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DOTTORATO DI RICERCA IN FISICA

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Multi-messenger optical microscopy: from multiphoton to nanoscopy

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Abstract: The possibility of integrating different light-matter interactions to form images and to correlate image data in optical microscopy taking advantage of the development of micro- and nano- optical technologies and artificial intelligence approaches are the key point for the design and implementation of a multi-messenger optical microscope. This represents a new paradigm in data collection and image formation due to visible light-matter interactions, also exploiting the possibility to "tune" the microscope across a large, almost unlimited, range of spatial and temporal resolution ranges. Fluorescence, including single molecule and nanoscopy, label free approaches, multiphoton, SHG, Mueller matrix microscopy provide the mechanisms of contrast that can be merged within a liquitopy – liquid tunable microscopy – perspective [1,2]. It is the melting pot for an effective demonstration of an applied physics approach. For this reason, we will discuss from basic to advanced aspects of confocal and multiphoton microscopy, single molecule localisation methods, nanoscopy and label-free approaches [3], correlative nanoscopy [4].

[1] R. Won, Nature Photonics, vol. 12, no. 5, pp. 259–260, 2018.
[2] A. Diaspro, Il Nuovo Saggiatore, vol. 35, no. 1, pp. 21–28, 2019.
[3] A. Le Gratiet et al. OSA CONTINUUM, 1 (3): 1, 2018.
[4] M.Cosentino et al. Science Advances, 5 (6): eaav8062