

Profile



Jungmin Park

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Education

B.A. in Applied Chemistry, Dongduk Women's University (Feb 2025)

- GPA 3.89/4.5

Work experience

Jun 2024 – Aug 2024 **Adolphe Merkle Institute (AMI)**

Project 4: QD-Spiropyran/Polymer matrix for FRET-Based Fluorescence Imaging — **p.7**

Aug 2023 – May 2024 **Max-Planck-Institute for Polymer research (MPI-P) - Prof. Mischa Bonn's group**

Project 1-2 : Ultrafast Spectroscopy on Metal-Halide Perovskites — **pp.2-5**

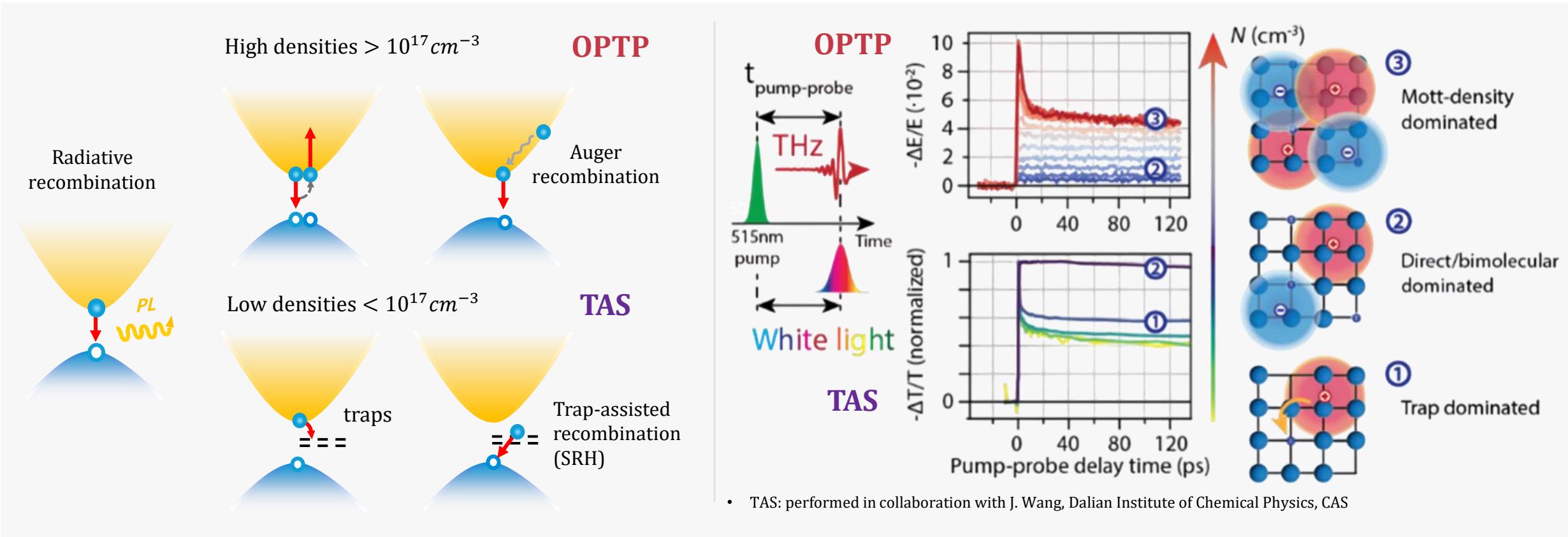
Mar 2023 – Jun 2023 **Korean Institute of Science and Technology (KIST)**

Project 3: Synthesis of Mechanophore Crosslinkers — **p.6**

Project 1.

