# Fast and Ultrasensitive SERS Detection
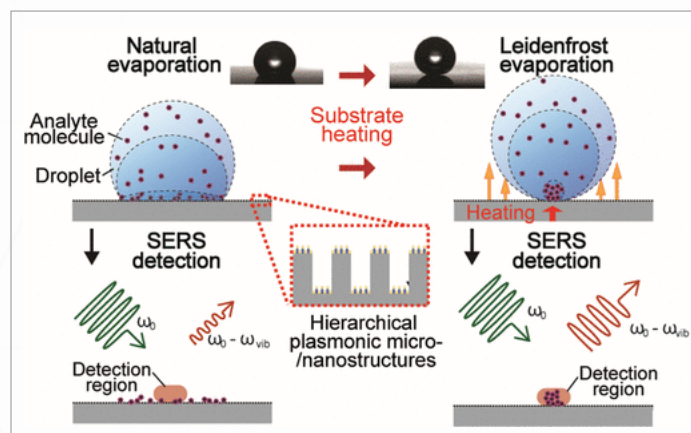
## VTIP 21-028: "Partial Liedenfrost Effect-Assisted Bioassay on Plasmonic Micro/Nanostructures"
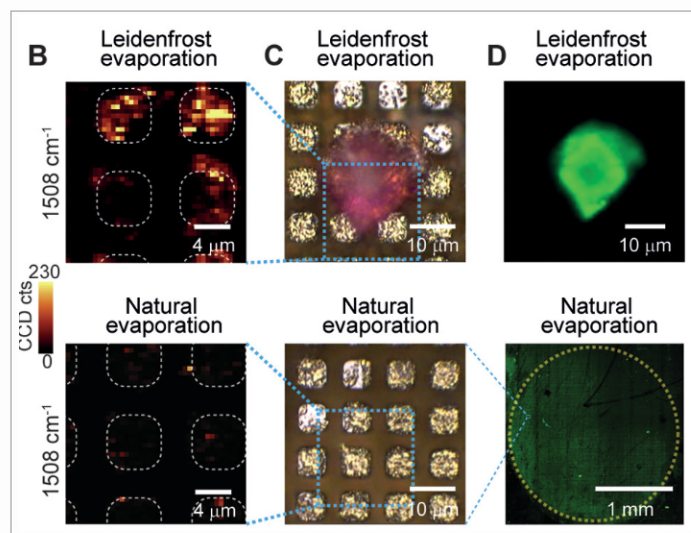
## THE CHALLENGE

The conventional methods of creating superhydrophobic surface-enhanced Raman spectroscopy (SERS) devices are by conformally coating a nanolayer of hydrophobic materials on micro/nanostructured plasmonic substrates. The problem with this, however, is that the hydrophobic coating may partially block hot spots and therefore compromise Raman signals of analytes. Furthermore restrictions such as the diffusion-limited transport processes make it very challenging to effectively deliver fast and high sensitivity detection of analytes at ultralow concentrations — which is an area of growing interest for certain application uses.



Schematic of partial Leidenfrost evaporation-assisted SERS detection of low-concentration analyte molecules in Janus water droplet on hierarchical plasmonic micro/nanostructures.

## OUR SOLUTION

This technology puts forth a strategy for fast and ultrasensitive SERS detection based on the partial Leidenfrost evaporation of nanomolar analyte droplets on hierarchical plasmonic micro/nanostructures. Partial Leidenfrost-assisted droplet evaporation can efficiently facilitate the analyte concentration process from hours to several minutes, reduce the final analyte deposition footprint much less than 1 mm x 1mm and accordingly increase analyte density on hot spots by 3-4 orders of magnitude. This technology provides an agile and facile solution to overcome the diffusion limit for fast and ultrasensitive detection of low-concentration analyte droplets without further chemical treatments on engineered SERS surfaces.



Partial Leidenfrost evaporation-assisted SERS detection of concentrated R6G molecules. B) Confocal Raman images, C) bright-field images, D) fluorescence images of R6G molecules.

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