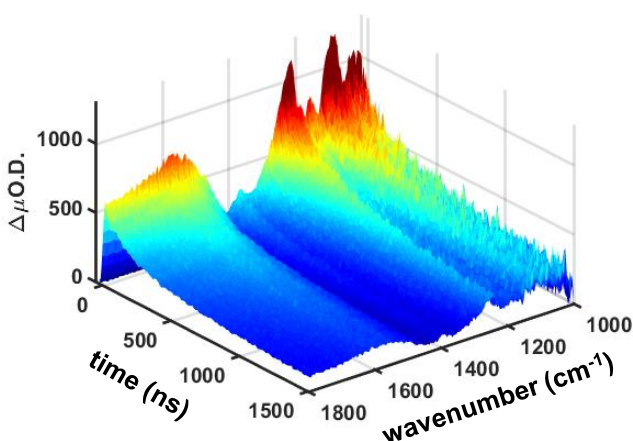


The inspIRe advantage

- Broad-band mid-IR ns TA spectrometer (850 – 5000 cm^{-1})
- Ease of use similar to an FTIR
- Unprecedented 100 nanoO.D. detection limit* with 10 ns time and 5 cm^{-1} frequency resolution
- True one-box, turn-key system; no need for an external pump source – can be modified to operate with existing pump source as desired
- Flexible sample geometry – easily switch between transmission and reflection within seconds
- No special laboratory requirements – locate on lab bench or optical table



Applications

- Photochemistry
- Photophysics
- Photocatalysis
- Photovoltaics
- Biochemistry
- Materials Science

NANOSECOND MID-IR TA SPECTROSCOPY WITH UNPRECEDENTED SENSITIVITY AND EASE OF USE

The inspIRe is the first broadband, nanosecond mid-IR transient absorption (TA) spectrometer in a true one-box platform (including pump laser and all electronics). The inspIRe sets the standard for mid-IR TA spectroscopy with the simplicity of an FTIR measurement. Our patent-pending detection technology enables an unprecedented 100 nanoO.D. detection limit and full 2D frequency and time resolution. Our patent-pending design enables rapid switching between transmissive and reflective sample geometries for photophysics and photocatalysis studies.

Ultrahigh sensitivity enables new regimes of behavior in TA spectroscopy not accessible by other means

The ultrahigh sensitivity of the inspIRe enables nanosecond TA spectroscopy under new regimes of behavior inaccessible with any other system. Mid-IR TA measurements can now be performed with pump intensities comparable to operating conditions of photovoltaic and photocatalytic systems** so insights from spectroscopy can be directly applied to understand functional devices and photocatalytic mechanisms. Protein and enzyme reaction dynamics can be investigated at low concentrations of biochemical relevance. The high sensitivity enables fast data collection for high throughput and ease of use without the training and maintenance required with ultrafast laser systems.

Reliability and Ease of Use

Our patent-pending detection technology enables unprecedented suppression of noise for ultrahigh sensitivity, enabling the use of robust laser and mid-IR light sources that cover the entire mid-IR spectral range from 850 – 5000 cm^{-1} . This enables us to deliver state of the art nanosecond mid-IR TA spectrometers with the ease of use, low maintenance and reliability of an FTIR.

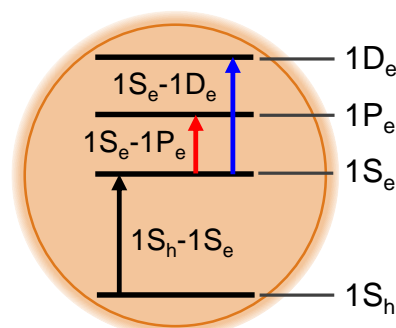
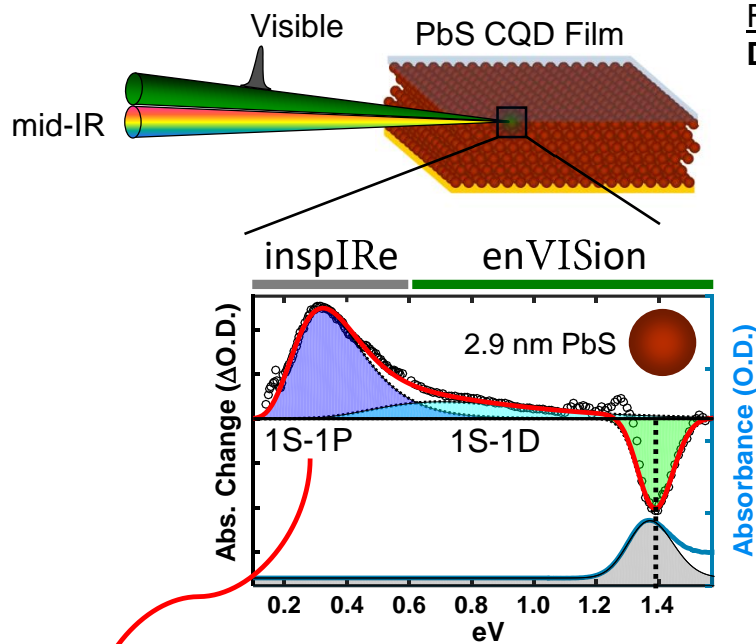
The fully integrated, one-box system includes everything: light source, excitation laser, detection system, and all electronics. State of the art TA spectroscopy measurements can now be performed with little training, making the system ideal for user facilities, multi-disciplinary research groups, undergraduate labs as well as advanced users seeking state of the art performance.