Temperature-dependent Carrier Dynamics in Photoexcited Metal-Halide Perovskites

* Published in J. Phys. Chem. Lett. (2025)



Motivation

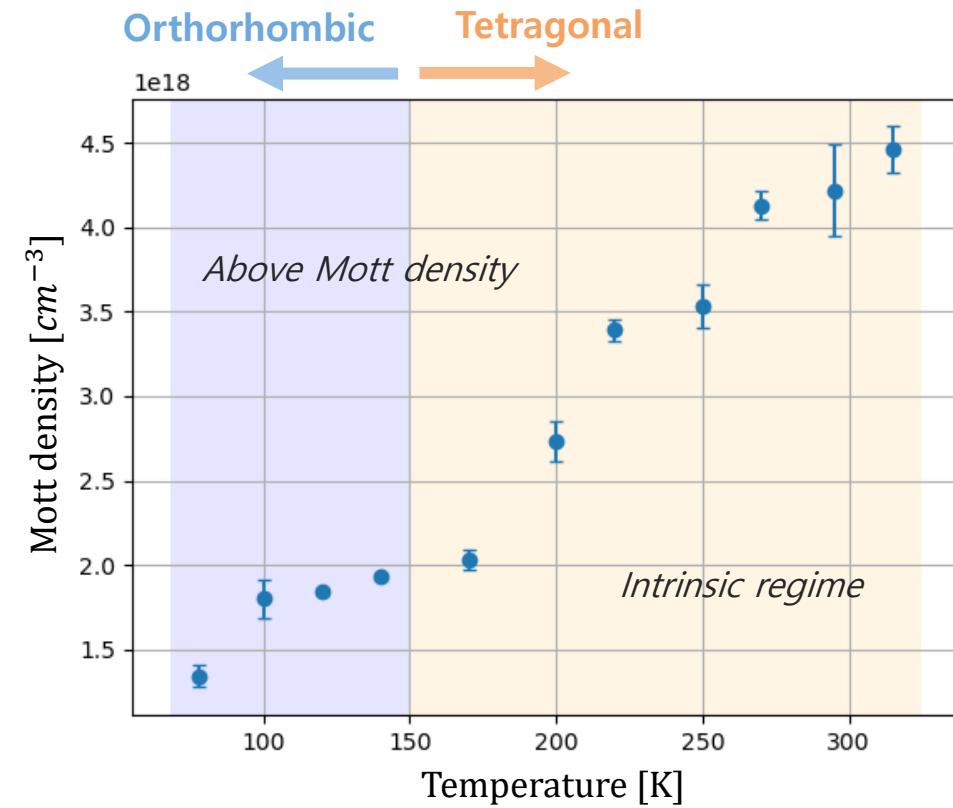
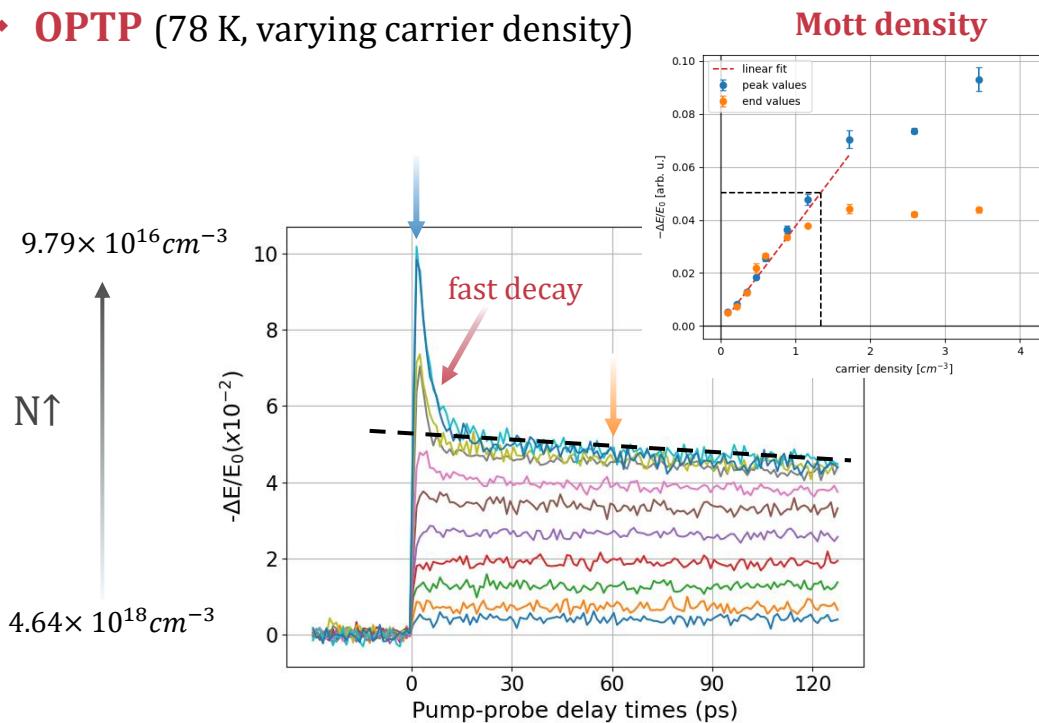
: recombination pathways in perovskites depend on carrier density and temperature, yet the transitions between **trap-, intrinsic bimolecular-, and Mott-dominated** regimes are not clearly established.

