

# Profile



## Jungmin Park

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## Education

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

- GPA 3.89/4.5

## Work experience

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

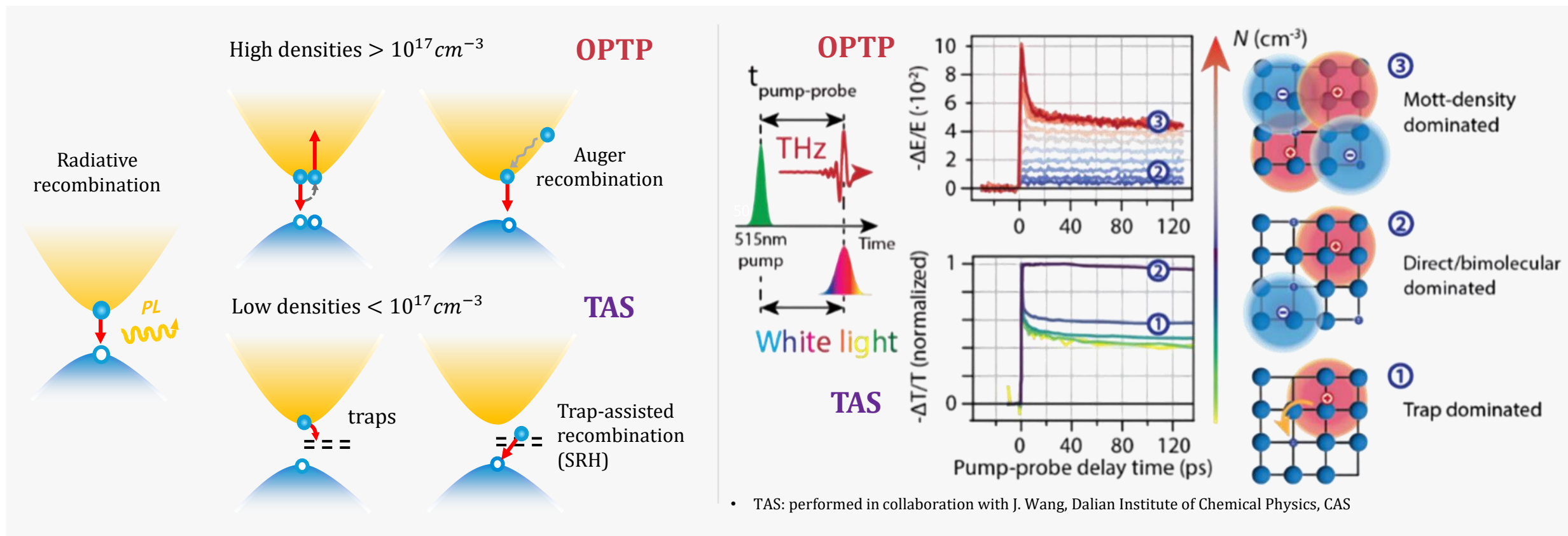
Project 4: QD–Spiropyran/Polymer matrix for FRET-Based Fluorescence Imaging — **p.7**

