# Plasmonically amplified fluorescence biosensors

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Fluorescence represents (arguably) the mostly spread readout method for the analysis of chemical and biological species in important areas of medical diagnostics (biomarkers and drugs) and food control (pathogens and toxins). Recent rapid advancements in plasmonics – a branch of nanophotonics that investigates tightly confined electromagnetic fields at metallic films and metallic nanostructures – offers efficient means for the amplification of fluorescence signal and thus advancing performance characteristics of fluorescence–based analytical technologies [1]. This paper will introduce surface plasmon-enhanced fluorescence that utilizes the combination of increased excitation rate, improved quantum yield of emitter, and directional fluorescence emission that is mediated by surface plasmons. Advantages of coupling of excitation and emitted light with surface plasmons that are tightly confined at the surface of continuous metallic surface and metallic nanoparticles will be discussed. In addition, strategies to tune the depth probed by surface plasmon field in order to maximize sensitivity of biosensor for the analysis of species that vary in size from several nanometers (e.g. biomolecules) to around hundred nanometers (exosome vesicles) and even several micrometers (bacterial pathogens) will be presented. Design of plasmonic structures providing the enhancement factor of around $10^2$ [2] and possible routes for even stronger enhancement $>10^3$ [3] will be shown.

Examples of PEF biosensors for detection of molecular analytes including biomarkers (with the limit of detection at low femtomolar concentrations [4,5]) as well as bacterial pathogens (at concentration as low as 10 colony forming units) will be presented. Approaches relying on plasmonic structures that can be prepared by mass production-compatible methods such as laser interference lithography or nanoimprint lithography will be particularly addressed.

Acknowledgments: This work was partially supported by the Austrian NANO Initiative (FFG and BMVIT) through the NILPlasmonics project within the NILAustria cluster (www.NILAustria.at) and by the Austrian Science Fund (FWF) through the project ACTIPLAS (P 244920-N20).

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