

Ultrasensitive Detection of Trace Chiral Prebiotic Molecules

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Chiral molecules are the building blocks of life. Study of enantiomeric excess of amino acids in interstellar ice enables scientific advancement and a better understanding of life origin on Earth. Resolution of interstellar chiral prebiotic compounds also plays a significant role in searching for life in space. Miniature systems with reduced mass, volume, power and complexity for resolving multiple (>20) trace chiral prebiotic molecules on icy bodies are desired for future planetary missions. We aim to develop miniaturized and ultra-sensitive opto-thermo-fluidic platforms with capabilities to enable chiral detection of amino acids at sub parts per billion (ppb) level and to resolve multiple pairs of trace amino acids. The platforms can be integrated with multi-level filters and heating elements for sample handling and analysis in icy environments to achieve ultracompact opto-thermo-fluidic systems with digital control and deep-learning-enabled analysis. In this talk, I will introduce our recent works in developing and improving the opto-thermo-fluidic sensing platforms, as well as establishing a deep convolutional mixture density network, which will benefit the further improvement of the platforms and the future rapid analysis of sensing signals.