Aug 2023 – May 2024 **Max-Planck-Institute for Polymer research (MPI-P)**

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**



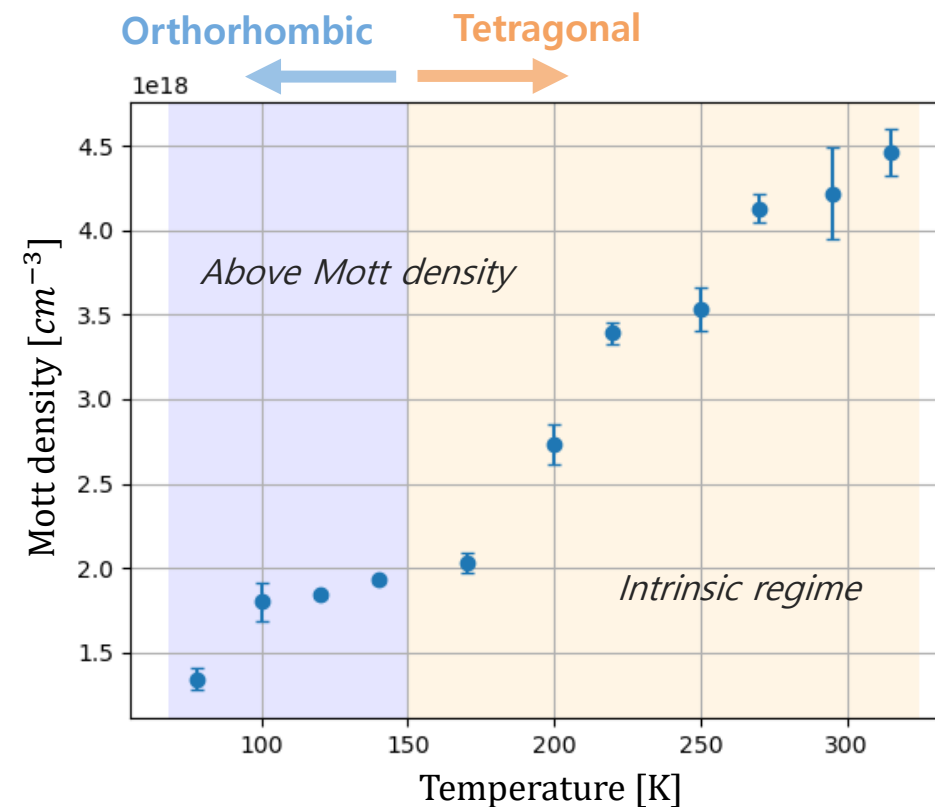
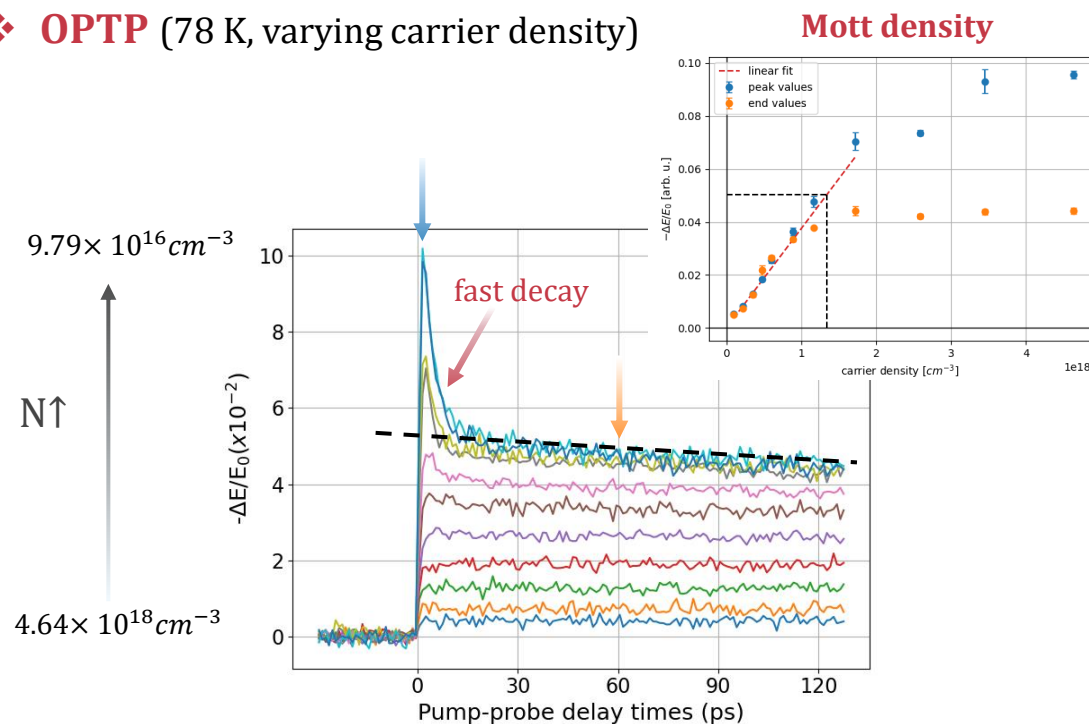
### Motivation