NanoSpec inspIRE

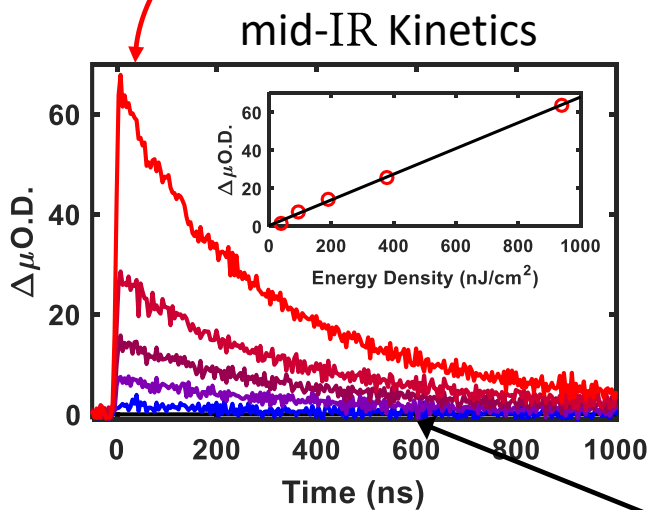
Unprecedented Performance and Sensitivity¹

Example – Probe forbidden 1S-1D intraband transitions in PbS quantum dots to reveal origins of fast relaxation processes that bypass the hot phonon bottleneck.

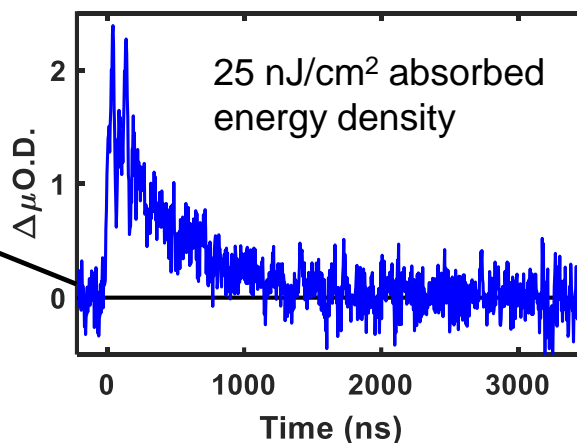
From Kennehan, Beard, Asbury *ACS Nano* 2018
DOI: 10.1021/acsnano.8b03216



Confined states in CQDs



- <100 sun peak intensity of pump pulses
- <<0.001 sun average pump intensity
- 10⁻⁷ O.D. detection limit after 1 hour



1. Patent-pending data collection and processing system enables collection of full 2D time-frequency data with simultaneous high time resolution (10 ns) and high frequency resolution (5 cm⁻¹).