Outline

: map density-dependent recombination pathways in photoexcited MAPbI_3 by combining **TAS** and **OPTP** spectroscopy to construct an **electronic polaron phase diagram**.

Project 1. Experiment – OPTP analysis & T-dept Mott density

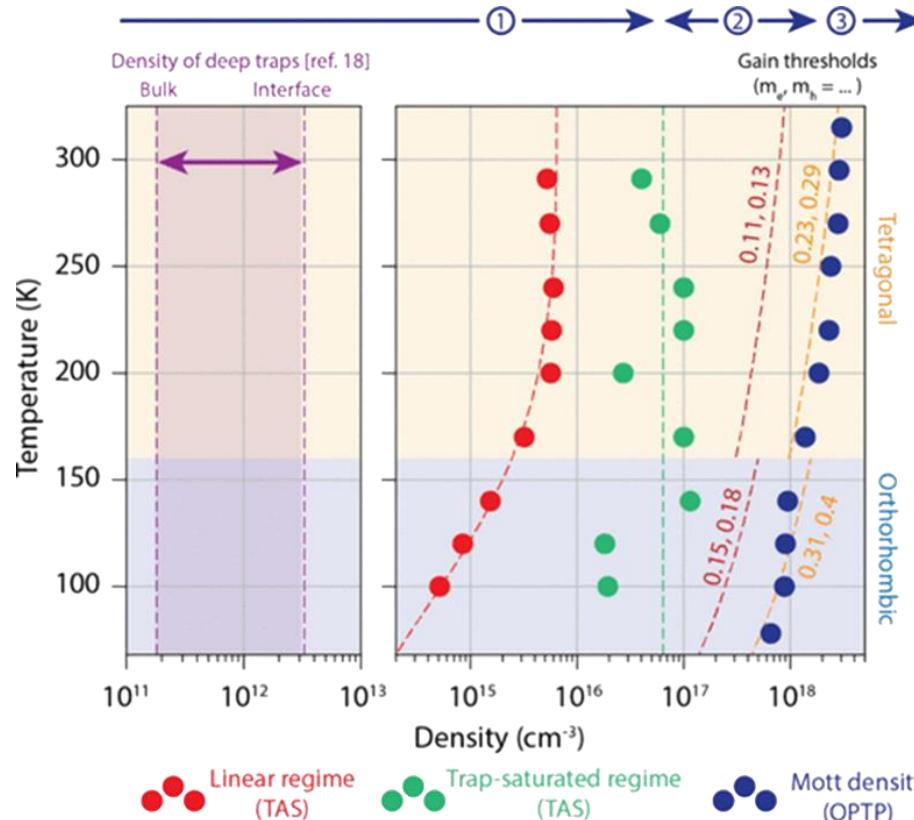
❖ OPTP (78 K, varying carrier density)



Key Results

- Quantified the temperature-dependent Mott density (N_{mott}) from OPTP measurements across 78–315 K.
- Observed rapid carrier decay above N_{mott} , consistent with polaron–polaron overlap.
- Identified a density-dependent transition from intrinsic bimolecular recombination to ultrafast many-body decay.