: 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

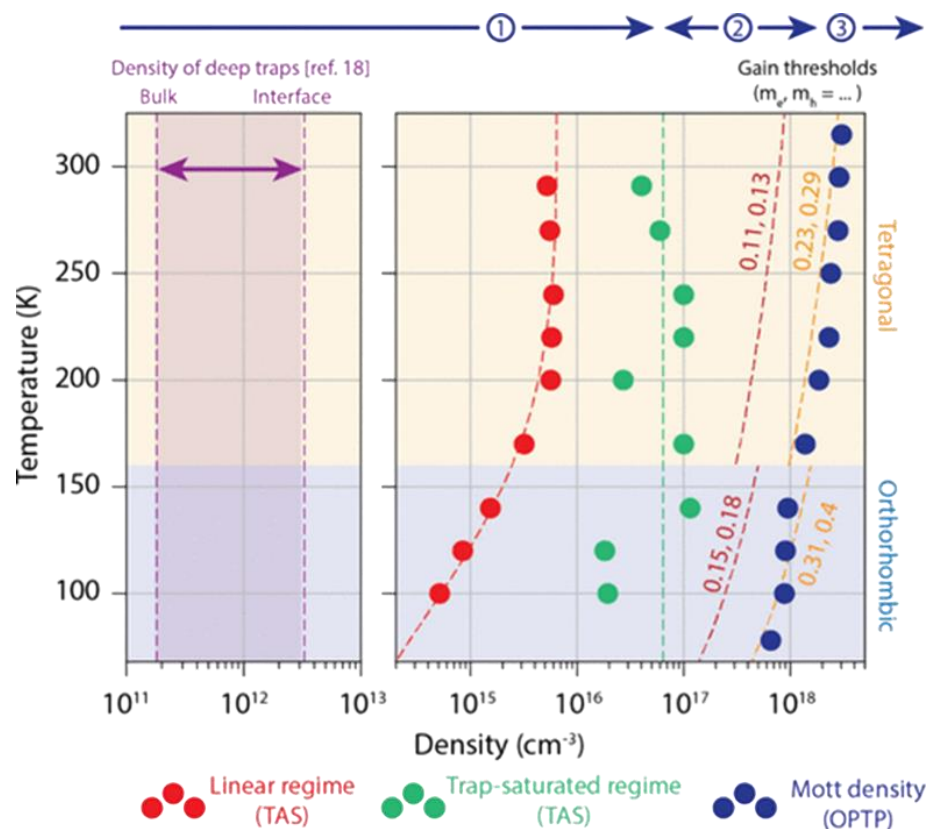
: map density-dependent recombination pathways in photoexcited  $\text{MAPbI}_3$  by combining **TAS** and **OPTP** spectroscopy to construct an **electronic polaron phase diagram**.

## ❖ OOTP (78 K, varying carrier density)



## Key Results

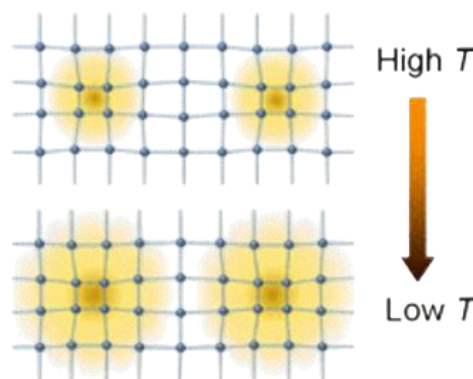
- Quantified the **temperature-dependent Mott density** ( $N_{\text{mott}}$ ) from OOTP measurements across 78–315 K.
- Observed **rapid carrier decay** above  $N_{\text{mott}}$ , consistent with **polaron-polaron overlap**.
- Identified a **density-dependent transition** from intrinsic bimolecular recombination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



## Polaron phase diagram

- **Low densities**  
: ps-scale trapping → ns –  $\mu\text{s}$  **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

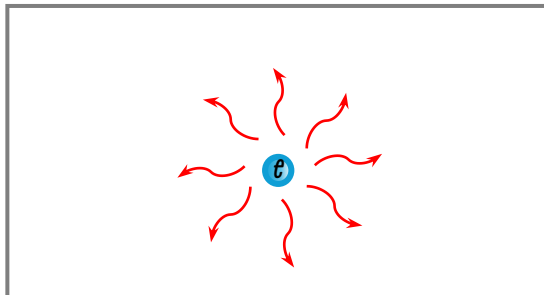
: higher lattice vibrations **reduce the polaron radius**  
→ requiring **higher  $N_{mott}$**  for overlap.

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

## ❖ Models for THz Conductivity

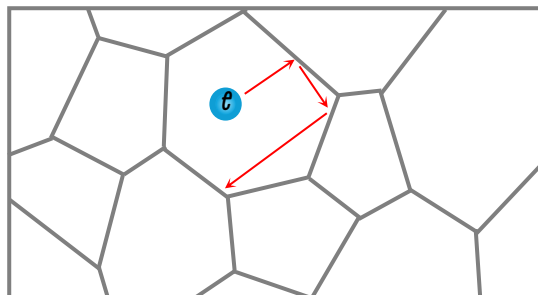
### Drude

: no localization (free-carrier response).



