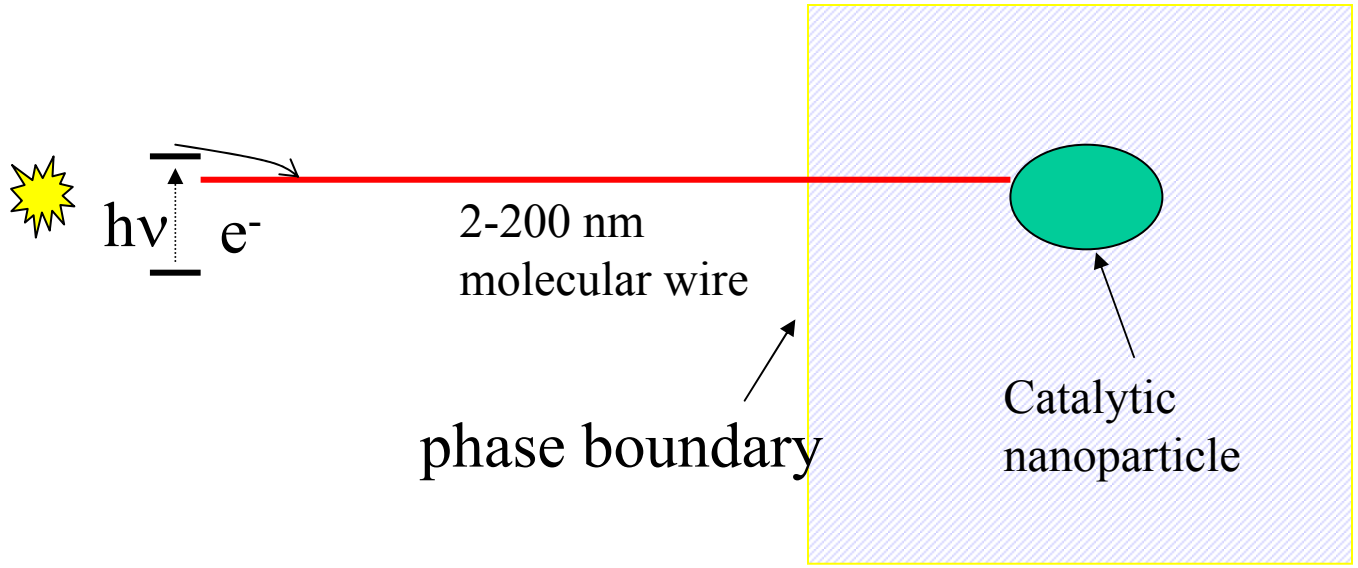
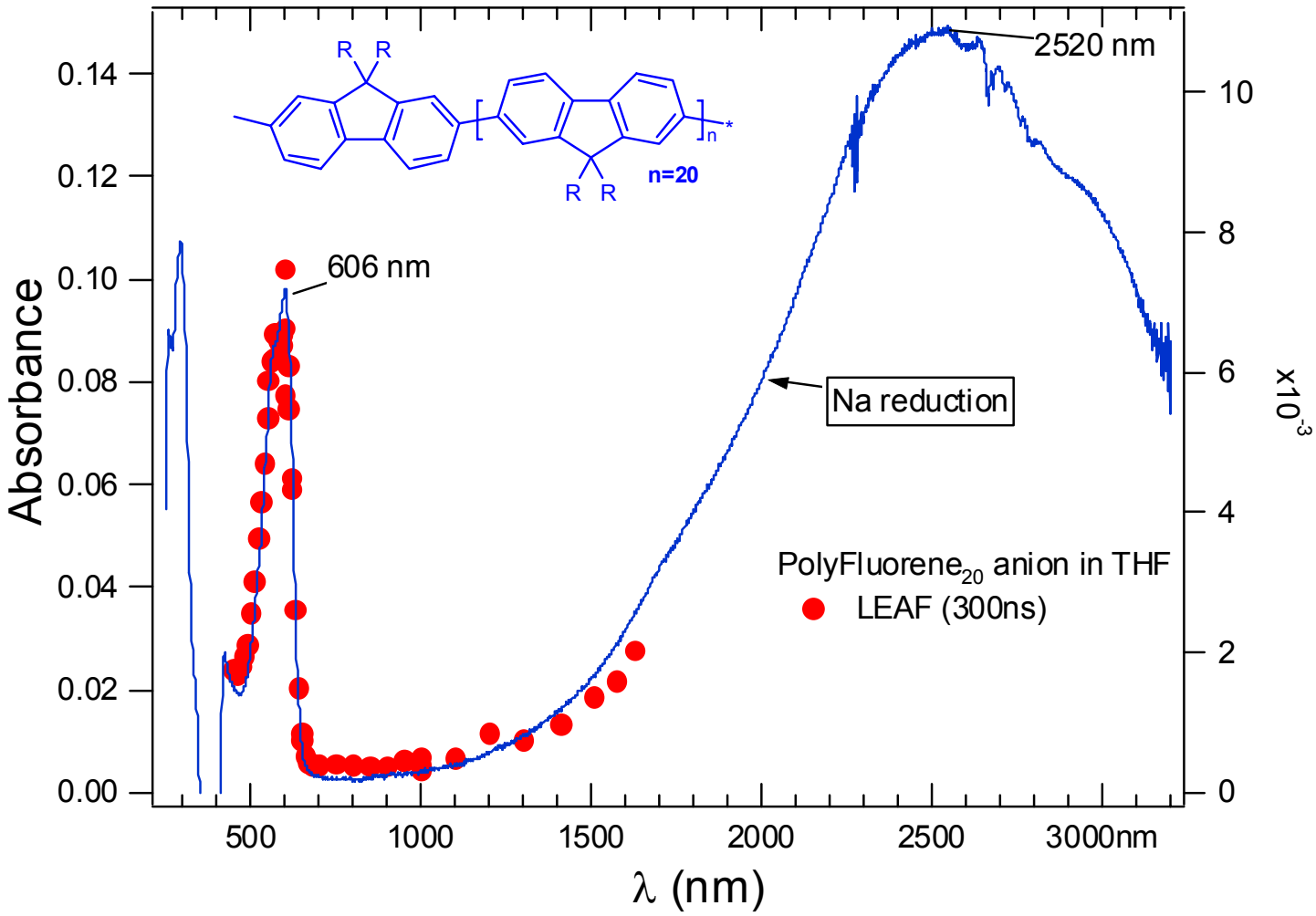
Fast Pulse Experiments on Molecular Processes in Organic Ions

