**Confinement of organic dyes inside carbon nanotubes**

J-L.Bantignies1, L.Alvarez1, P. Hermet2, Anouar Belhboub1, Ana Carolina Salvati1, Y. Almadori1,R. Aznar1, R. Le parc1, S. Rols, A. Rahmani3, B. Jousselme4, [S. Campidelli](http://pubs.acs.org/author/Campidelli%2C%2BS)5, Y. Sato6, K. Suenaga6 , F. Fossard7

*1Laboratoire Charles Coulomb (L2C), UMR 5221 CNRS, Université de Montpellier, F-34000 Montpellier, France*

*2* [*Institut Charles Gerhardt Montpellier*](http://www.icgm.fr/)*, UMR5253, Université de Montpellier, F-34000 Montpellier, France*

*3Laboratoire d’Etude des Matériaux Avancés et Applications (LEM2A), Université Moulay Ismaïl, Faculté des Sciences, BP 11201,Zitoune, 50000 Meknès, Morocco*

*3Institut Laue Langevin, 6 Rue Jules Horowitz, B.P. 156, Grenoble 38042 Cédex 9, France*

*4Laboratoire d’Innovation en Chimie des Surfaces et Nanosciences (LICSEN), NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay, Gif-sur-Yvette 91191 Cédex, France*

*5CEA-Saclay, IRAMIS, Laboratoire d’Innovation en Chimie des Surfaces et Nanosciences (LICSEN), NIMBE, 91191 Gif-sur-Yvette, France*

*6Nanomaterials Research Institute, AIST, Central 5, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8565, Japan*

*7Laboratoire d’Étude des Microstructures, CNRS-ONERA, 92322 Châtillon, France*

Opto-electronic properties of single-walled carbon nanotubes can be significantly modified by chromophore confinement into their hollow core. This presentation deals with quaterthiophene derivatives encapsulated into nanotubes displaying different diameter distributions. We show that the supramolecular organizations of the confined chromophores depend on the nanocontainer size. The Raman radial breathing mode frequency is monitored by both the number of confined molecules into a nanotube section and the competition between dye/dye and dye/tube wall interactions. The confinement properties lead also to an exaltation of the infrared absorption response in single-walled carbon nanotubes from dye molecule interactions due to a symmetry breaking, allowing us, thanks to the complementarity of DFT calculations and experimental IR spectra to study interactions between both subsystems. Significant electron transfer from the confined molecules to the nanotubes is also reported from Raman investigations. This charge transfer leads to an important enhancement of the photoluminescence intensity by a factor of nearly five depending on the tube diameter. In addition, close to the molecule resonance, the magnitude of the Raman G-band shifts is modified and the intensity loss is amplified, indicating a photo-induced electron transfer. Results are discussed in the frame of electron-phonon coupling. Thus, confinement species into nanotubes allow moving the Fermi level and consequently to monitor their opto-electronic properties.