Submission Date: 08/09/2024

2023 Academic Year Bio-SPMs Collaborative Research
Research Report Summary

Title of the research project		**Multiscale dynamics in bio-inspired active systems assembled from the bottom-up**	
PI (Person in charge of the research project)	Name	Isabella Guido	
	Affiliated Institution and Department/Division/etc.	University of Surrey – School of Mathematics and Physics	
	Position	Senior Lecturer (equivalent to associate professor)	
Bio-SPMs that you used (Check the boxes)		x	Atomic resolution/3D-AFM
		☐	High-speed AFM
		☐	SICM
		☐	AFM for Cell Measurement
Collaborative NanoLSI Faculty Members		Prof. Franz Clemens, prof. Carsten Beta	

Introduction

The project focused on investigating the multiscale dynamics of synthetic cytoskeletal systems made of microtubules and motor proteins assembled from the bottom up by scanning them at the nanoscale. Our primary objective was to map the force field that defines the collective emergent behaviour of these structures. For this purpose, we intended to analyse the hierarchical organization of these networks by characterizing the behaviour at the level of single filaments and then progressively increasing the number of filaments to understand the larger-scale dynamics. We believe that the characterization of the length scale separation in biological samples will contribute to the understanding of basic principles of cellular cytoskeleton.

For this investigation I took part to the program Bio-SPMs Collaborative Research at WPI-NanoLSI, Kanazawa University and collaborate with Professor Kodera, Professor Franz, and Professor Beta. The motivation was driven by the expertise of the NanoLSI in High-speed AFM. The choice for this advanced form of microscopy was motivated by its combined capabilities of the high spatial resolution of conventional AFM with significantly enhanced temporal resolution. This makes it suitable for capturing dynamic events at the molecular level.
In collaboration with the NanoLSI members (Professor Kodera, Professor Franz, and Professor Beta) I planned three visit of two weeks each. I have visited the NanoLSI in June 2023 for a period of 20 days and the aim of my first visit was to observe and analyse the behaviour of few microtubules crosslinked and streched by kinesin motors. The analysis was intended to be done at the individual microtubule level to allow the characterisation of the individual interactions filament- motor protein.

My collaborator Prof. Akira Kakugo at the University of Kyoto provided me with tubulin and motor proteins kinesin-1, the required materials for running the experiments and not available at NanoLSI.

*This form (Form 3) will be open on the NanoLSI website in the following academic year.

*Note that this form should be prepared in one A4-size paper.

*Submission Deadline: May 10, 2024 (Friday). Submit it as a PDF file.

*Submission Destination: the person in charge of Bio-SPMs collaborative research at WPI-NanoLSI, Kanazawa University
Email: nanolsi_openf01@ml.kanazawa-u.ac.jp