

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)**

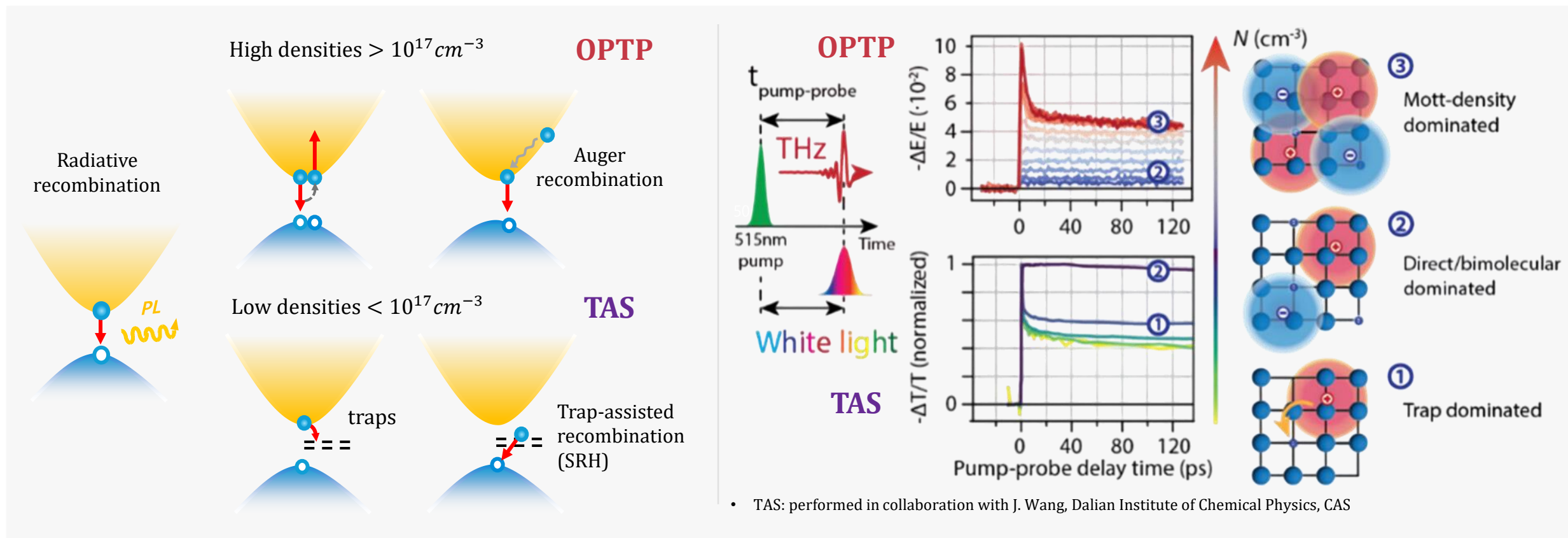
Project 4: QD–Spiropyran/Polymer matrix for FRET-Based Fluorescence Imaging — **p.7**