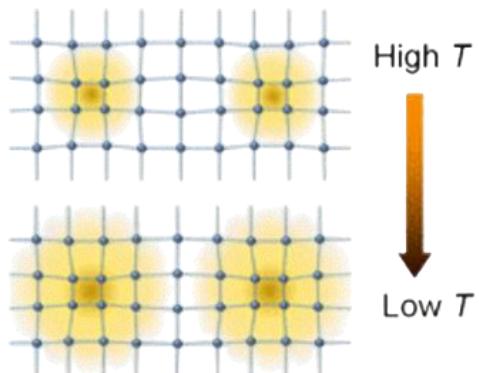
Project 1. Results – Polaron Phase Diagram



Polaron phase diagram

- Low densities**
: ps-scale trapping → ns – μs trap-assisted recombination dominates.
- Above Mott density**
: polaron overlap + Auger recombination → **ultrafast decay**. (fs – tens ps)

OPTP-derived N_{mott} + TAS regimes map the **full density–temperature landscape**.



- Temperature effect**
: higher lattice vibrations **reduce the polaron radius**
→ requiring **higher N_{mott}** for overlap.

Heng Zhang et al. ACS Energy Lett. 2023, 8, 420–428.

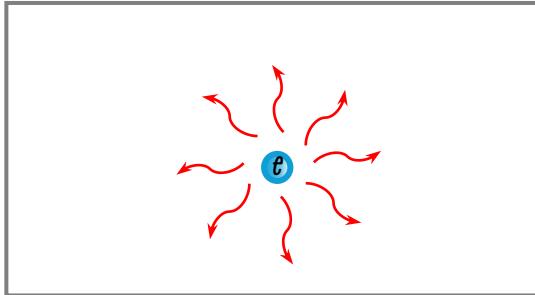
Project 2.

THz Photoconductivity Modelling in Lead-Halide Perovskites

❖ Models for THz Conductivity

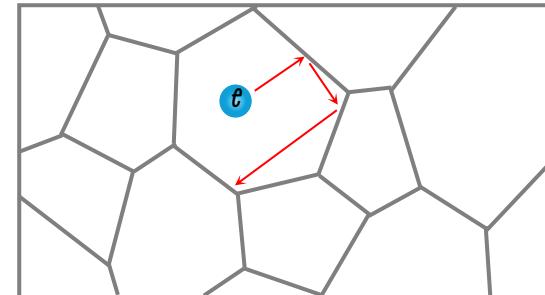
Drude

: no localization (free-carrier response).



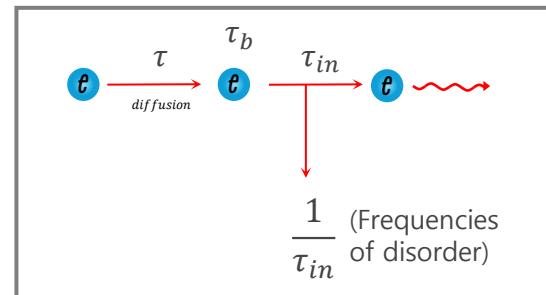
Drude-Smith (DS)

: static disorder + backscattering



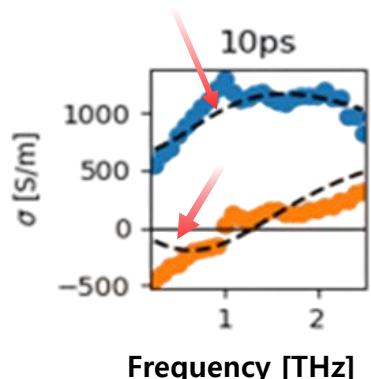
Drude-Anderson (DA)

: dynamic disorder + electron–phonon coupling.

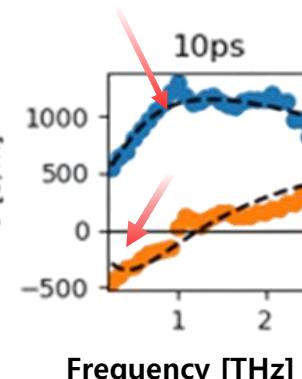


❖ THz Photoconductivity spectra of $FAPbI_3$

DS model fit



DA model fit



Motivation

: to clarify how static and dynamic disorder shape early-time carrier localization.

