Graduate School Event

Thesis Defense: Construction of a cryo-super-resolution microscope to guide in situ structure analysis

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Host: Georgios Katsaros

The internal structure of biomolecules and their organization in higher-order arrangements are key factors governing the working principles of biological systems. Bioimaging has successfully revealed arrangements across relevant spatial scales. For example, cryo-electron tomography has become widely used for analyzing biomolecular structures in situ due to its comprehensive structural visualization of near-natively preserved samples, and its capability of sub-nm resolution via averaging. However, the identification of molecules withing crowded cellular environments is often hindered by low contrast. Fluorescence microscopy, on the other hand, routinely visualizes specifically labeled targets at single-molecule contrast against essentially zero background. Moreover, it provides comparatively high throughput and is amenable to multiplexing. Due to this complementarity, combining datasets from both modalities acquired on the same region via correlative light and electron microscopy can reveal novel types of information. The spatial scale at which information can be extracted depends on imaging resolution and correlation accuracy. Since diffraction of light limits the resolution of conventional fluorescence microscopy to few hundreds of nanometers, reaching the full potential of correlative imaging requires super-resolution approaches. Performing imaging at cryogenic temperature preserves structures in a near-native state and minimizes distortions between the fluorescence and the electron microscopy datasets. Implementations of this concept have achieved correlation on the scale of cellular organelles or bacterial domains.We have worked towards pushing correlative imaging to the single-molecule scale by improving cryo-super-resolution microscopy, and devising a refined image correlation workflow. As part of this project, I constructed a microscopy setup and adopted it for super-resolution fluorescence microscopy at room temperature and cryogenic conditions. I explored different cryo-stages and acquisition strategies. Specifically, I developed a new scheme for correcting sample drift, thus increasing mechanical stability during microscopy acquisitions.

Thursday, August 14, 2025 03:00pm - 04:00pm
Moonstone Bldg / Ground floor / Seminar Room G (I24.EG.030g) and Zoom

This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station. Please find a schedule of the ISTA Shuttle on our webpage: https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.