

# Plasmonic SERS tags: fabrication, optical properties, and applications to biosensing, bioimaging, and theranostics

**Nikolai Khlebtsov**

*Institute of Biochemistry and Physiology of Plants and Microorganisms, "Saratov Scientific Centre of the Russian Academy of Sciences", Russia,*

*Saratov State University, Russia*

*e-mail: [khlebtsov@ibppm.ru](mailto:khlebtsov@ibppm.ru)*

## **Abstract**

Plasmonic SERS tags have found promising analytical, bioimaging, and theranostic applications. In this lecture, I discuss recent progress in the synthesis, simulation, and experimental studies of the optical properties and biomedical applications of novel spherically symmetrical and anisotropic SERS tags fabricated with common plasmonic metals—gold (Au) and silver (Ag). My lecture is focused on the design and synthetic strategies that ensure the optimal parameters and highest enhancement factors of tags for sensing, bioimaging, and theranostics. In particular, I consider various core–shell structures with build-in nanogaps to explain why they would benefit the plasmonic gap-enhanced Raman tags (GERTs) as a superior SERS tag and how this would help future research in clinical analytics and therapeutics. Because of ultrabright SERS response, SERS tags can improve the bioimaging abilities down to single-particle level and the sensitivity of common lateral flow immunoassay (LFIA) as applied to SARS-CoV-2 biosensing.