Key Results

DA model fits the data best

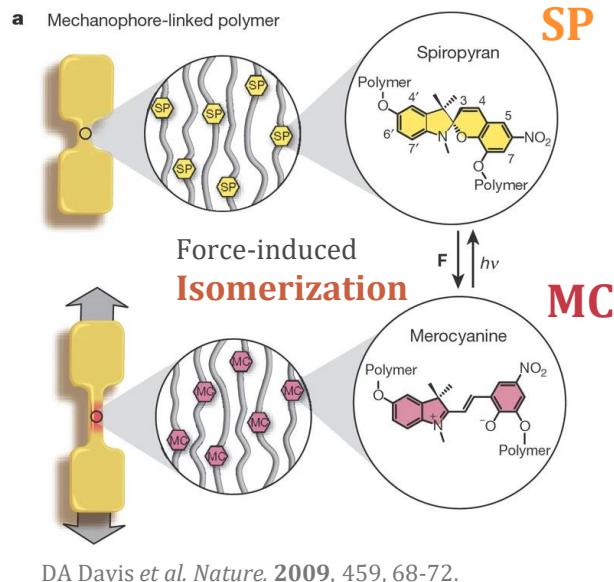
- Captures **dynamic disorder-induced localization**.
- Provides more reliable transport parameters (mobility, τ_b , τ_{in}).

- DS model misses low-frequencies σ .
- DA model captures sub-THz roll-off and localization effects.

Project 3.

Spiropyran Mechanophore for Stimuli-Responsive Polymer Matrices

(Synthesis, Characterization, and Monomer Optimization)

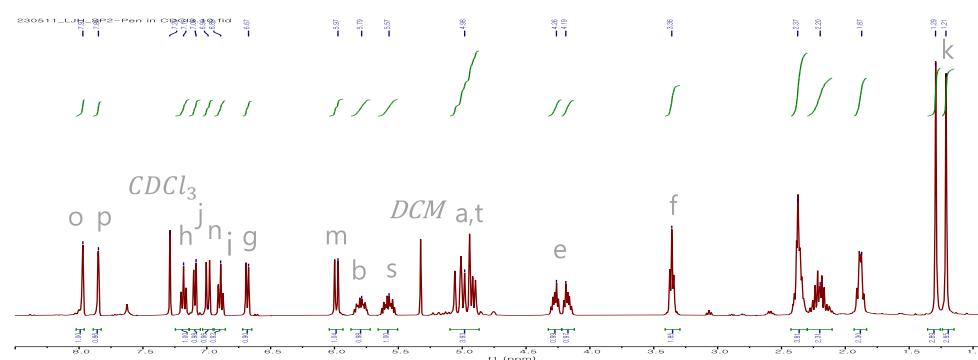
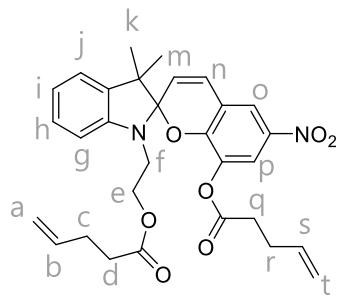


DA Davis *et al.* *Nature*. 2009, 459, 68-72.



Jonghwa Park *et al.* *Adv. Mater.* 2019, 1808148.

¹H NMR (400 MHz, CDCl₃)

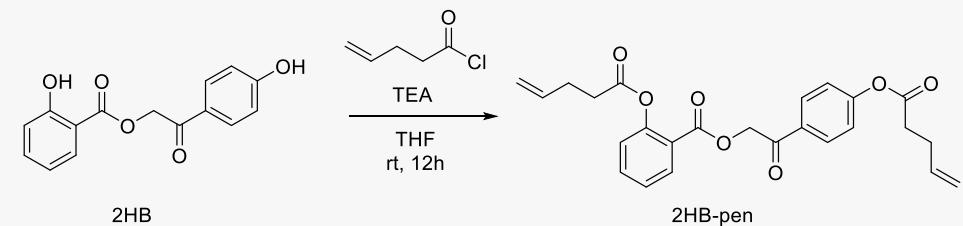


Outlines

- Synthesized a **spiropyran (SP)** crosslinker with reversible **mechano-/photochromic response**.
- Application: mechanochromic polymers for damage monitoring.

