

Seminář odd. 26

Tenkých vrstev a nanostruktur

Fyzikální ústav AVČR, Cukrovarnická 10, Praha 6

datum: 7. 6. 2017 středa

čas: 10:00

*mítnost: sál č. 206, sídlo AV ČR,
Národní 3, Praha 1*

TÉMA

Cooperative Function in Atomically Precise Nanoscale Assemblies

Paul S. Weiss

**Distinguished Professor of Chemistry & Biochemistry
and of Materials Science & Engineering, UCLA**

We use molecular design, tailored syntheses, intermolecular interactions, and selective chemistry to explore the ultimate limits of miniaturization. We direct molecules into desired positions to create nanostructures, to connect functional molecules to the outside world, and to serve as test structures for measuring single or bundled molecules. Interactions within and between molecules can be designed, directed, measured, understood, and exploited at unprecedented scales. Such interactions can be used to form precise molecular assemblies, nanostructures, and patterns, and to control and to stabilize function. We selectively test hypothesized mechanisms of function by varying molecular design, chemical environment, and measurement conditions to enable or to disable function and control using predictive and testable means. Critical to understanding these variations has been developing the means to make tens to hundreds of thousands of independent single-molecule/assembly measurements in order to develop sufficiently significant statistical distributions, while retaining the heterogeneity intrinsic in the measurements. We use a number of excitation mechanisms to induce changes in the molecules and assemblies, including electric field, light, electrochemical potential, ion binding, and chemistry. We measure the electronic coupling of the contacts between the molecules and substrates by measuring the polarizabilities of the connected functional molecules. We have likewise developed and applied the means to map buried chemical functionality and interactions. The next steps are to learn to assemble and to operate molecules together, both cooperatively and hierarchically, in analogy to biological muscles. We discuss our initial efforts in this area, in which we find both interferences and cooperativity.

odborný garant: *RNDr. Antonín Fejfar, CSc.*

Prof. Dr. Paul S. Weiss

Curriculum Vitae

Paul S. Weiss holds a UC Presidential Chair and is a distinguished professor of chemistry & biochemistry and of materials science & engineering at UCLA. He received his S.B. and S.M. degrees in chemistry from MIT in 1980 and his Ph.D. in chemistry from the University of California at Berkeley in 1986. He was a postdoctoral member of technical staff at Bell Laboratories from 1986-88 and a visiting scientist at IBM Almaden Research Center from 1988-89. He served as the director of the California NanoSystems Institute and held the Fred Kavli Chair in NanoSystems Sciences at UCLA from 2009-14. Before coming to UCLA, he was a distinguished professor of chemistry and physics at the Pennsylvania State University, where he began his academic career in 1989. His interdisciplinary research group includes chemists, physicists, biologists, materials scientists, mathematicians, electrical and mechanical engineers, computer scientists, clinicians, and physician scientists. They focus on the ultimate limits of miniaturization, exploring the atomic-scale chemical, physical, optical, mechanical, and electronic properties of surfaces, interfaces, and supramolecular assemblies. He and his students have developed new techniques to expand the applicability and chemical specificity of scanning probe microscopies. They have applied these and other tools to the study of catalysis, self- and directed assembly, and molecular and nanoscale devices. They advance nanofabrication down to ever smaller scales and greater chemical specificity in order to operate and to test functional molecular assemblies, and to connect these to the biological and chemical worlds. Two major themes in his laboratory are cooperativity in functional molecules and single-molecule/assembly biological structural and functional measurements. He has written over 300 publications, holds over 30 patents, and has given over 600 invited, plenary, keynote, and named lectures.

Weiss has been awarded a National Science Foundation (NSF) Presidential Young Investigator Award (1991-96), the Scanning Microscopy International Presidential Scholarship (1994), the B. F. Goodrich Collegiate Inventors Award (1994), an Alfred P. Sloan Foundation Fellowship (1995-97), the American Chemical Society (ACS) Nobel Laureate Signature Award for Graduate Education in Chemistry (1996), a John Simon Guggenheim Memorial Foundation Fellowship (1997), a NSF Creativity Award (1997-99), and the ACS Award in Colloid and Surface Chemistry (2015), among others. He was elected a fellow of: the American Association for the Advancement of Science (2000), the American Physical Society (2002), the American Vacuum Society (2007), the ACS (2010), the American Academy of Arts and Sciences (2014), the American Institute for Medical and Biological Engineering (2016), and an honorary fellow of the Chinese Chemical Society (2010). He was also elected a senior member of the IEEE (2009). He received Penn State's University Teaching Award from the Schreyer Honors College (2004), was named one of two nanofabrication fellows at Penn State (2005), and won the Alpha Chi Sigma Outstanding Professor Award (2007). He was a visiting professor at the University of Washington, Department of Molecular Biotechnology (1996-97) and Kyoto University, Electronic Science and Engineering Department and Venture Business Laboratory (1998 and 2000), and a distinguished visiting professor at the Kavli Nanoscience Institute and the Joint Center for Artificial Photosynthesis at Caltech (2015). He is a visiting scholar at the Kavli Institute for Bionano Science & Technology and the Wyss Institute for Biologically Inspired Engineering at Harvard University (2015-17). He has been named the Institut National de la Recherche Scientifique (INRS) Chaire d'excellence Jacques-Beaulieu at the Centre for Energy, Materials and Telecommunications (2016-17). Weiss was a member of the U.S. National Committee to the International Union of Pure and Applied Chemistry (2000-05). He has been the technical co-chair of the Foundations of Nanoscience Meetings, thematic chair of the Spring 2009 and Fall 2018 ACS National Meetings. He was the senior editor of IEEE Electron Device Letters for molecular and organic electronics (2005-07), and is the founding editor-in-chief of ACS Nano (2007-). At ACS Nano, he won the Association of American Publishers, Professional Scholarly Publishing PROSE Award for 2008, Best New Journal in Science, Technology, and Medicine, and ISI's Rising Star Award a record ten times.