs are located in the new IIT Center for Human Technologies in Erzelli Great Campus. The successful candidate will have the chance to participate in national and international training opportunities, workshops, and to access funding for visits abroad.

Research team: Alberto Diaspro, (supervisor) Paolo Bianchini, Marco Castello, Simonluca Piazza, Irene Nepita.

Bib ref (open access): Diaspro, A., Bianchini, P. Optical nanoscopy. Riv. Nuovo Cim. 43, 385–455 (2020). <https://doi.org/10.1007/s40766-020-00008-1>

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2. Label-free optical microscopy, using circular intensity differential scattering (CIDS) and non linear processes (multiphoton and second harmonic generation), towards nanoscale biophysics applications.

The project deals with the realization of label free optical modules, incorporating advanced linear and non-linear fluorescence approaches, based on phase-contrast, circular intensity differential scattering (CIDS) and second-harmonic generated signals. The system will benefit of advances in Mueller matrix microscopy and multiphoton imaging. Case studies will be related to exploit in a light-matter interaction context, ray tracing and photon detection, light-matter interactions in single cells, cellular spheroids and tissues.

The ideal candidate holds a Master Degree in a technical or scientific field (e.g. Physics, Engineering, Computer Science). Knowledge in scientific programming with Matlab, Labview or Python is desirable.

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