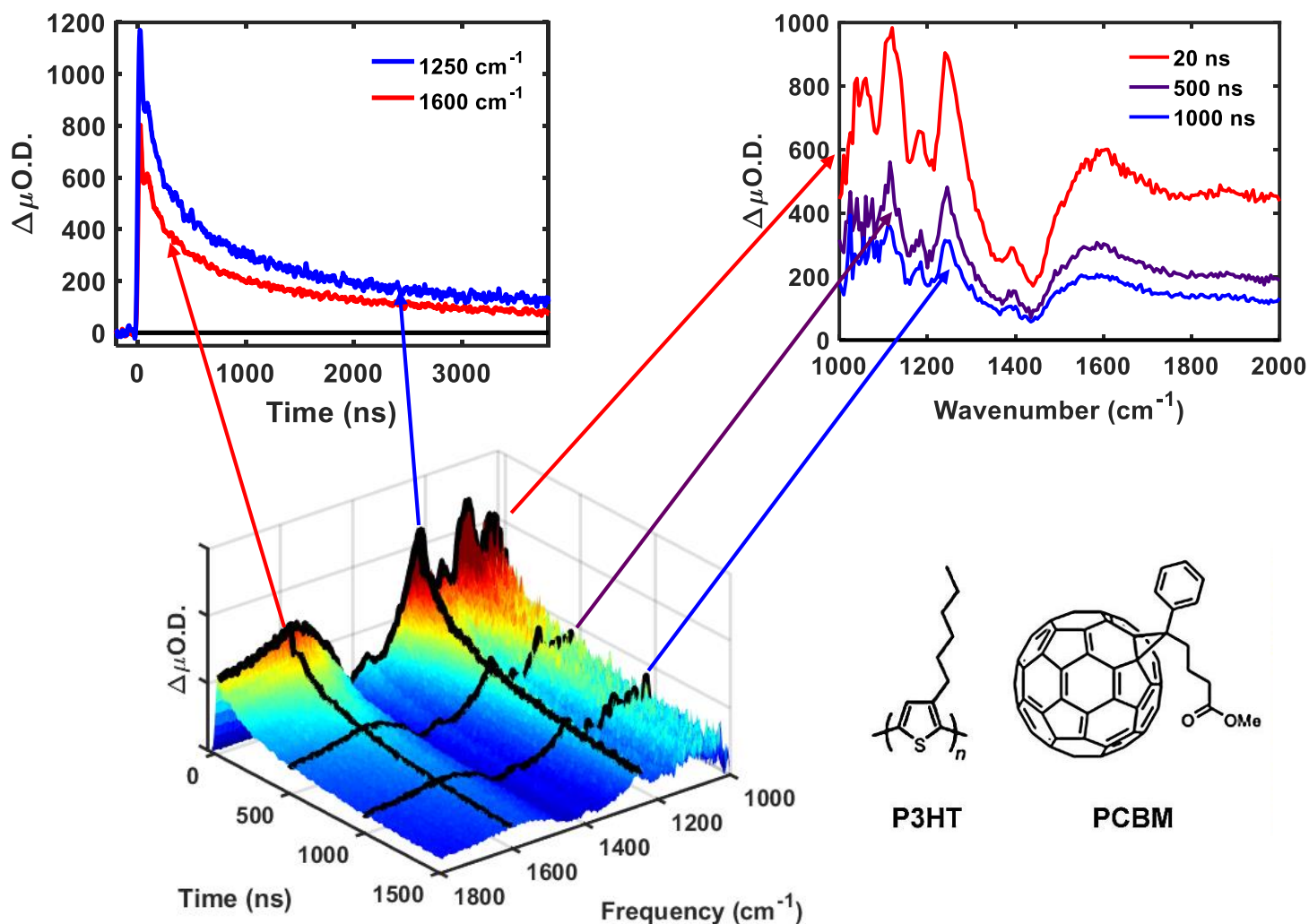
NanoSpec inspIRE

2D Spectra and Kinetics Capability¹

Example – Polaron absorption and IRAVs in a P3HT:PCBM blend film.

Experimental conditions

- 532 nm pump, 2.5 ns pulse with $10 \mu\text{J}/\text{cm}^2$ excitation density
- Measurements at 200 frequencies combined to form spectrum
- 30 minute total data collection time
- Only 9 seconds to collect each kinetic trace at each frequency



1. Patent-pending data collection and processing system enables collection of full 2D time-frequency data with simultaneous high time resolution (10 ns) and high frequency resolution (5 cm^{-1}).

NanoSpec inspIRE

NanoSpec inspIRE	Specifications ^{2,3,4}
Probe frequency range	Broadband – over 850 cm ⁻¹ – 5000 cm ⁻¹ (12 μm – 2 μm)
Probe frequency resolution	5 cm ⁻¹ with recommended slit widths to probe vibrational features
Excitation source and wavelengths	High repetition rate Nd:YAG laser (266, 355, 532 or 1064 nm)
Time resolution and time window	10 ns IRF, up to 800 μs time window (@ 1 kHz), longer time window available at lower repetition rates.
Detection limits (single frequency)	10 ⁻⁷ ΔO.D. (one hour); 10 ⁻⁶ ΔO.D. (< one minute)
Rapid data acquisition	Full time axis recorded within a single laser shot enables rapid signal acquisition; automated or user-defined frequency sampling for full 2D frequency-time data with unprecedented speed and sensitivity.
Standard sample options and geometries	Patent-pending optical design can be switched between a transmissive geometry for solution or thin film samples and a reflective geometry for photoelectrochemical samples without repositioning mirrors.
Instrument control and software	Fully automated control of instrument from software: time and frequency sampling, repetition rate, probe resolution, automated filter wheel to eliminate higher order diffraction in monochromator.
Software	User-friendly signal optimization tools; real-time data processing permits data to be viewed as it will appear for publication – no need to guess when signal-to-noise is “good enough” to stop an experiment.

2. Specifications listed here are for instrument utilizing our standard excitation laser.
3. Instrument can be customized to meet specific customer needs.
4. Due to our continuous product improvement program, minimum specifications may change without notice.

Instrument Layout

