



Event Report

RESEARCH TALK

Under the initiative of IICC, NIT Raipur

DATE: 9th FEBRUARY, 2026

Event Name	Expert lectures <u>under</u> Industry -Institute Collaboration Cell (IICC), NIT Raipur
Organizing Department	Department of Biomedical Engineering, NIT Raipur
Name of Resource person	Dr. Himanshu Shekhar
Designation	Associate Professor, Electrical Engineering Indian Institute of Technology (IIT) Gandhinagar
Name of Resource person	Dr. Karla P. Mercado-Shekhar
Designation	Associate Professor, Biological Sciences and Engineering Indian Institute of Technology (IIT) Gandhinagar
Time	10:00 AM --- 1:30 PM
Venue	Hira Auditorium, NIT Raipur
Total Participants (Students and faculty)	~ 120
Program Coordinator	Dr. Sudip Paul



Event Summary

1: TALK BY DR. HIMANSHU SHEKHAR

TOPIC: ADVANCING ACTIVE AND PASSIVE IMAGING TECHNIQUES FOR HISTOTRIPSY MONITORING

Dr. Himanshu Shekhar's talk focused on recent advances in ultrasound-based monitoring techniques for histotripsy, a non-invasive, bubble-mediated focused ultrasound ablation therapy approved for treating liver tumors. He discussed the fundamental challenge of visualizing the cavitation bubble cloud, which is critical to ensuring treatment safety and efficacy, especially in deep tissues or regions outside the imaging field of view. To address this, he presented active imaging strategies, including nonlinear subharmonic imaging combined with chirp-coded excitation and Volterra filtering, which significantly improve signal-to-noise ratio and bubble cloud visibility. Experimental results demonstrated contrast-to-tissue ratio improvements of up to 40 dB in vitro and 25 dB in vivo, with strong agreement between the bubble cloud location and the actual ablation zone.

The talk also covered passive imaging approaches, including 5th-coherence-factor-weighted delay-sum-integrate beamforming, which enables improved axial resolution at reduced computational cost. Validation studies in phantoms and porcine kidney models showed improved cavitation localisation and temporal tracking. Dr. Shekhar emphasised the synergy between active and passive imaging for developing quantitative surrogate markers of histotripsy outcomes, ultimately enhancing the safety and clinical reliability of therapeutic ultrasound procedures.

2: TALK BY DR. KARLA P. MERCADO-SHEKHAR

TOPIC: ENABLING ULTRASOUND TECHNIQUES FOR TISSUE CHARACTERIZATION

Dr. Karla Mercado-Shekhar's presentation highlighted the role of ultrasound elastography and viscoelastography in accurate tissue characterisation. She emphasised that biological tissues are inherently viscoelastic, and treating them as purely elastic can introduce significant errors in shear wave elastography (SWE). To address this limitation, her research focuses on developing tissue-mimicking viscoelastic phantoms with clinically relevant acoustic and mechanical properties. These phantoms are used for systematic performance evaluation and validation of emerging ultrasound techniques.

She presented experimental and numerical studies demonstrating large discrepancies between linear-elastic SWE estimates and rheometry measurements, while viscoelastic SWE showed close agreement with ground truth. The talk also covered advanced applications, such as anisotropic tissue imaging, in which muscle fiber orientation affects shear modulus estimates. An angle-adaptive, model-free viscoelastography framework was introduced to compensate for pennation-angle effects without specialised hardware. Additionally, Dr. Mercado-Shekhar discussed shear wave attenuation as a sensitive biomarker for tissue fluid content and its potential role in disease assessment. Overall, the talk underscored the need to move beyond simplified elastic models toward robust, quantitative ultrasound biomarkers for clinical translation.