Photoexcitation and Free-Carrier Transport Phenomena for Organic Optoelectronics and Photovoltaics

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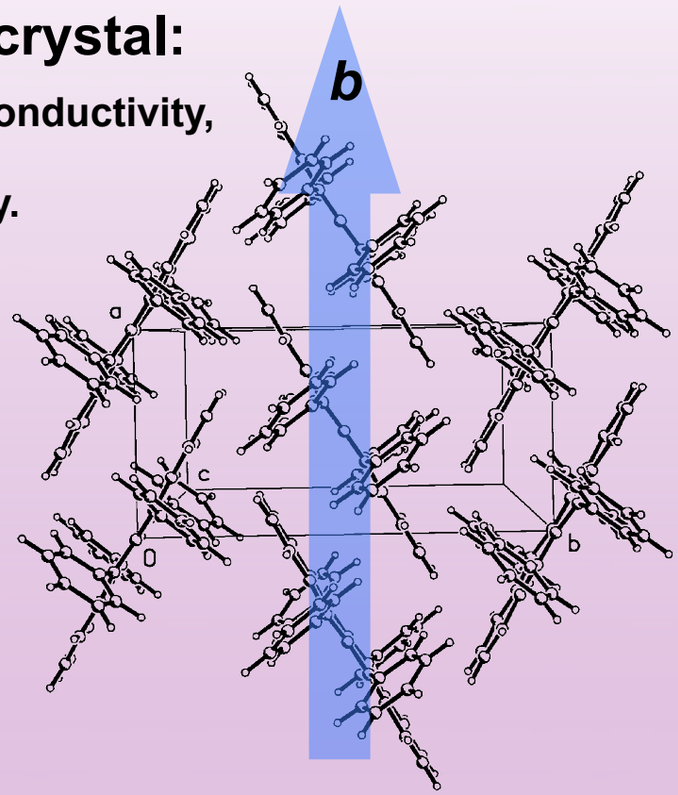
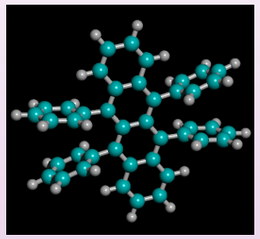
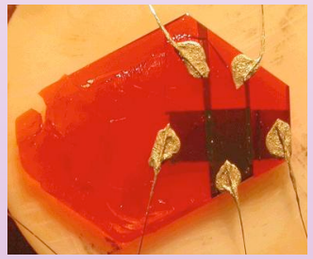
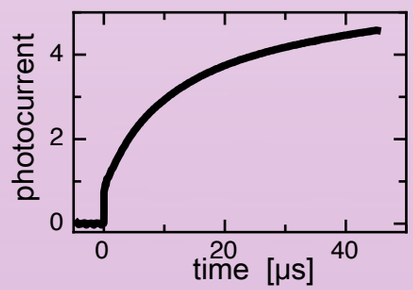
Rubrene crystal:

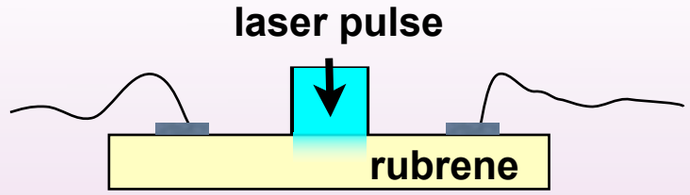
large photoconductivity,
high quality,
large mobility.