Energy Capture and Storage Using Nano Objects





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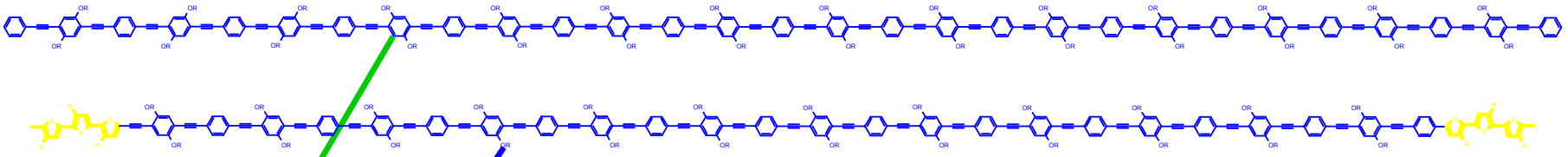
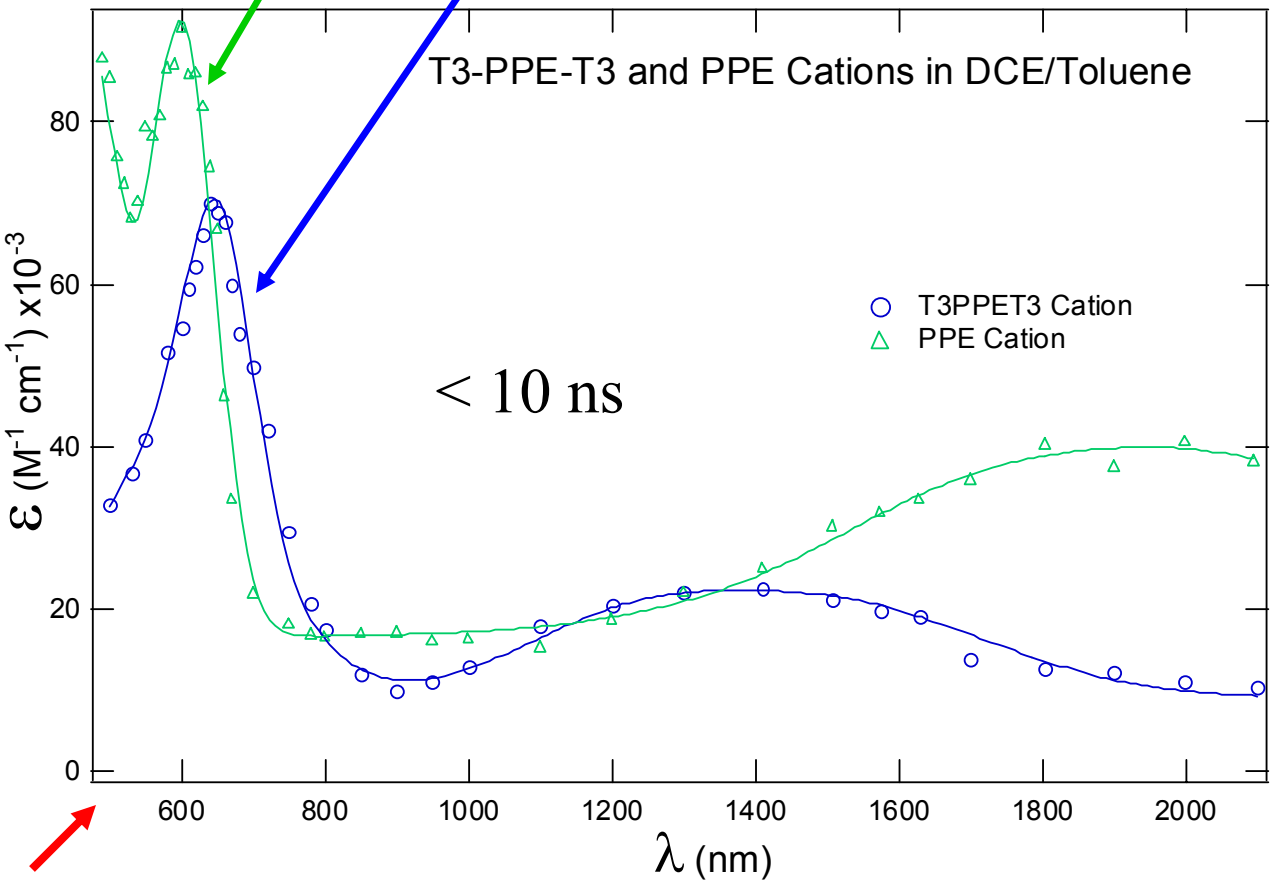