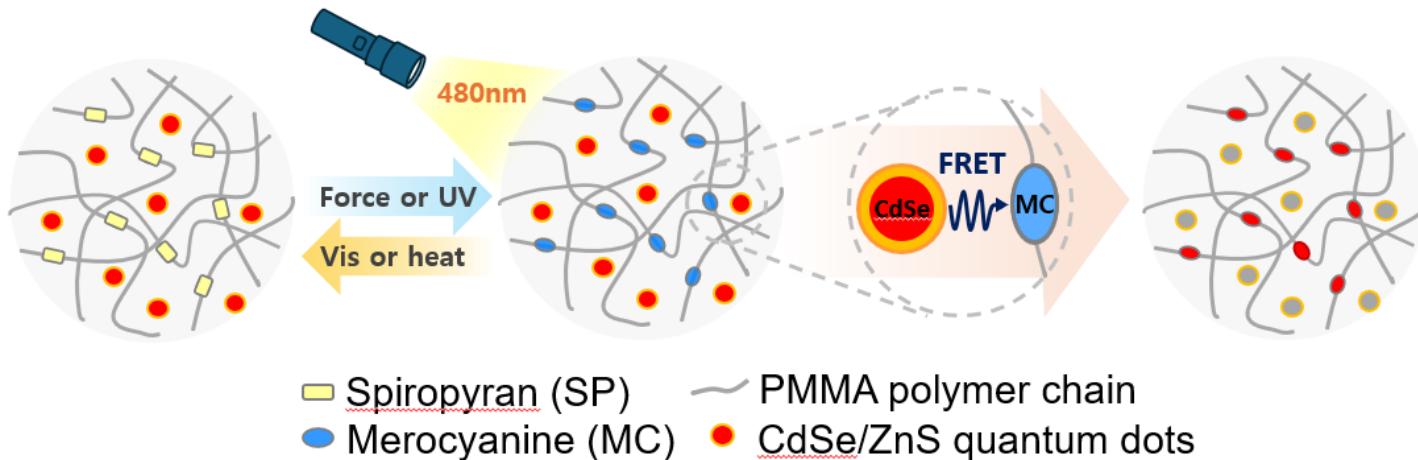
Achievement

- Observation:** A low yield (22%) and anomalous R_f behavior on TLC (counter-intuitive polarity)



- Approach:** Hypothesizing solvent-dependent H-bonding effects modulate effective molecular polarity. (EA:Hex → DCM:Hex)
- Result:** Improved insufficient chromatographic separation and increased yield from **22% → 43%**

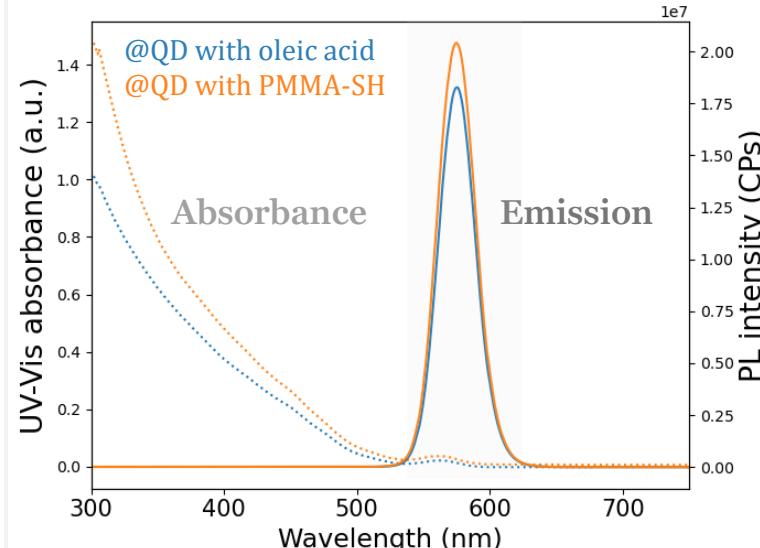
Project 4. Super-Resolution Mechano-imaging of SP-QD polymer Matrices via FRET