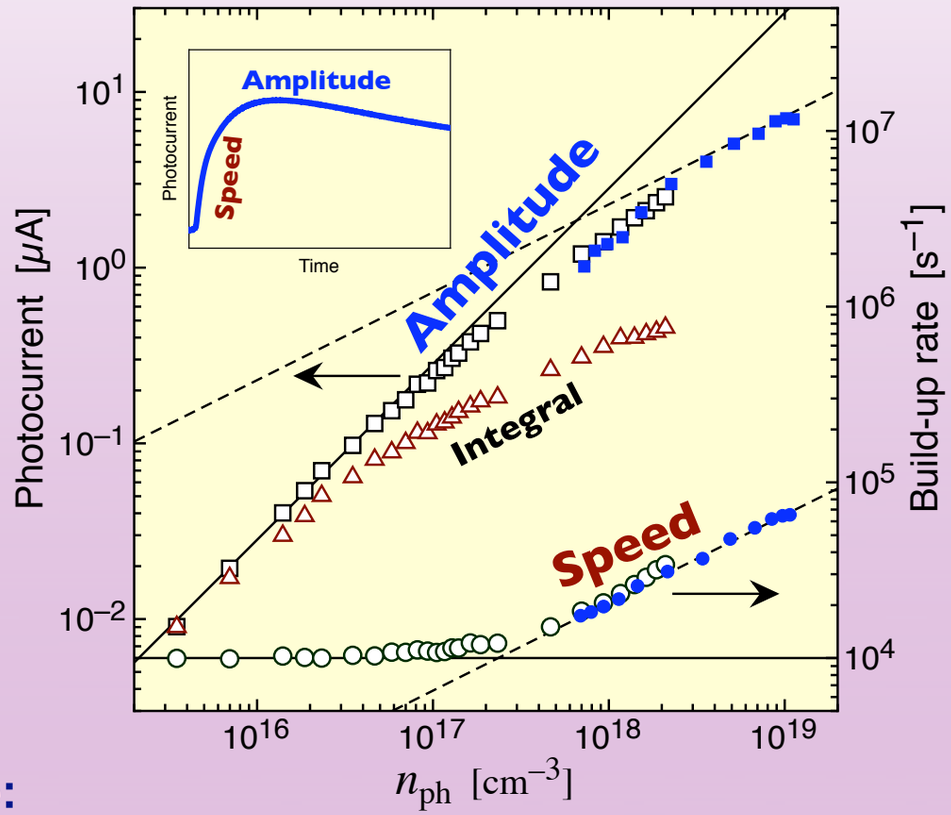






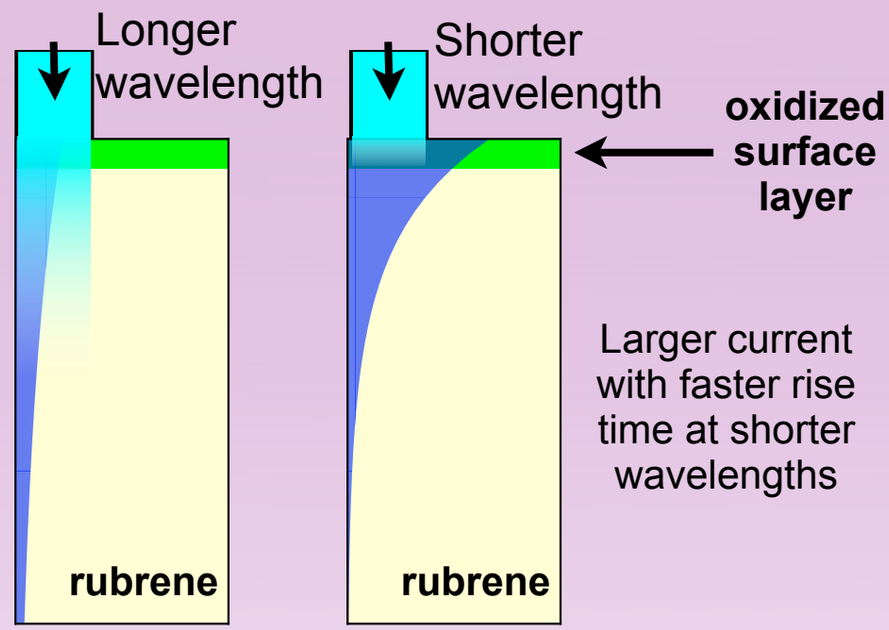






Investigating the origin of the high photoconductivity of rubrene:
Exciton ionization mechanisms and organic photovoltaics

- After picosecond pulse photoexcitation in rubrene one observes a small photocurrent arising during the nanosecond lifetime of the excitons and a **large delayed photocurrent** that appears ~100 microseconds later.
- The largest portion of photoexcited excitons are stabilized at defect centers close to the surface that then lead to the delayed photocurrent via thermal excitation.
- This exciton ionization process has a **quantum efficiency close to one**.
- Quadratic recombination of charge carriers released from exciton ionization leads to a dependence of the delayed photocurrent amplitude and build-up speed on the density of photoexcited excitons.
- The small, fast photocurrent has a different origin, probably related to bulk defects that lead to exciton ionization during its lifetime.



H. Najafov, B. Lyu, I. Biaggio, V. Podzorov, PRB 77, 125202 (2008)