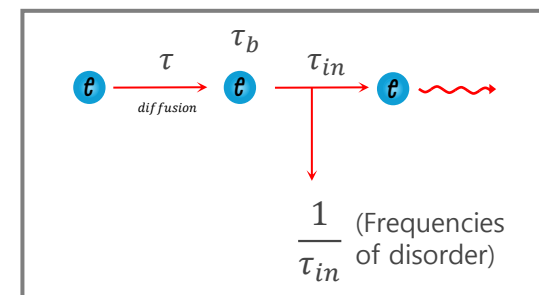
### Drude-Smith (DS)

: **static disorder** + backscattering

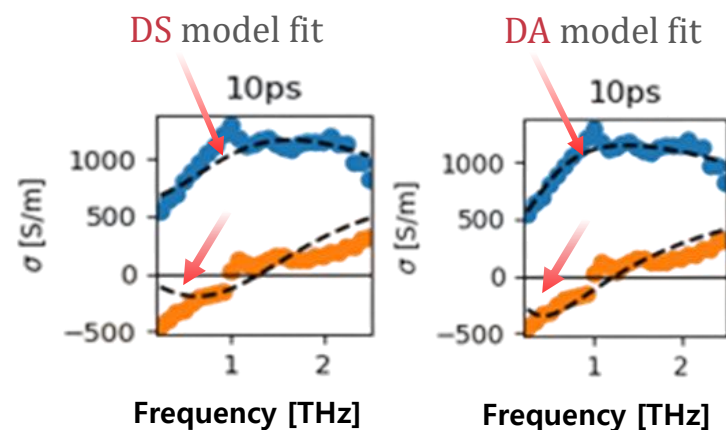


### Drude-Anderson (DA)

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



## ❖ THz Photoconductivity spectra of $FAPbI_3$



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

### Motivation

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

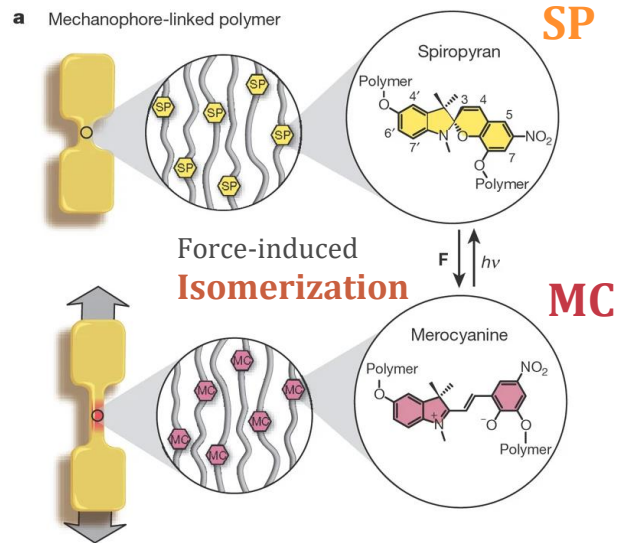
### Key Results

#### DA model fits the data best

- Captures **dynamic disorder-induced localization**.
- Provides more reliable transport parameters (mobility,  $\tau_b$ ,  $\tau_{in}$ ).

