The intrinsic luminescence of individual plasmonic nanostructures in aqueous suspension by photon time-of-flight spectroscopy

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Résumé en anglais	We have studied the intrinsic one-photon excited luminescence of freely diffusing gold nanoparticles of different shapes in aqueous suspension. Gold nanospheres were used as a reference, since their luminescence has been investigated previously and their light absorption and scattering properties are described analytically by Mie theory. We then studied gold nanobipyramids and nanostars that have recently gained interest as building blocks for new plasmonic nanosensors. The aim of our study is to determine whether the luminescence of gold nanoparticles of complex shape (bipyramids and nanostars) is a plasmon-assisted process, in line with the conclusions of recent spectroscopic studies on spheres and nanorods. Our study has been performed on particles in suspension in order to avoid any artefact from the heterogeneous environment created when particles are deposited on a substrate. We employ a recently developed photon time-of-flight method in combination with correlation spectroscopy of the light scattered by the particles to probe the luminescent properties of individual particles based on a particle-by-particle spectral analysis. Furthermore, we have performed resonant light scattering spectroscopic measurements on the same samples. Our work demonstrates the power of our time-of flight method for uncovering the plasmonic signatures of individual bipyramids and nanostars during their brief passage in the focal volume of a confocal set-up. These spectral features of individual particles remain hidden in macroscopic measurements. We find that the intrinsic photoluminescence emission of gold bipyramids and gold nanostars is mediated by their localized surface plasmons.
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