Professor
Mischa Bonn
Max Planck Institute
for Polymer Research

Website:
http://www.amolf.nl/research/biosurface-spectroscopy

Faculty Host: Professor Aaron Massari

Professor Mischa Bonn received his undergraduate degree in physical chemistry from the University of Amsterdam, and his doctorate from the University of Eindhoven. He has been director of the Max Planck Institute for Polymer Research since the spring of 2011, and before that was a professor in the physics department at the University of Amsterdam. He has published more than 150 papers and given more than 130 seminars on his research. He has received many awards for his research and his teaching.

The aim of the Bonn's Biosurface Spectroscopy group is to elucidate intermolecular interactions between the different molecular constituents (lipids, proteins and water) of model biological membranes, using (ultrafast) optical techniques. In a second line of research, we are attempting to characterize and control optical properties and charge carrier dynamics in semi-conductor nanostructures using ultrafast TeraHertz spectroscopy.in large molecular structures on surfaces.

Structure and Dynamics of Interfacial Water Studied Using Femtosecond 2-Dimensional Surface Vibrational Spectroscopy

9:45 a.m. Thursday, November 1, 2012, 331 Smith Hall

At the surface or interface of water, the water hydrogen-bonded network is abruptly interrupted, conferring properties on interfacial water different from bulk water. Despite its importance for disciplines such as electrochemistry, atmospheric chemistry and membrane biophysics, the structure of interfacial water is highly debated. We elucidate the structure and structural dynamics of interfacial water using ultrafast two-dimensional surface-specific sum-frequency generation vibrational spectroscopy (2D-SFG) [1,2]. We present data for the water-air, water-lipid and water-protein interfaces. The data reveal that these interfaces are structurally heterogeneous, yet highly dynamical. We determine the timescale on which the heterogeneity decays, reveal the presence of surprisingly rapid inter- and intramolecular energy transfer processes and quantify the reorientational dynamics of interfacial water [3].

Time-resolved 2D-SFG data for interfacial water at the water/air interface at zero delay time between pump and probe. The right panel shows the static SFG spectrum. The 2D spectrum reveals an on-diagonal response with a slope smaller than one (dashed line indicates slope of 1), expected for a heterogeneous surface. Off-diagonal peaks revealing energy transfer are highlighted by dotted ovals.
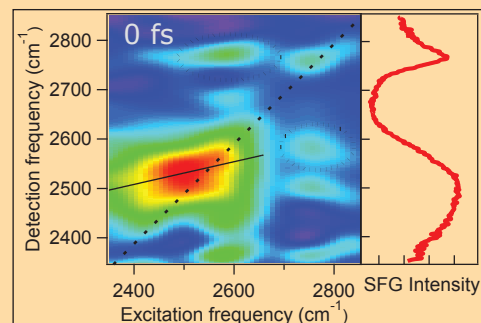
[1] Z. Zhang, L. Piatkowski, H.J. Bakker, M. Bonn, Nature Chem. 3, 888 (2011).
[2] Z. Zhang, L. Piatkowski, H.J. Bakker, M. Bonn, J. Chem. Phys. 135, 021101 (2011).
[3] C.S. Hsieh, R.K. Campen, A.C.V. Verde, P. Bolhuis, H.K. Nienhuys, M. Bonn, Phys. Rev. Lett. 116102, 1-4 (2011).

Bryce L. Crawford Jr. was a renowned Department of Chemistry professor and scientist. He died in September 2011, at the age of 96. He joined the department in 1940, and became a full professor of physical chemistry in 1946. He was chair of the department from 1955 to 1960, and was dean of the graduate school from 1960 to 1972. He retired in 1985. He loved studying molecular vibrations and force constants, and the experimental side of molecular spectroscopy and molecular structure. During World War II, Crawford worked in research on rocket propellants, making significant contributions to rocketry, and the development of solid propellants for the much larger rockets that evolved after the war. Crawford received many honors during his career, including the prestigious American Chemical Society Priestley Medal; and being named a Fellow of the Society for Applied Spectroscopy, a Guggenheim Fellow at the California Institute of Technology, and a Fulbright Fellow at Oxford University. He held the distinction of membership in three honorary science academies, and was actively involved in many professional associations.