# Nano Meets Spectroscopy:

## Surface-Enhanced Raman Spectroscopy and Imaging with Molecularly Functionalized Noble Metal Nanoparticles

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**Abstract:**

Surface-enhanced Raman scattering (SERS) is nowadays widely used in the chemical, life and material sciences.[1] This talk begins with a short tutorial on the fundamentals of SERS [1,2]. Then our recent results on experimental precision plasmonics for applications in biomedical imaging and chemical energy conversion using molecularly functionalized noble metal colloids in conjunction with SERS will be discussed.[3-7] Firstly, a highly efficient synthesis of SERS labels/nanotags is presented, which generates extremely bright dimer particles in very high yield with precise distance control at the level of single chemical bonds. Correlative microscopic and microspectroscopic experiments at the single-particle level demonstrate their unprecedented optical properties.[3] Secondly, applications of immuno-SERS (iSERS) using SERS nanotag-labeled antibodies are presented: i) a rapid, quantitative and ultrasensitive SERS-based lateral flow assay with a home-built compact Raman reader [4] as well as iSERS microscopy for single cell- and tissue-based cancer diagnostics. Thirdly, our most recent efforts on using hot electrons in conjunction with photo-recycling using plasmonic nanostructures [5,7] for performing reduction chemistry involving multiple electron and proton transfer steps will be highlighted.

**References**

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