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**



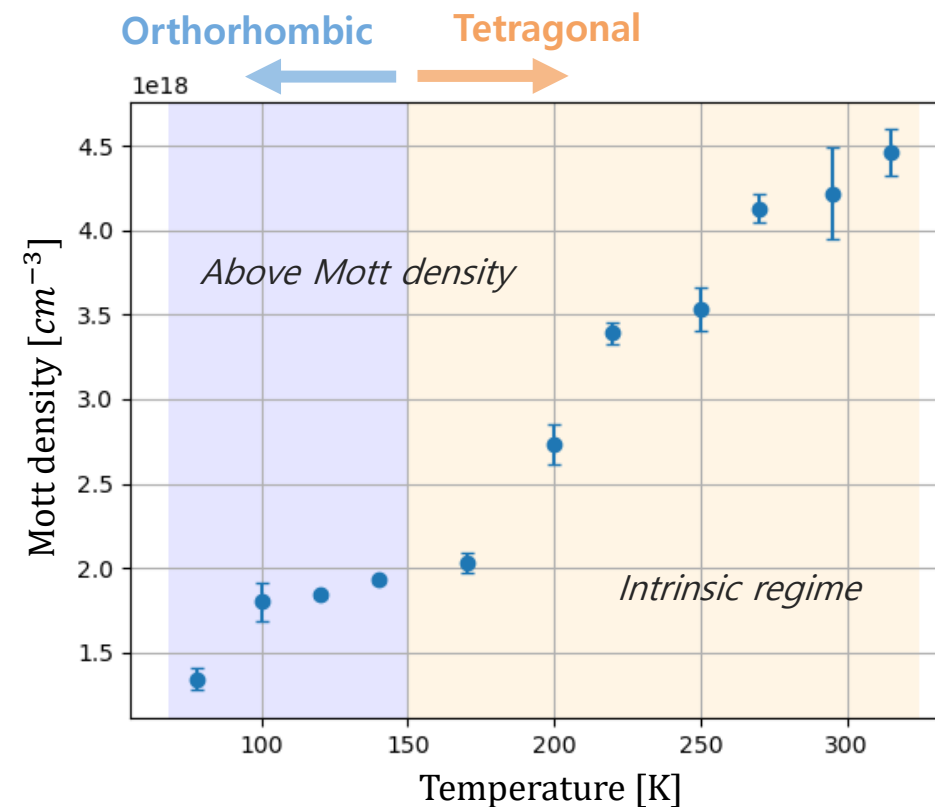
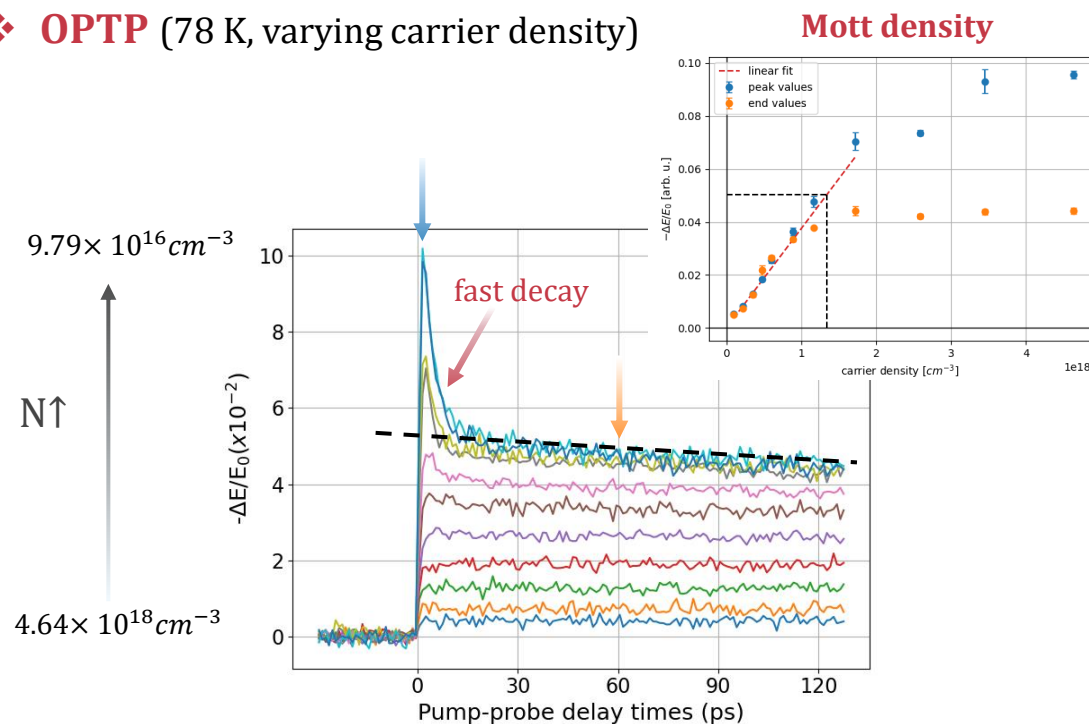
Motivation