- The spectrum of the T_3 end-capped polymer is red-shifted relative to that of the parent
- The PPE cation radical is trapped by the T_3 end-groups in <10 ns !

Funston, A. M.; Silverman, E. E.; Miller, J. R.; Schanze, K. S. *Journal of Physical Chemistry B* **2004**, *108*, 1544-1555.

Similar e- transport in Si_n : Matsui, Y.; Nishida, K.; Seki, S.; Yoshida, Y.; Tagawa, S.; Yamada, K.; Imahori, H.; Sakata, Y. *Organomet.* **2002**, *21*, 5144-5147.

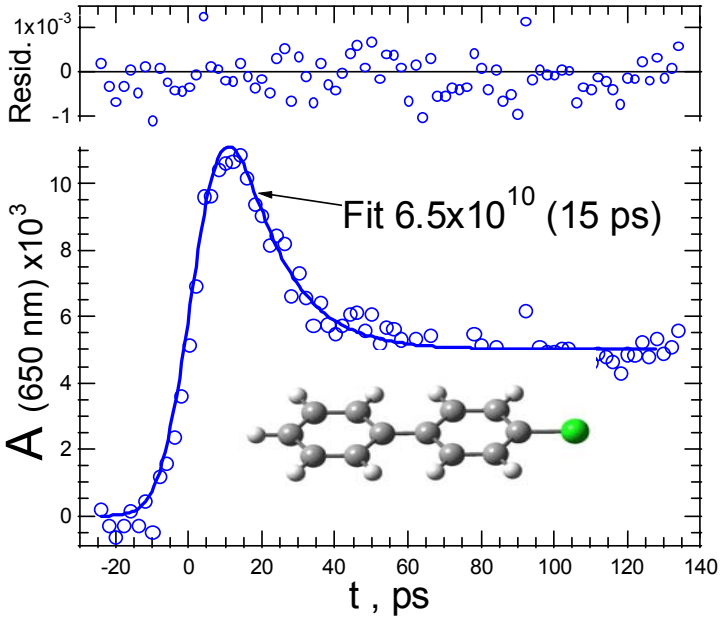
Fast and Efficient Transport of:

