**Tip-enhanced Raman spectroscopy**

Though optical microscopy has advanced a lot, spatial resolution of optical microscopy is limited by Abbe limit, which is defiend as Δx= 0.61λ/2NA. Here NA is numerical aperture of the optical system, which depends on (i) the refractive index of the surrounding medium (n), and (ii) the maximum collection angle of the optical system (θmax). λ is the wavelenght of the light used. In general, maximum possible spatial resolution along x-y plane is approximately half the wavelength of the incident light. Since the nanoprobe is smaller than wavelengh of the light used, such diffraction limited image loses the informations at the image plane.

Tip-enhanced Raman spectroscopy (TERS) is an advanced approach to surface-enhancement Raman spectroscopy (SERS). Raman enhancement occurs only at the sharp tip coated with gold or silver nanoparticles. Here, surface plasmon resonance-induced enhancement and confinment of light near the metallic nanostructures could produce optical image far beyond the diffraction limits.

Tip-enhanced Raman spectroscope is a combination of confocal microscope and a atomic force microscope (or scanning tunneling microscope, STM). Here, optical microscope is used to align the laser at SERS-active metal nanoparticle-coated tip.