: 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

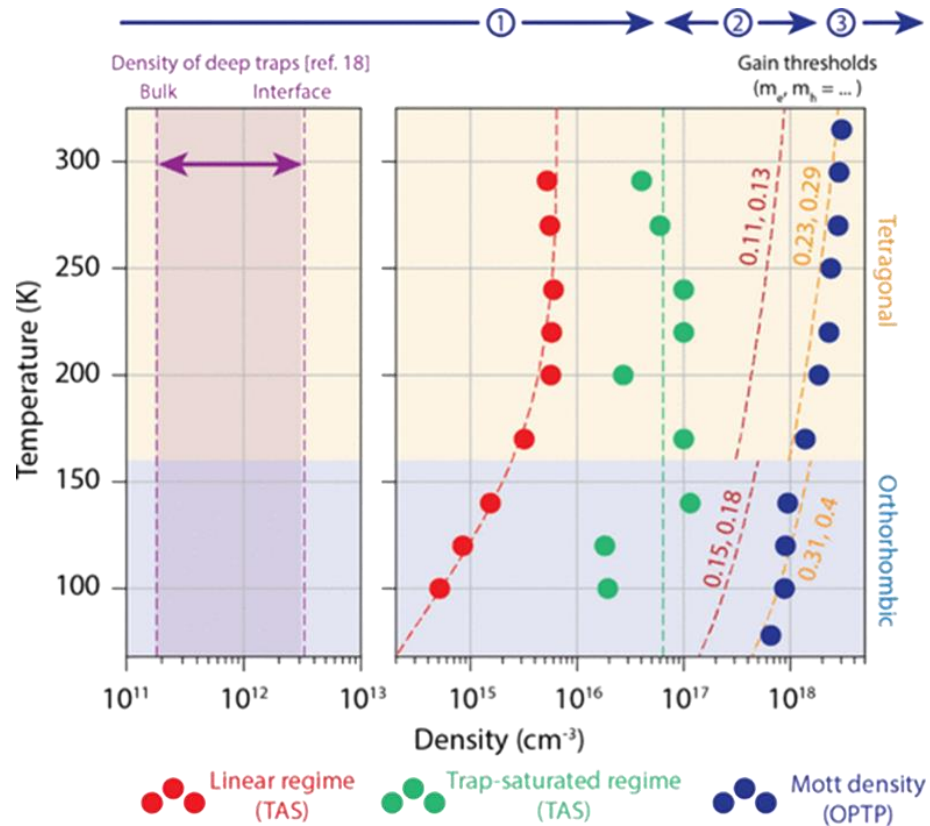
: map density-dependent recombination pathways in photoexcited MAPbI_3 by combining **TAS** and **OFTP** spectroscopy to construct an **electronic polaron phase diagram**.

❖ OOTP (78 K, varying carrier density)



Key Results

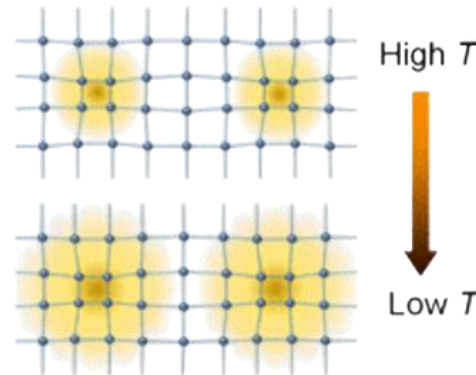
- Quantified the **temperature-dependent Mott density** (N_{mott}) from OOTP measurements across 78–315 K.
- Observed **rapid carrier decay** above N_{mott} , consistent with **polaron-polaron overlap**.
- Identified a **density-dependent transition** from intrinsic bimolecular recombination to ultrafast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



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

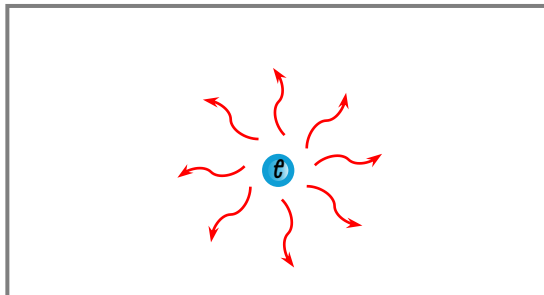
: higher lattice vibrations **reduce the polaron radius**
→ requiring **higher N_{mott}** for overlap.

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

❖ Models for THz Conductivity

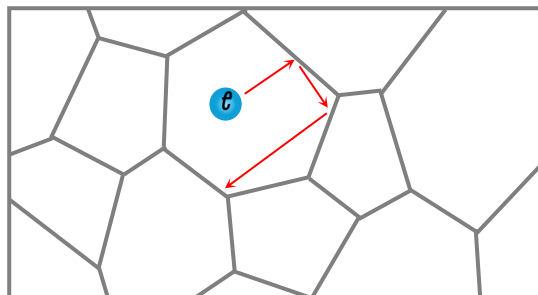
Drude

: no localization (free-carrier response).



