



**Les Séminaires de la Fondation  
“Nanosciences aux limites de la Nanoélectronique”**

**Lundi 6 Juillet 2009  
à 16 h**

**Paul F. Barbara**

Director of the Center for Nano- and Molecular  
Science and Technology at the University of Texas  
(Austin, USA)



*présentera un séminaire intitulé :*

**Are the electronic properties of  
conjugated polymers deformable?**

*Vous êtes tous cordialement invités au pot qui suivra la présentation.*

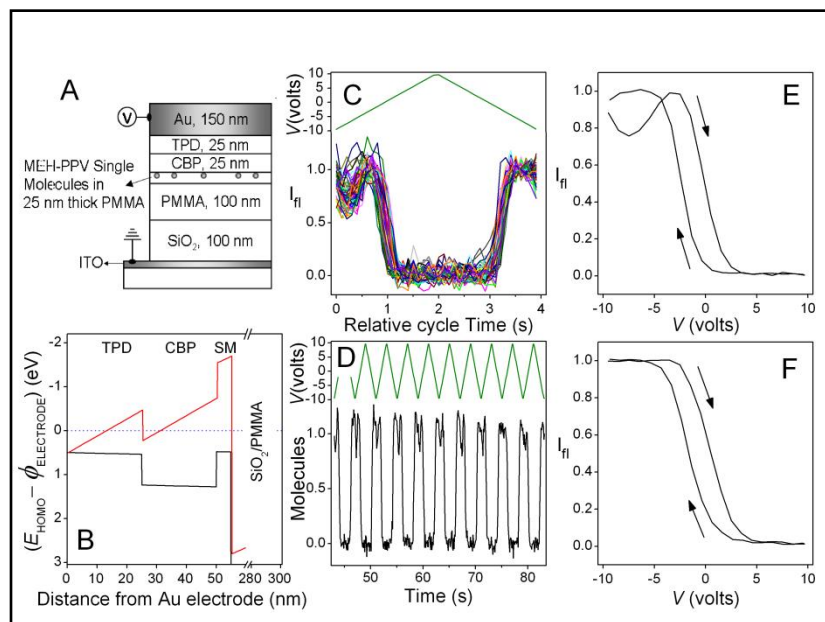
**Amphithéâtre 15 de l'école PHELMA**  
(anciennement ENSERG)  
23 rue des Martyrs – 38000 Grenoble

# Are the electronic properties of conjugated polymers deformable?

The injection of positive charge carriers (holes) into conjugated polymer chains is a critical in solar cells based on organic materials and organic/inorganic hybrid materials.

We have observed that hole injection into single conjugated polymer chains is light-assisted and highly cooperative. This unprecedented effect may underlie critical, but poorly understood, organic electronic device phenomena such as the build-up of functional deeply-trapped-charge layers in polymer light emitting displays and the poor fill factors in organic photovoltaic devices.

The charging/discharging dynamics of conjugated polymer devices were investigated indirectly by a variety of single molecule fluorescence spectroscopy electro-optical techniques (see Fig. 1).



**Fig. 1:**

**(A) Hole-injection device structure.**

**(B) HOMO energy levels relative to the work function of the hole-injection electrode for the device shown in A. The black and red lines are Poisson-Boltzmann simulations at 0V (at equilibrium) and 10V (before charging) respectively.**

**(C) single-molecule fluorescence-intensity trajectories**  
**(D) Ensemble average of ~100 single-molecule normalized fluorescence-intensity trajectories obtained while applying a triangular bias (top green line)**

**(E,F) Ensemble average of ~100 single-molecule F-V trajectories obtained at: high vacuum ( $10^{-7}$  Torr) (E) and 5 Torr of  $O_2$  (F).**

My talk will also give a brief overview of the Center for Nano and Molecular Science and Technology and the University of Texas at Austin.

## Biographie

**Paul F. Barbara**

### **Richard J.V. Johnson Welch Chair in Chemistry**

Paul Barbara is the Director of the Center for Nano- and Molecular Science and Technology at the University of Texas at Austin, and the Director of the DOE Energy Frontier Research Center: Understanding Charge Separation and Transfer at Interfaces in Energy Materials and Devices.

He received a BA degree in Chemistry from Hofstra University in 1974 and a Ph.D. in Chemistry from Brown University in 1978. From 1978 to 1980 he carried out postdoctoral work at Bell Laboratories. He joined the faculty of the University of Minnesota in 1980, achieving the rank of full professor in 1990.

In 1995 he was named 3M-Alumni Distinguished Professor of Chemistry. He moved to the University of Texas in 1998.

His general research interests include the nanoscience and nanotechnology of conjugated polymer materials, especially the applications of single molecule spectroscopy in the investigation of the morphology of these materials.

He is currently a Senior Editor of Accounts of Chemical Research, and a Past Chair of the Division of Physical Chemistry of the American Chemical Society. He was elected to the American Academy of Arts and Sciences in 1999, a Fellow of the American Physical Society in 1993, a Fellow of the American Association for Advancement of Science in 2004 and a Member of the National Academy of Sciences in 2006.

Other awards include an Alfred P. Sloan Fellowship in 1983, a Presidential Young Investigator award in 1984, a NSF Creativity Award in 1998, and the ACS E. B. Wilson Award in Spectroscopy in 2008.

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