

## **A Ping-Pong Match in Plasma: How an AI-Guided Inertrope Reads the Game to Diagnose Cancer**

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This talk introduces a revolutionary liquid biopsy that redefines cancer diagnostics. Instead of asking what is in the blood, we ask how the blood behaves as a complete thermodynamic system by playing a game of 'thermodynamic ping-pong' in just a few drops of patient plasma. Our star player is Inertrope, a unique biologically inert probe discovered and guided by AI. It doesn't hunt for a specific biomarker; instead, it 'pings' the plasma, and we read the energetic rally that follows. This interaction generates a rich calorimetric fingerprint, a holistic heat signature of the patient's health. When fed into a machine learning model, these fingerprints allowed us to classify cancer, benign, and healthy states with over 95% AUC-ROC in a 176-patient cohort. Mechanistic insights link the role of hydrogen peroxide in plasma with that of the observed pathology-specific calorimetric fingerprints. Our work establishes a powerful 'diagnostic-by-thermodynamics' paradigm, transforming chemical "dark matter" into potent diagnostic probes and paving the way for a new generation of non-invasive cancer detection. Please note: The hand-on session will be conducted in building the model using ITC, and shall include data acquisition, pre-processing, and then model building and validation.