Transient absorption or emission

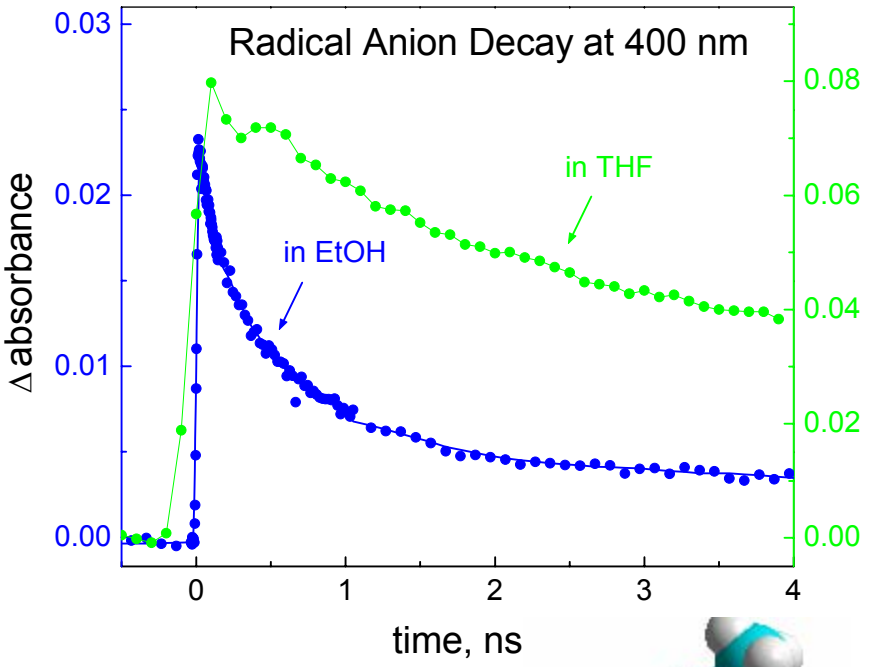
Singlet Excited States	Lasers or other photon sources
Triplet Excited States	Lasers or accelerators, Alison's slow triplets
Electrons	e^- in polysilane k> $(10\ ns)^{-1}$ (Osaka; Tagawa, Seki)
Holes	h^+ in PPE k> $(10\ ns)^{-1}$ BNL Funston et al.

Transient μ-wave conductivity (Delft; Warman, Siebeles, DeHass, polysilanes, phenylenevinylenes, fluorenes….
Mobilities often more than 10^3 larger within single strands

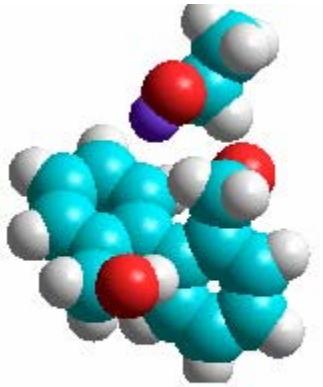
Fast Breaking and Making of Chemical Bonds