## 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.

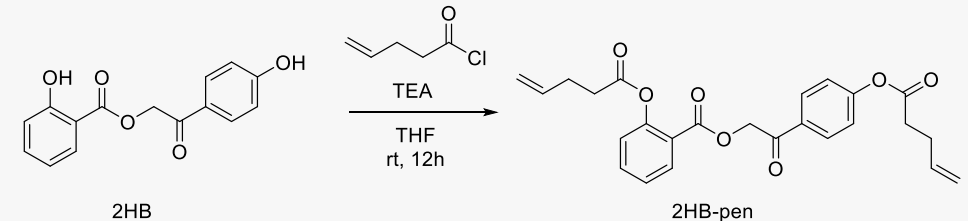
# Outlines

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

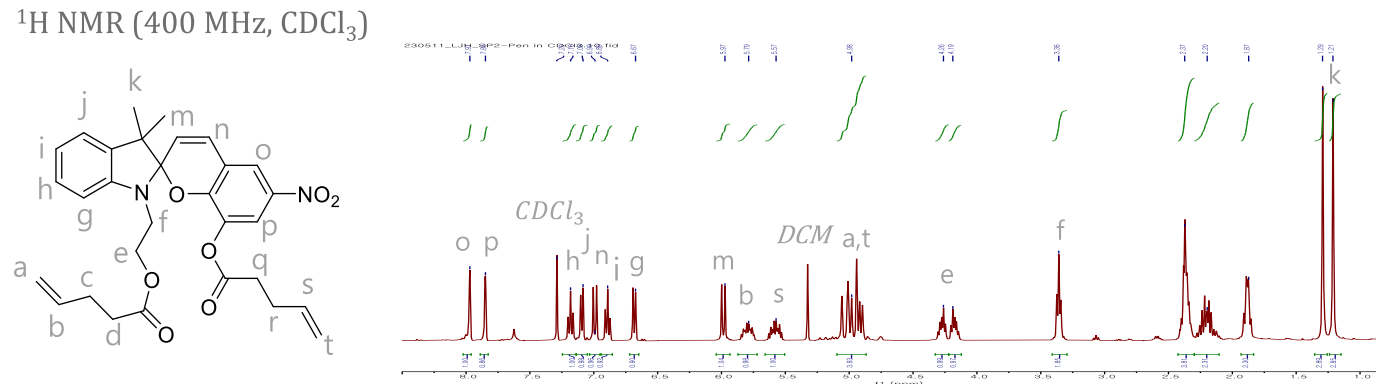
## Achievement

- Motivation : low yield hindered reliable monomer preparation → leading me to identify the main cause using TLC and NMR.

\* Acylation step for photodegradable monomer synthesis

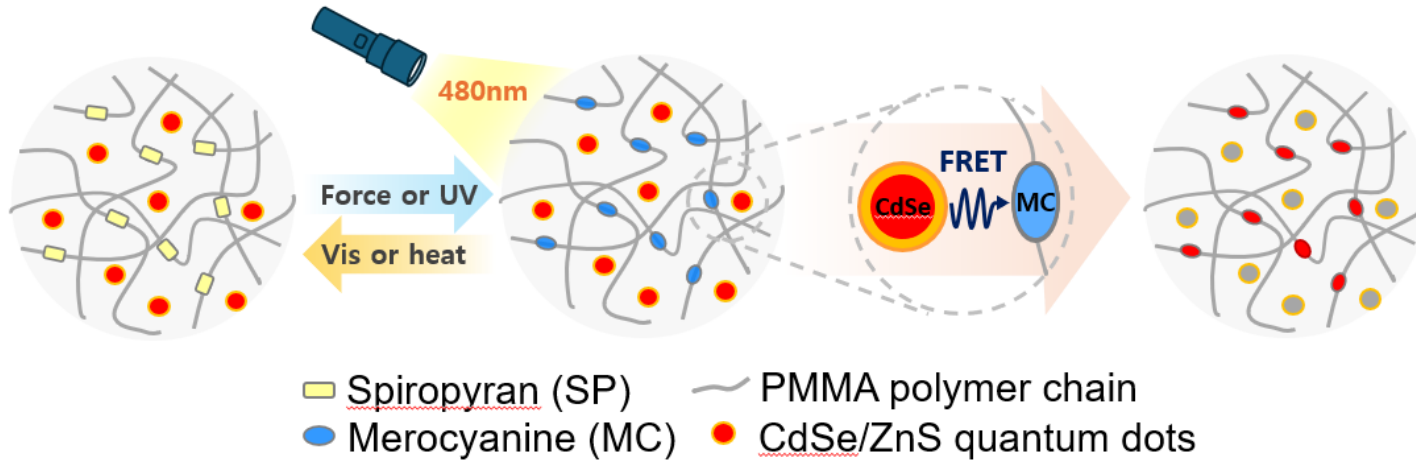


- Resolved insufficient chromatographic separation by developing an efficient eluent system, increasing the yield from **22% → 43%**





