Francis Lawrence Hong

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RESEARCH INTERESTS

- Analysis of reflectivity and absorption in multilayer structures using polarized light
- Microstructural changes in materials for biosensing or photonics

EDUCATION

University of Illinois, Urbana-Champaign (UIUC) Aug. 2024 – May 2026 (expected)
M.S. in **Materials** Science & Engineering GPA: 3.94/4.0

Korea Aerospace University Mar. 2013 – Feb. 2015
B.S. in Materials Science & Engineering GPA: 3.91/4.5

Yonsei University (**transfer**) Mar. 2016 – Feb. 2019
B.S. in Materials Science & Engineering GPA: 3.66/4.3

Yonsei University (**2nd bachelor's degree, not completed)** Mar. 2022 – May 2024
B.S. in Mechanical Engineering

University of California, Berkeley (**exchange student**) Jan. 2023 – May 2024
Major in Physics GPA: 4.0/4.0

Total physics course GPA: 3.96/4.3

RESEARCH EXPERIENCE

Graduate Researcher

- **UIUC** Sep. 2024 – Present

  Biomaterials, Optics, and Neuroengineering Laboratory

  Advisor: Yuecheng Peter Zhou

  Project: Computational modeling of optical reflectivity for measuring action potentials in neurons

  - Implemented **transfer matrix method (TMM)** to model reflectivity in multilayered device with anisotropic PEDOT:PSS using light across 400–1100 nm
  - Applied **MATLAB particle swarm optimization** to extract and optimize real (n) and imaginary (k) refractive index components of PEDOT:PSS based on mean squared error between simulated reflectivity and ECORE-measured s- or p-polarized reflectivity
  - Calculated voltage- and wavelength-dependent **extinction coefficients** of PEDOT:PSS and developed Python tool to generate spectra from UV–Vis absorption data, achieving **<12% error at 561 nm and 255 mV**
  - Synthesized physiological Tyrode's solution for maintaining tissue environments

- **Measured absorption spectra** of PEDOT:PSS films using UV-Vis spectroscopy
- **Engineered PEDOT:PSS thin films** with controlled thicknesses (30 – 240 nm) via spin-coating and polymerization
- **Determined thickness** of PEDOT:PSS using profilometer
- **Performed chicken dissection** to prepare biological samples
- **Designed and fabricated custom experimental tools** for cell recording experiments and chemical synthesis using **FUSION 360** CAD software

Undergraduate Research Assistant

- **University of California, Berkeley**

1) Quantum Sensing Laboratory, Department of Chemistry

Advisor: Ashok Ajoy Mar. 2023 – Aug. 2023

Project: Using novel techniques to achieve high ODMR contrast to analyze magnetic properties of materials

- Adjusted laser power & frequency to find optimal ODMR contrast
- Used pulsed laser and microwave to modulate electronic transitions
- Employed Fusion 360 to create frames for optical devices and furnaces for pentacene-doped p-terphenyl synthesis
- Utilized Python to plot graph based on data

2) *Ultrafast Nano-Optics Group, Department of Physics*

Advisor: Feng Wang Sep. 2023 – May 2024

Project: Investigating type-II band alignment and interlayer exciton dynamics through gate-tunable optical measurements

- Exfoliated two-dimensional materials such as graphene, transition-metal dichalcogenide (TMD), and hexagonal boron nitride (hBN)
- Fabricated dual-gated $MoSe_2/WS_2$ heterostructures to induce electric-field-tunable type- II band alignment , enabling controlled study of interlayer exciton dynamics
- Fabricated van der Waals heterostructures by transferring hBN-encapsulated WS_2/ WSe_2 stacks onto trilayer graphenes over micro-cavities
- Used photolithography and gold evaporation chamber to fabricate circuit connected to device

[Presentation Link]

- **Yonsei University**

1) Nanopolymers Laboratory, Department of Materials Science and Engineering

Advisor: Cheolmin Park Sep. 2017 – Dec. 2017

Project: Design & manufacture of new TENG (triboelectric nanogenerator) device

- Transformed dielectric (polystyrene) into powder by ball milling to increase surface area in contact with aluminum (Al) metal
- Deposited Al onto PET substrate using Al vapor deposition; removed tape from plate to create cross-shaped figure

[Presentation link]

2) *Materials Characterization Laboratory, Department of Material Science and Engineering*
Advisor: Hyungho Park Sep. 2018 – Dec. 2018

Project: Synthesizing piezoelectric material, $BaTiO_3$

- Synthesized $BaTiO_3$ through controlled chemical processes using laboratory equipment such as two-neck flasks, burettes, beakers, condensers, magnetic stirrers, hot plates, centrifuges, and dryers

HONORS & AWARDS

- High Honors, Fall Semester, 2017
- Merit-based Scholarship, Fall Semester, 2022

SCHOLARSHIP (PLANNED APPLICATIONS)

- Graduate Fellowships for STEM Development (GFSD), due January 15th, 2026
- National Science Foundation Graduate Research Fellowship Program (NSF GRFP), 2027 cycle
- National Defense Science and Engineering Graduate Fellowship (NDSEG), 2027 cycle

OTHER ACTIVITIES

- **Military Service (Ground Force)** **Aug. 2019**
  - Served in Army Chemical Corps, trained in chemical and biological defense operations
- **SCC** **Sep. 2022 – Dec. 2022**
  - *Academic/Research Club in Yonsei University's Department of Physics*
  - Participated in weekly discussions on current physics research topics
  - Presented on twistronics: superconductivity in bilayer graphene twisted at 1.1° "magic angle"
- **CCC (Campus Crusade for Christ)** **Mar. 2016 – June 2019**
  - Mentored two undergraduate students, providing academic and personal guidance

- Participated in Bible study and served as piano accompanist for one semester

- **Orchestra Club** **Mar. 2016 – Mar. 2017**
  - Served as orchestral pianist for semester concerts, blending timbre with orchestra in major symphonic works

- **Peace Tour Volunteer work** 10 days. **Aug. 2018**
  - Collaborated with Japanese university students near Korean DMZ on volunteer farm work and peace discussions

- **Hiking Club joint with Ewha University** **Mar. 2022 – Dec. 2022**
  - Climbed local mountains and participated in two-day hiking trip to Seoraksan (1,707 m)

- **English Corner at UIUC** **June 2025 – Present**
  - Participated in weekly meetings to meet international students and attended field trips to local cultural sites