

# “Imaging for physiologically relevant 3D micro-environment”



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**Abstract:** Biological tissues are composed of multiple cell types organized in a complex three-dimensional architecture. However, because of the limited penetration depth of visible photons, observing the molecular and structural composition of intact tissues remains challenging.

By chemically clearing a tissue or an organ, the depth over which an optical microscope can deliver an image is dramatically increased. However, because a large variety of tissue clearing methods exist, each optimized for different types of samples that necessitate specific solvents, imaging with sub-cellular resolution has remained out of reach. In the first part of this presentation, I will talk about my postdoctoral research where I developed a microscopy platform that can image large specimens such as an entire mouse brain or kidney with high resolution, irrespective of the clearing protocol. Also, unlike any other microscope, our system achieves isotropic resolution (i.e. the same resolving power in any spatial direction). Owing to its high-speed, our microscope can image specimens within hours that previously required days to weeks of imaging time. I will also show how various researchers across many different biological fields (neuroscience, stem-cell and cancer research, developmental biology etc.) are using this platform to address their biological questions.

Observing cells in tissue is to some degree is also possible with multiphoton microscopy. However, due to its raster scanning nature, such microscopes are notoriously slow. Scanning in the third dimension is especially slow, as a change of focus is traditionally achieved by mechanically moving heavy optical components. Here I will present a new optical method that can convert any lateral scan motion into an axial scan while avoiding spherical aberrations. I will demonstrate the potential of this technique by using normal and resonant galvanometric scanners to achieve high resolution axial refocusing at a rate of up to 12kHz. I will discuss how this technology can obtain even faster scan rates in the MHz range and how this will impact intravital imaging using multiphoton microscopy.

**Bio:** I am an Assistant professor in the Department of Physics and Astronomy and a full member of UNM Comprehensive Cancer Center (UNMCCC). I have recently started my research program focused on the development of transformative microscopy techniques. In particular, I specialize in developing light sheet and multiphoton-based imaging platforms that have an impact in biological research and the study of human diseases.

After gaining several years of microscopy experience in semiconductor industry, as Analytical and Metrology Engineer, I transitioned into my doctoral research through the laboratory of Dr. Jonathan Petrucci at the State University of New York at Albany. Thereafter, I moved to UTSW to hone my skills in microscopy development and design and importantly to immerse myself in an environment of biomedical researchers to ensure that my designs and tool building is guided by the needs and problems of biology.



**Department of Chemistry**  
**Graduate Seminar**  
Host: Praveen Patidar

**Friday,**  
**September 10, 2021**

**12.10-1.00 PM (MST)**

## **Zoom Link**

<https://zoom.us/j/93622297036>

Meeting ID: 936 2229 7036

**Note:** Presentation will be projected on Lopez 106 screen, interested faculty members and students are welcome to convene in Lopez 106.