Spectroscopic Nanoscopy of Biological to Extraterrestrial Materials

by

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Host: Asst. Prof. Cesare Soci

Abstract

Near-field optical microscopy (by scattering from an AFM tip, s-SNOM) returns local absorbance from a tiny volume of only (20 nm)3 under the tip apex, thus enabling VIS-to-IR-to-THz mapping at exciting 20 nm resolution. The mid-infrared is ideal for nanoscale chemical recognition by vibrational and phonon contrasts. Highlights will be presented of finding and characterizing natural nanoscale inhomogeneities, chemical as well as structural, in organic solar-conversion films, in bone/shell biomineral matter, and in slices through a cometary dust particle.—Nano-FTIR is no less than the continued success story of FTIR-based chemical analysis into resolutions hundreds, if not thousands of times better than previously attainable. It is a highly welcome solution to nanoanalysis requirements in all nanotechnologies and nanosciences.

Short Biography

Fritz Keilmann (born 1942) studied meteorology and physics in München and received a Dr. rer. nat. for research on infrared plasma diagnostics. As postdoc of Ali Javan at MIT he developed antenna-based harmonic mixing and high-power THz lasers. He has been a staff researcher of the Max-Planck Society from 1973 to 2012: Initially at the MPI für Festkörperforschung Stuttgart, he pioneered far-infrared nonlinear optics and spectroscopy of solids, and investigated phonon physics, microwave biological effects, carrier dynamics of semiconductors, far-infrared ellipsometry of superconductors, and cyclotron pumping of quantum-Hall edge states.

In 1995 he relocated to the MPI für Biochemie Martinsried where he pioneered infrared scattering near-field microscopy, and also coherent Fourier-transform infrared spectroscopy using frequency-comb beams. From 2007 - 2012 he was with the MPI für Quantenoptik Garching, in the DFG Cluster "Munich-Centre for Advanced Photonics", developing broad-band infrared spectroscopic near-field microscopy. He has been a guest researcher at UC Santa Barbara and UC San Diego. He has been awarded the Kenneth J. Button prize 2009.Besides operating his firm LASNIX, he is presently a Scientific Advisor to Neaspec GmbH, producer of near-field infrared microscopes, and a Senior Researcher at LMU München investigating soft matter and biological nanocomposites.