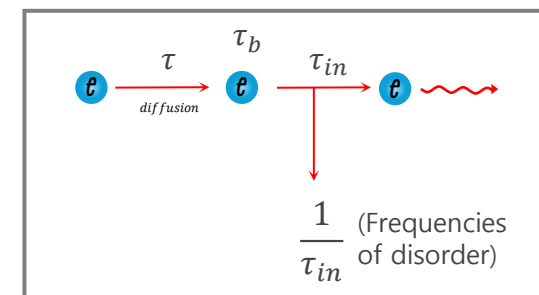
Drude-Smith (DS)

: **static disorder** + backscattering

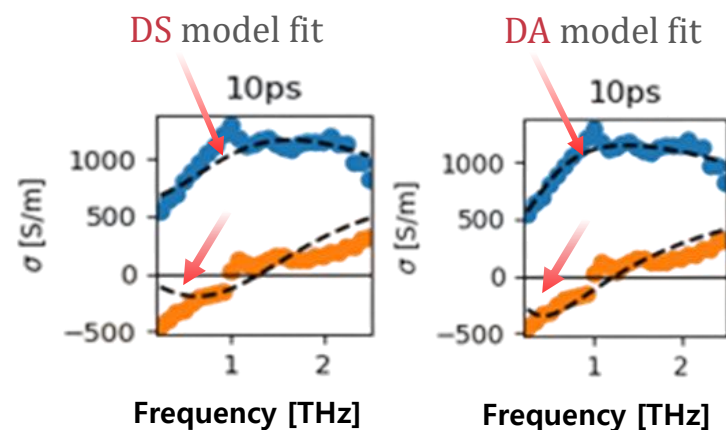


Drude-Anderson (DA)

: **dynamic disorder** + electron-phonon coupling.



❖ THz Photoconductivity spectra of $FAPbI_3$



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

Motivation

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

Key Results

DA model fits the data best

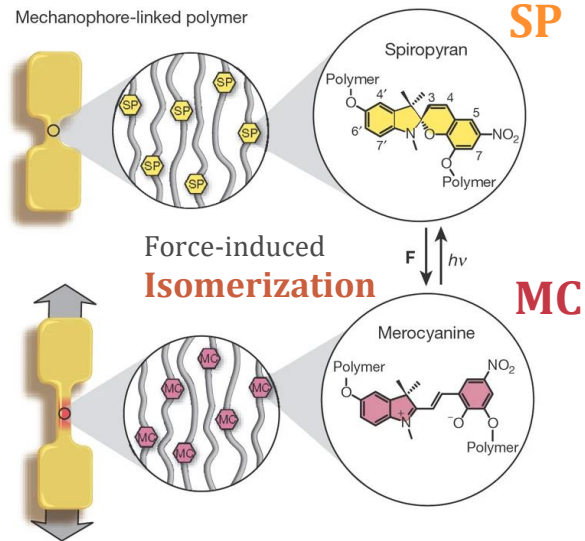
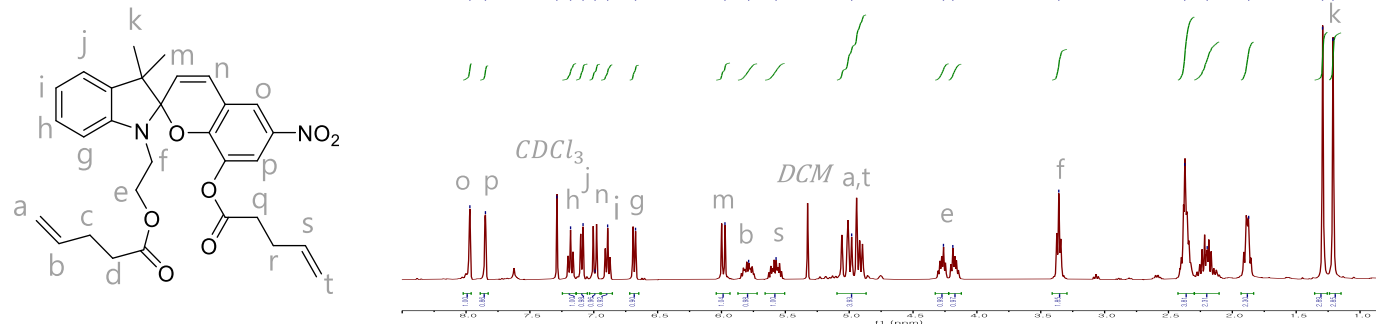
- Captures **dynamic disorder-induced localization**.
- Provides more reliable transport parameters (mobility, τ_b , τ_{in}).

