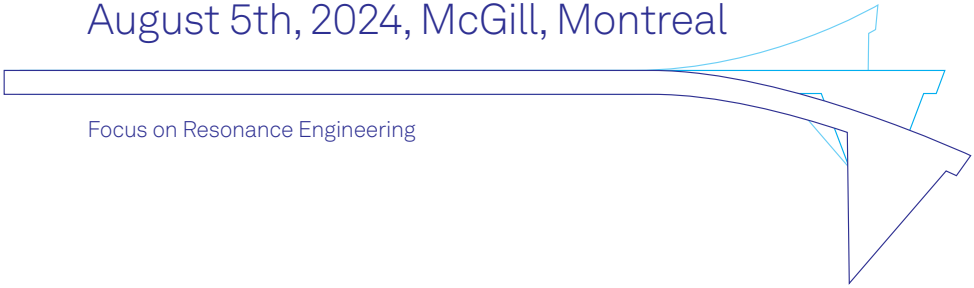
Zurich Instruments

7th SPM User Meeting, NC-AFM
August 5th, 2024, McGill, Montreal

Focus on Resonance Engineering



Program

Time	Session
09:00–09:10	Zurich Instruments for Scanning Probe Microscopy **Jorge Medina –** Zurich Instruments USA
09:10–09:40	Resonance Enhancement Techniques in SPM **Romain Stomp –** Zurich Instruments
09:40–10:20	Exploring the Full Potential of Multimodal Cantilever for MFM, KPFM, and True Atomic Resolution AFM **Hans Josef Hug –** EMPA Switzerland
10:20–10:50	Coffee break
10:50–11:30	Hands-on Tutorial on Resonance Engineering **Romain Stomp –** Zurich Instruments
11:30–12:10	Cryogenic AFM Instrumentation and Automation with Python API **Yoichi Miyahara –** Texas State University
12:10–13:30	Lunch sponsored by Zurich Instruments

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Speakers Bio and Abstracts

Hans Josef Hug is a Professor and Head of the Empa Laboratory for Magnetic and Functional Thin Films at the Swiss Federal Laboratories for Materials Science and Technology, and a Titular Professor at the University of Basel. He earned his Ph.D. and habilitation in experimental physics from the University of Basel. Prof. Hug has held several teaching positions and led multiple research groups, focusing on magnetic force microscopy (MFM) and nanostructured materials. His work has resulted in over 170 publications, patents, and the start-up company NanoScan, integrated into IONTOF GmbH since 2022.

Exploring the Full Potential of Multimodal Cantilever for MFM, KPFM, and True Atomic Resolution AFM

Microfabricated cantilevers, with their low stiffness-to-frequency ratio, present a unique opportunity for multimodal operation, enabling both consecutive and simultaneous measurements of tip-sample forces in different directions and physical natures, while achieving true atomic resolution. By integrating the Zurich Instruments Lock-in Amplifier/PLL system with a conventional SPM data acquisition system, we establish a versatile experimental platform to realize these capabilities. Particularly, the digital data acquisition from the Zurich Instruments system offers significant advantages for successive data deconvolution methods, facilitating extensive post-measurement data processing. This presentation will delve into the methods and benefits of this approach, showcasing its potential to advance the field of atomic force microscopy.

Dr. Yoichi Miyahara joined the Department of Physics at Texas State University as an Assistant Professor since 2019, following positions at École Polytechnique Fédérale de Lausanne and McGill University as a Research Associate. He earned his Ph.D. in Electrical Engineering from Waseda University in Japan. His work focuses on advanced scanning probe microscopy (SPM) techniques for nanoscale material property characterization. Dr. Miyahara is the recipient of an NSF-CAREER award and has served as the principal investigator on an NSF-MRI development grant and co-PI on an NSF-PREM grant. His research group is dedicated to creating unique instrumentation for investigating quantum materials and quantum electronic devices at mK temperatures.

Cryogenic AFM Instrumentation and Automation with Python API

We present a low-temperature AFM system which is integrated in a cryogen free dilution refrigerator. The AFM is equipped with a fiber-optic interferometer which is used for both detecting the cantilever deflection and exciting the cantilever oscillation. We will discuss automated noise measurements and Kelvin probe force microscopy operations enabled by an MFLI lock-in amplifier with python scripting [N. Austin-Bingamon et al 2024 Jpn. J. Appl. Phys. 63 04SP84].