Fritz-Haber-Institut der Max-Planck-Gesellschaft

Physikalische Chemie — Direktor: Prof. Dr. Martin Wolf

MAX-PLANCK-GESELLSCHAFT

Department Seminar:

Monday, June 19, 2017, at **11:00** a.m.;
— all are invited to meet at around 10:40 for a chat and coffee —

Dr. Sylwester Gawinkowski Molecular Nanophotonics group,
ICFO – Institute of Photonic Sciences,
Castelldefels, Barcelona, Spain.

Single-molecule surface-enhanced Raman and surface-enhanced coherent anti-Stokes Raman scattering of porphyrinoids

PC Seminar Room **G 2-06**, Building G, Faradayweg 4. T. Kumagai

Abstract:

The vigorous increase in the application of surface-enhanced Raman scattering (SERS) in biology and medicine in recent two decades was stimulated by its richness of spectral information and high sensitivity, reaching a single molecule level. The single-molecule SERS (SM-SERS) was first time reported twenty years ago, but the number of chemical species reported so far is relatively small. The explanation of such low output can be explained by the lack of profound understanding of factors influencing SERS detectability of chemicals on the single-molecule level. The results of SM-SERS investigations of porphycene (the structural isomer of porphyrin) and its derivatives shade light on the subject. Especially the influence of mild substituents and the temperature on the detectability of porphycene derivatives was studied. The results show that even minor changes in the structure of the molecule induce dramatic changes of its detectability. The ratio of SERS to the luminescence background can increase or decrease with the temperature depending on the presence of substituents in the porphycene molecule. In the extreme cases, even exchange of protons into deuterons can affect detectability of porphycene.

Recent years showed that even time-resolved single-molecule SERS spectra could be measured with femtosecond resolution by combining surface-enhancement with coherent anti-Stokes Raman scattering (CARS) technique. Such time-resolved surface-enhanced CARS (SE-CARS) may have a strong influence on the understanding chemical processes in the molecules located in the vicinity of metallic nanoparticles. The application of SE-CARS technique even for samples with the concentration much higher than single-molecule limit could increase the understanding of such processes.