Project 3.

Spiropyran Mechanophore for **Stimuli-Responsive** Polymer Matrices

(Synthesis, Characterization, and Monomer Optimization)

a Mechanophore-linked polymer

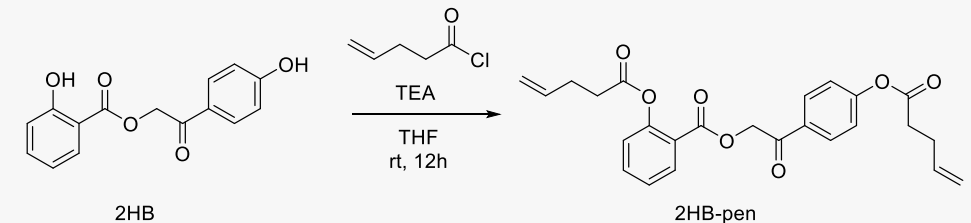
DA Davis et al. *Nature*. 2009, 459, 68-72.Jonghwa Park et al. *Adv. Mater.* 2019, 1808148.¹H NMR (400 MHz, CDCl₃)

Outlines

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

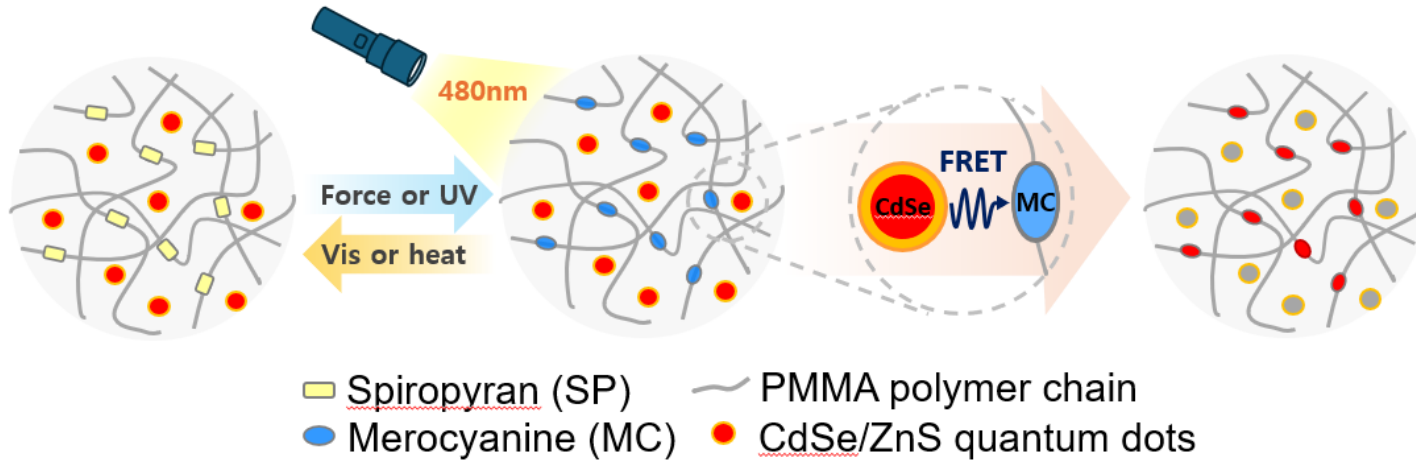
Achievement

- 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%**