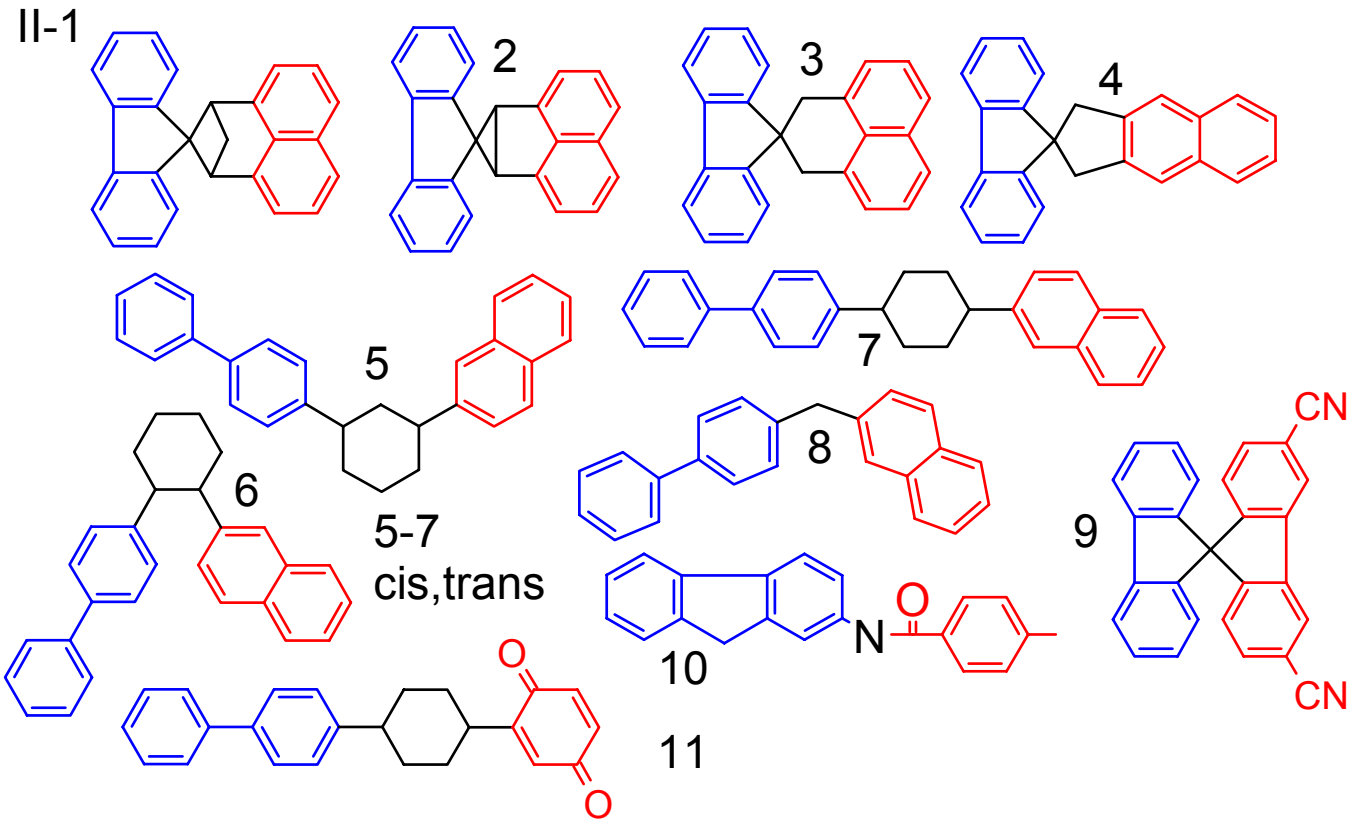
Takeda, N.; Poliakov, P. P.; Cook, A. R.; Miller, J. R. *J. Am. Chem. Soc.* **2004**, *126*, 4301-4309.



Alison, Sergei



Measure Fast Electron Transfer Rates in Bifunctional Molecules



Most of these are weakly exoergic $\Delta G^{\circ} = \sim 50$ mV yet very fast

Capturing Photon Energy With Materials Containing Long, Connected Strands, Fast Bond Breaking and Making, Fast ET

Needs:

•Better understanding of fast radiation chemistry. We know radiation chemistry in water well; not yet as well in organic media. Species and reactions, dry electron and hole capture.

•Faster transient absorption measurements in pulse radiolysis. BNL, AC PPP Sub ps plans at Osaka, Tokai and ANL

•Transient absorption further into infrared, faster time resolution.

•Additional probes– terahertz spectroscopy (begun in Delft)

•Relation of theory, optical absorption and transport measurements

•Always- better signal/noise ratios, more rapid data acquisition

•Whodunnit?

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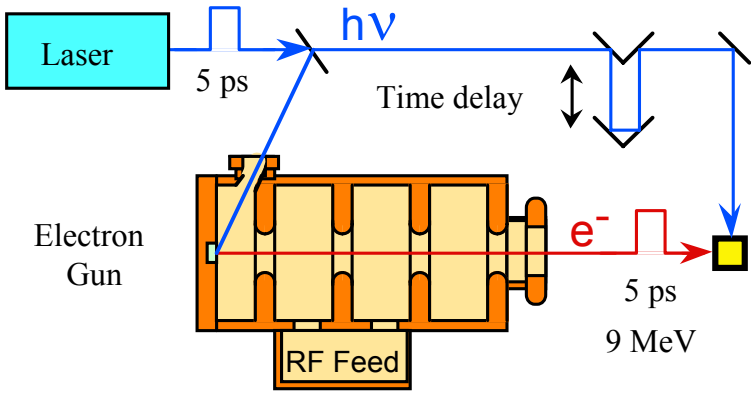
JP Kirby (BNL, Fordham)
Andrew Cook
James Wishart
Sergei Lymar
Kirk Shcanze ,Eric Silverman (Florida)
Sadayuki Asaoka, Tomokazu Iyoda (Tokyo. Inst. Tech.)
Steve Howell



Office of Basic Energy Sciences, US DOE