Attogram-Scale LIBS

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Nanoparticle analysis is extremely useful in many disciplines and applications. Optical excitation techniques are limited in resolution by the diffraction limit, and imaging below the diffraction limit is only possible with near-field optics in most cases. Single nanoparticle analysis was previously unattainable with laser induced breakdown spectroscopy (LIBS), but the authors of my 2017 landmark paper were able to achieve attogram-scale absolute limits of detection by using optical trapping and levitation to isolate single nanoparticles. It represents an entirely new paradigm for high-sensitivity elemental analysis (in an all-optical fashion), opening up new possibilities in single particle analysis.

I hope to see future demonstrations of this technology in different nanoparticle systems to assess absolute limits of detection, the use of different laser wavelengths (for example, UV) for LIBS excitation, and the effects of laser pulse duration on analytical figures of merit.

Vassilia's Landmark Paper

P Purohit, FJ Fortes, JJ Laserna, "Spectral identification in the attogram regime through laser-induced emission of single optically trapped nanoparticles in air", Angew Chem Int Ed, 56, 14178 –14182 (2017).

Shifting Gears

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As a researcher with an interest in both targeted and non-targeted metabolomics, it is encouraging to see the constant evolution of technical and computational advances for the analysis of metabolites in complex biological samples such as urine and plasma. Mass spectrometry is undoubtedly the most powerful analytical tool for these experiments, with the ability to measure thousands of analytes in a single bio-fluid screen. However, this power does not come without drawbacks. Constant and careful attention to the instrumentation and samples must be maintained to minimize crossover, contamination, competition for ionization and fluctuations in detector responses.

Nuclear magnetic resonance (NMR) spectroscopy could be described as a cruder tool for metabolomics analyses. Its excellent analytical capability comes with a caveat: reduced number of detectable analytes, which is in turn offset by its ability to analyze samples with minimal clean-up in a high-throughput manner, with quantitation