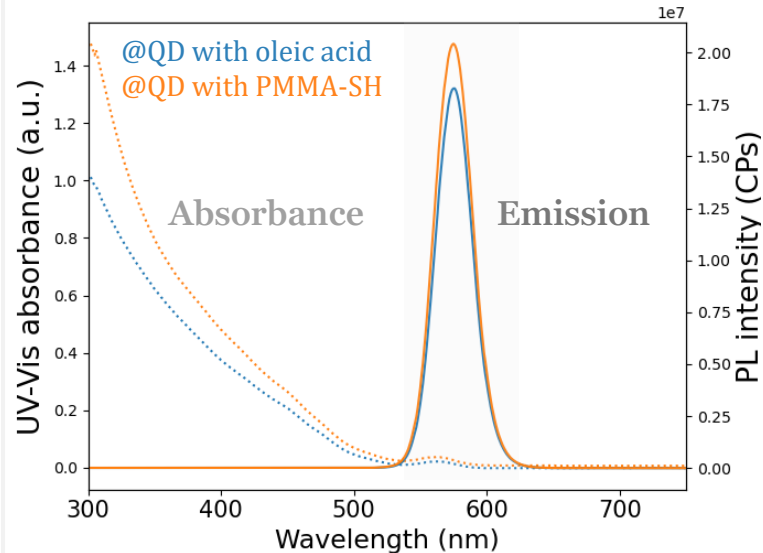
Project 4. Super-Resolution Mechano-imaging of SP-QD polymer Matrices via FRET



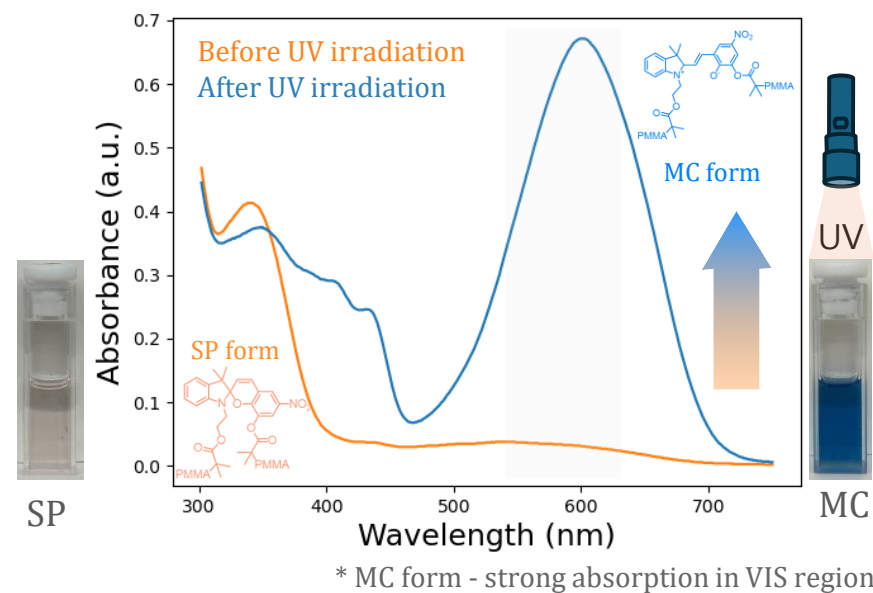
Outlines

- 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.

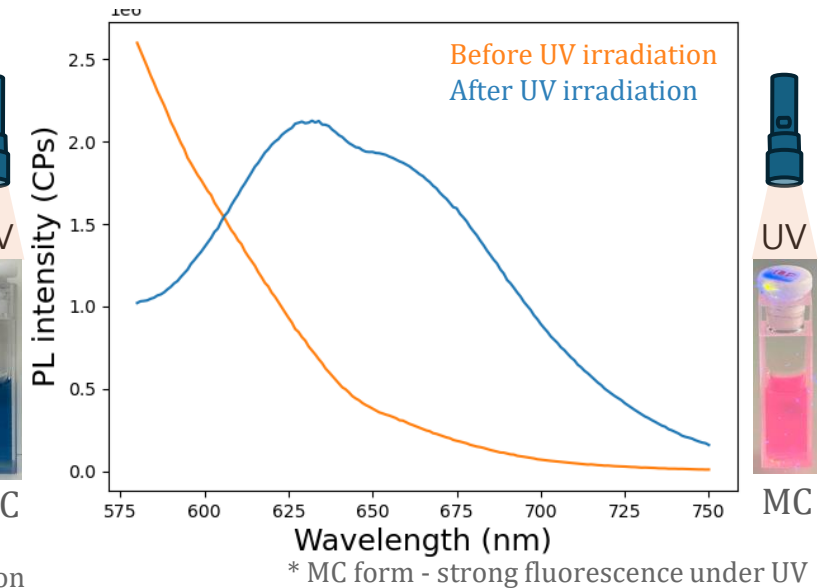
❖ UV-Vis absorption & PL @QDs-polymer



❖ UV-Vis absorption @SP-PMMA



❖ PL spectra @SP-PMMA



Thank you for your attention.

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