n. 1 posto aggiuntivo del corso di perfezionamento in Nanoscienze sarà assegnato in relazione a temi di ricerca inerenti il progetto EU ERC "CAPTUR3D: Capturing the Physics of Life on 3D-Trafficking subcellular Nanosystems".

Al vincitore di questo posto, in luogo della borsa di perfezionamento prevista dall'art. 6 del bando di concorso, sarà attribuito dalla Scuola un assegno di ricerca dell'importo di € 19.542,00 (lordo beneficiario), di cui all'articolo 22 della legge 30 dicembre 2010, n. 240.

# CAPTURING THE PHYSICS OF LIFE ON 3D-TRAFFICKING SUBCELLULAR NANOSYSTEMS
# CAPTUR3D

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Institution hosting the project: **SCUOLA NORMALE SUPERIORE, PISA, ITALY**

## SUMMARY:

Which physical principles govern life regulation at the level of subcellular, membrane-enclosed nanosystems, such as transport vesicles and organelles**?** How do they achieve controlled movements across the crowded intracellular world**?** Which is the structural and functional organization of their surface and their lumen**?** This is only a small subset of key open questions still open within living matter.

Thus far, in fact, state-of-the-art optical microscopy tools for delivering quantitative information in living matter failed to subtract the natural 3D movement of subcellular nanosystems while preserving the spatial and temporal resolution required to probe their structure and function at the molecular level.

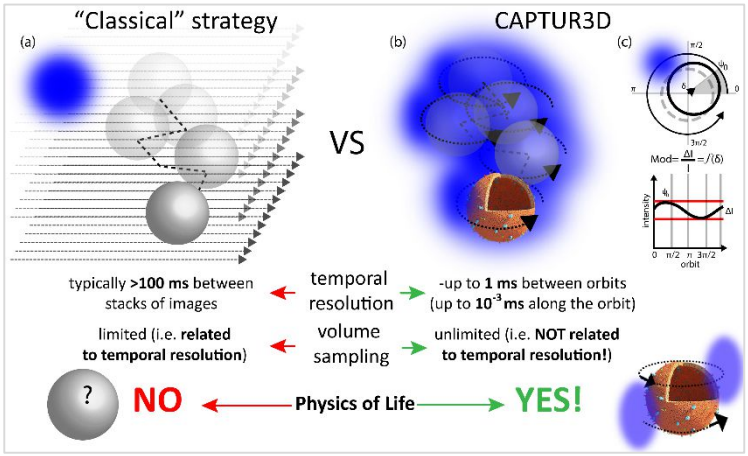


***Figure 1.*** *The classical strategy of imaging subcellular nanostructures in 3D relies on probing the volume in a time-consuming target-search process (**a**). The time resolution in not enough to grab (molecular) details on the structure of interest. By contrast, CAPTUR3D forms a light envelope around the point of interest (**b**). Modulation of signals detected along the orbit is kept at a minimum, i.e. the target is kept at the center of the orbit (**c**). Time resolution becomes suitable to study molecular processes on the target.*

Within CAPTUR3D it is proposed to tackle this bottleneck by an excitation light-beam focused in a periodic orbit around the nanosystem of interest and used to localize its position with unprecedented spatial (~10 nm) and temporal (~1000 Hz frequency response) resolution. Such a privileged observation point will push biophysical investigations to a new level. In fact, state-of-the-art imaging technologies and analytical tools (e.g. fluorescence correlation spectroscopy), will be now available to perform molecular investigations directly on a moving, nanoscopic reference system.

The insulin secretory granule (ISG) is selected as a paradigmatic case study. Key open issues at the ISG level are selected, namely: *(i)* ISG-environment interactions and their role in directing ISG trafficking, *(ii)* ISG-membrane spatiotemporal organization, *(iii)* ISG-lumen structural and functional organization, (*iv*) ISG alterations in type-2 diabetes (T2D). These issues will be tackled directly within human-derived Langherans islets.

CAPTUR3D is an interdisciplinary Project that lies at the crossroad between physical and life sciences. The distinctive feature of the Project is the challenging idea of bringing a toolbox of analytical techniques along the trajectory of nanoscopic subcellular objects. At the same time, the complementary expertise in cell biology will be required to make meaningful progress in understanding the physiopathology of the target subcellular object.

In light of these consideration, graduates in physics, biology, chemistry or other scientific fields with a keen motivation towards research and innovation are strongly invited to apply to this position (within the PhD Program in Nanoscience at Scuola Normale Superiore).