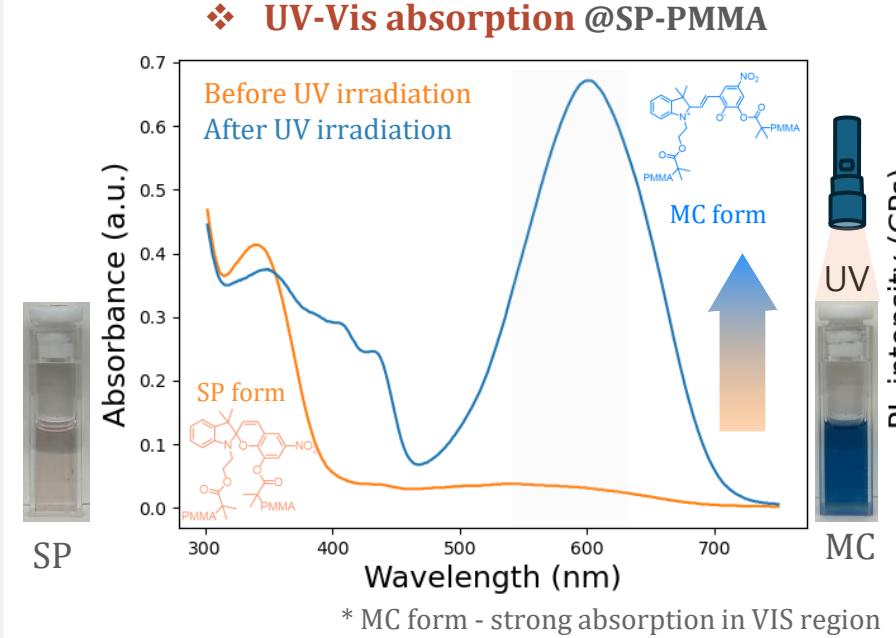
Outlines

- Motivation: Spectral overlap between QD emission and merocyanine absorption enables **QD→MC FRET** for mechano-responsive imaging.
- Synthesized SP-PMMA and PMMA-SH polymer ligands, followed by QD ligand exchange to improve dispersion & FRET compatibility.

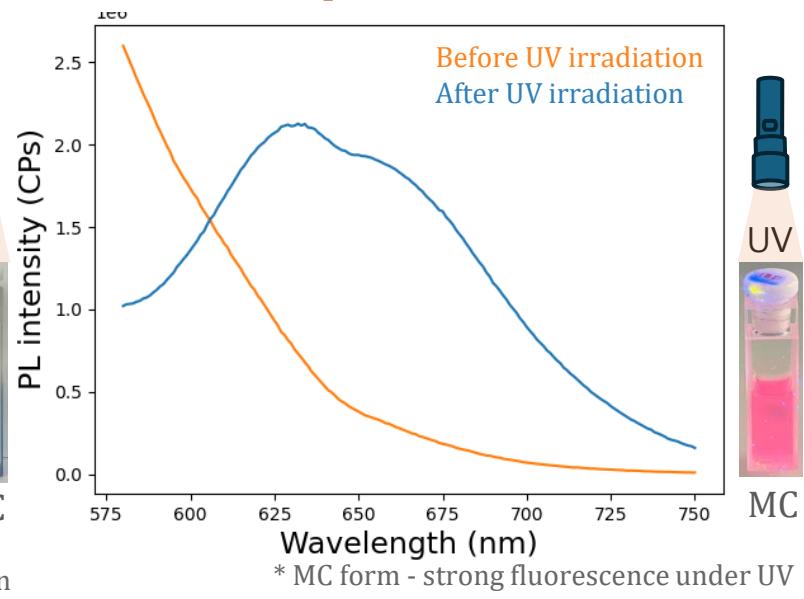
UV-Vis absorption & PL @QDs-polymer



UV-Vis absorption @SP-PMMA



PL spectra @SP-PMMA



Thank you for your attention.

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CV link. [\[Google Drive\]](#)