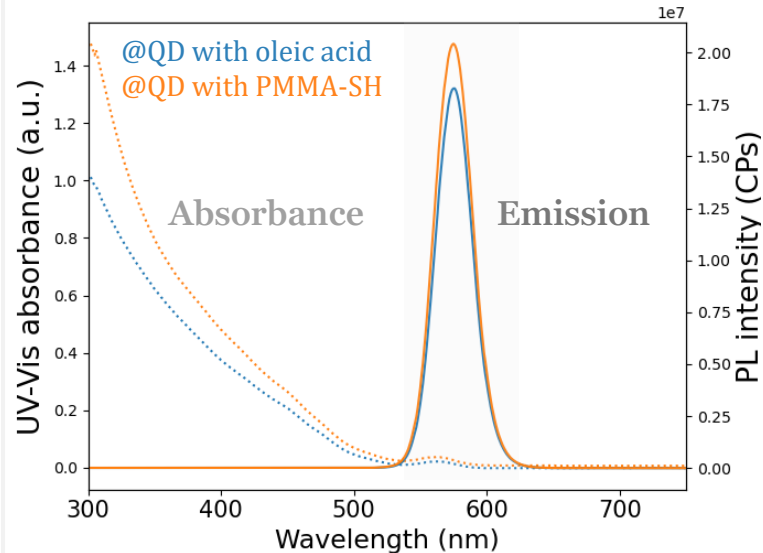
# Project 4. Super-Resolution Mechano-imaging of **SP-QD** polymer Matrices via FRET.



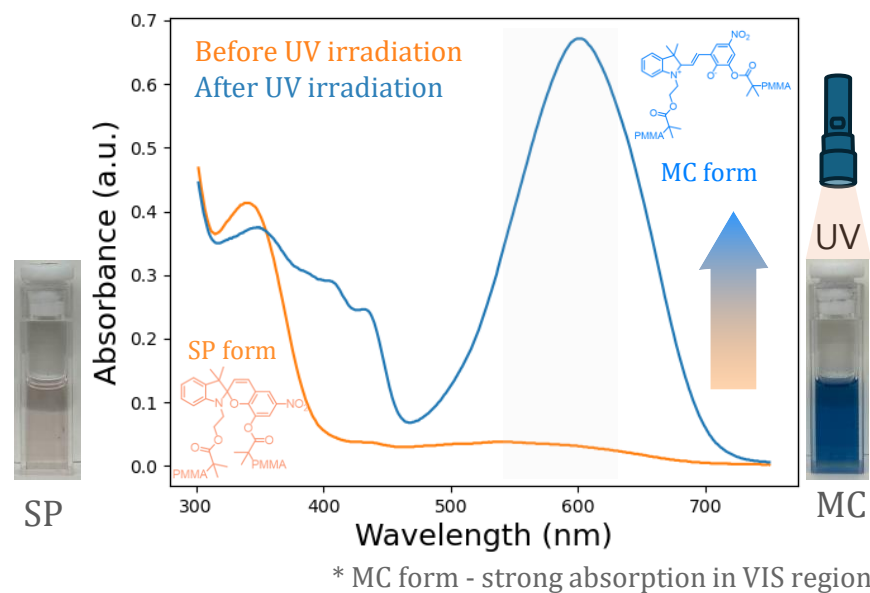
## Outlines

- 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.

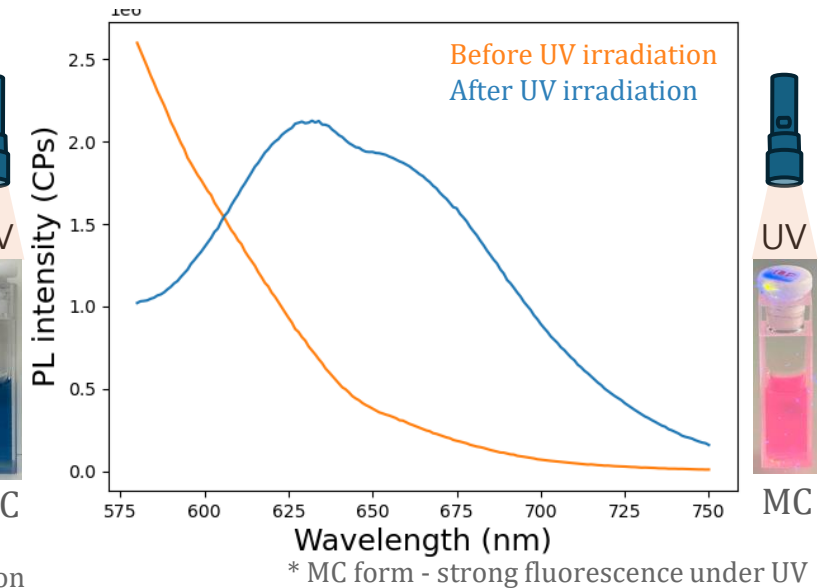
### ❖ UV-Vis absorption & PL @QDs-polymer



### ❖ UV-Vis absorption @SP-PMMA



### ❖ PL spectra @SP-PMMA



***Thank you for your attention.***

***Jungmin Park***

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