



Wednesday, July 27, 2016 – 11:00 h a.m.
CFEL Seminar room IV (Bldg. 99)

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Chemistry under Strong Coupling

Light-matter interactions have been extensively studied by physicist in quantum optics and condensed matter physics, [1] but there are only fewer attempts to understand this effect in molecular science. [2, 3] Here, we are trying to understand the hybridization of photons with organic and semiconductor molecules in a confined electromagnetic field generated by Fabry-Perot cavities or plasmonic nanostructures. Our studies clearly show that both the chemical and physical properties of such systems can be changed drastically. For example, chemical reaction rates, thermodynamics, work function, conductivity and energy transfer etc... of molecular systems are affected upon strong coupling. [4-7] First part of the presentation mainly covers different aspects of matter-matter interactions and their comparison with light-matter states. Efforts will be made to showcase the properties of polaritonic states both in the electronic and vibrational strong coupling regime. [8, 9] our recent experiments on ground state chemical reaction rate modifications and polaritonic band gap opening under ultra-strong vibrational coupling conditions are also be discussed. [10, 11]

References:

[1] Haroche, S.; Kleppner, D., *Phys. Today* 1989, 42, 1; [2] Pockrand, I.; Brillante, A.; Möbius, D., *J. Chem. Phys.* 1982, 77, 6289; [3] Lidzey, D. G.; Bradley, D. D. C.; Skolnick, M. S.; Virgili, T.; Walker, S.; Whittaker, D. M., *Nature* 1998, 395,53; [4] Hutchison, J. A.; Schwartz, T.; Genet, C.; Devaux, E.; Ebbesen, T. W., *Angew. Chem. Int. Ed.* 2012, 51, 1592 ; [5] Hutchison, J. A.; Liscio, A.; Schwartz, T.; Canaguier-Durand, A.; Genet, C.; Samori, P.; Ebbesen, T. W., *Adv. Mater.* 2013, 25, 2481; [6] Orgiu, E.; George, J.; Hutchison, J. A.; Devaux, E.; Dayen, J.-F.; Doudin, B.; Stellacci, F.; Genet, C.; Samori, P.; Ebbesen, T. W., *Nat. Mater.* 2015, DOI: 10.1038/nmat4392; [7] X. Zhong, T. Chervy, S. Wang, J. George, A. Thomas, J. A. Hutchison, E. Devaux, C. Genet, T. W. Ebbesen, *Angew. Chem. Int. Ed.* 2016, 55, 6202-6206.; [8] Shalabney, A.; George, J.; Hutchison, J.A.; Pupillo, G.; Genet, C.; Ebbesen, T.W., *Nat. Commun.* 2015, 6, 5981; [9] George, J.; Shalabney, A.; Hutchison, J. A.; Genet, C.; Ebbesen, T. W., *J. Phys. Chem. Lett.* 2015, 6, 1027-1031; [10] Thomas, A.; George, J.; Shalabney, A.; Dryzhakov, M.; Varma, S. J.; Moran, J.; Chervy, T.; Zhong, X.; Devaux, E.; Genet, C.; Hutchison J. A.; Ebbesen T.W. (under revision; *Angew. Chem. Int. Ed.*); [11] George, J.; Chervy, T.; Shalabney, A.; Devaux, E.; Hiura, H.; Genet, C.; Ebbesen T. W. (under revision; *Phys. Rev. Lett.*)..

Host: Angel Rubio

