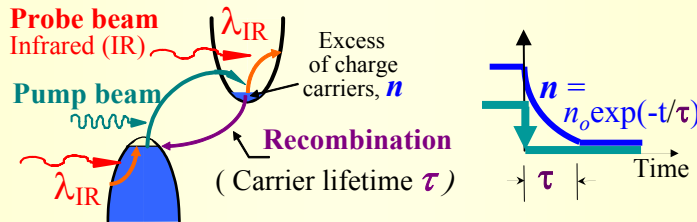


Probing Charge Carrier Dynamics at Interfaces

Pump-probe optical characterization of semi-conductor materials.

Carrier lifetime measurement (τ)



Carriers are excited with **pulsed visible light** and their time decay τ is probed with **cw infrared radiation**.

τ is a parameter indicative of **material quality**. A large value of τ implies a defects-free material.

Objectives:

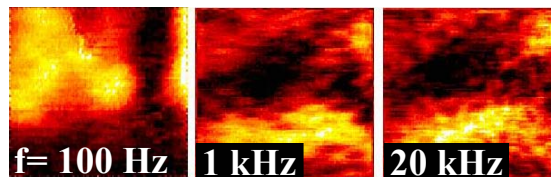
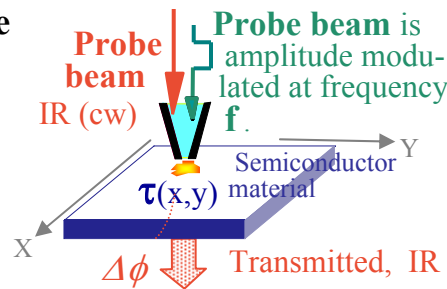
- Development of a Frequency-Resolved Near-field Imaging technique for characterizing the dynamics of charge-carriers in bulk and mesoscopic semiconductor materials, and devices.
- Understand quantum transport mechanism of charge carriers in nanostructures.
- Study interaction of bio-electronic interfaces (role of defects and impurities).

Near-field Optics (NFO) Implementation

Mapping carrier lifetime

in silicon. The images capture, pixel by pixel, the dynamic response of carriers (synchronously measured in terms of the changes in

$\Delta\phi$ experienced by the probe beam) while the **pump beam's** amplitude is modulated at different frequencies.



Impact:

- Development of bioelectronic sensors.
- Improve reliability of nanoelectronic devices.

Collaborators:

J. Freeouf (PSU, Physics Department).