# Introduction to nano-Raman spectroscopy

**Evgeniya Sheremet**

*Tomsk Polytechnic University, Russia*

## Abstract

The lecture serves as an introduction to Raman spectroscopy and its plasmon-enhanced varieties. While Raman is an optical method that allows identifying the samples by "fingerprinting" them, it is limited due to low signal intensity. Surface-enhanced Raman is a method that provides extreme signal amplification by utilizing localized surface plasmons (LSP). LSPs excited on metallic nanoparticles are extremely localized serving as nanoscale light sources. By controlling their position it is possible to break the diffraction limit of light and obtain hyper spectral Raman maps with nanoscale or even sub molecular resolution. Advances in both SERS and TERS are promising exciting breakthroughs in biomedicine, material science, fundamental research while facing non-trivial technical challenges. The lecture will introduce the key concepts necessary to understand these fascinating methods.

The lecture will cover:

1. The principle of Raman spectroscopy, Raman spectrometer, information obtained about the sample
2. Localized surface plasmons and their resonance (including hot spots, rods vs. spheres, lightning rod effect, dimers to introduce gaps)
3. SERS (enhancement factor, enhancement localization, examples) - also highlighting the challenges for reproducible SERS
4. TERS (diffraction limit, tip control, scanning, enhancement factor, examples)
5. Impact (when these methods are the most promising and therefore are actively investigated) - also highlighting SERS tags