AI and Collaborative Mentorship for Sustainable Research and Innovation in APEC

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Symposium on Artificial Intelligence
"AI for a Sustainable Tomorrow: Policy Innovations for APEC and the Philippines"

June 11, 2025, Pilar Herrera Palma Hall
University of the Philippines Diliman

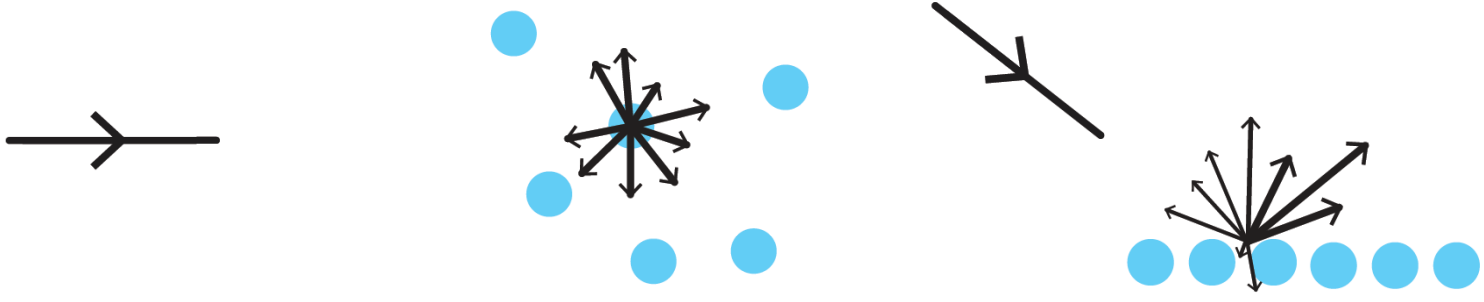
Outline

- Review of optical effects
  - Light scattering and absorption
  - Imaging systems
- Application in Wildlife Biology
- Application in Dental Materials
- Application in Agriculture
- Application in Dermatology

- Exercise: Exploring Possible Collaborations

What is scattering of light?

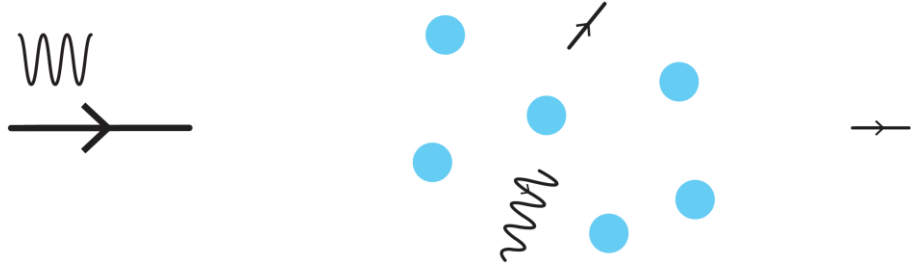
Optical process where light incident on particles changes its path, generally, in random directions



Optics, 5th ed, E. Hecht, 2017.

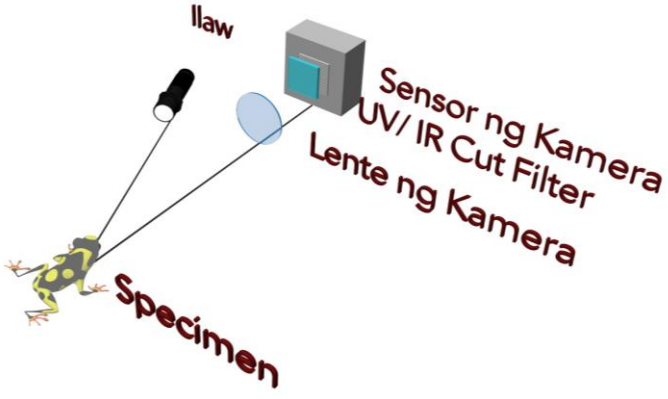
What is absorption of light?

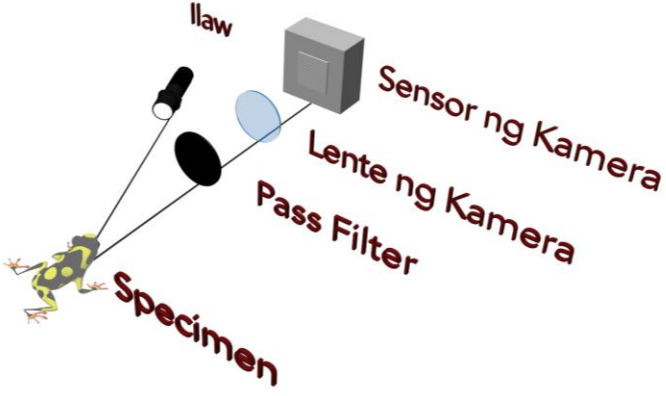
- **Optical process where a material transforms incident light energy into heat, or other color**



Optics, 5th ed, E. Hecht, 2017.

Imaging Systems



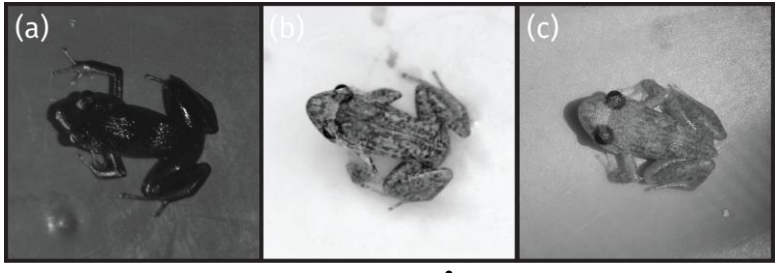


Ordinary Camera

Modified Camera

- Cut filter removed
- Pass filter inserted
- Special source used

Enhanced Characterization of Frogs Using Multi-Wavelength Imaging

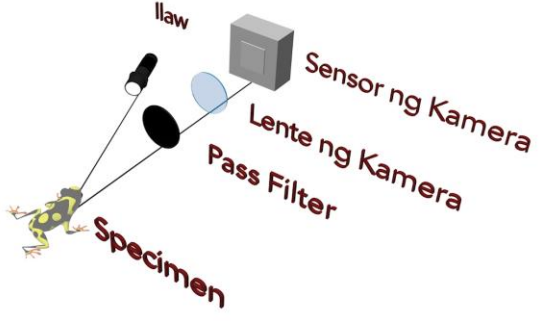


WL Imaging

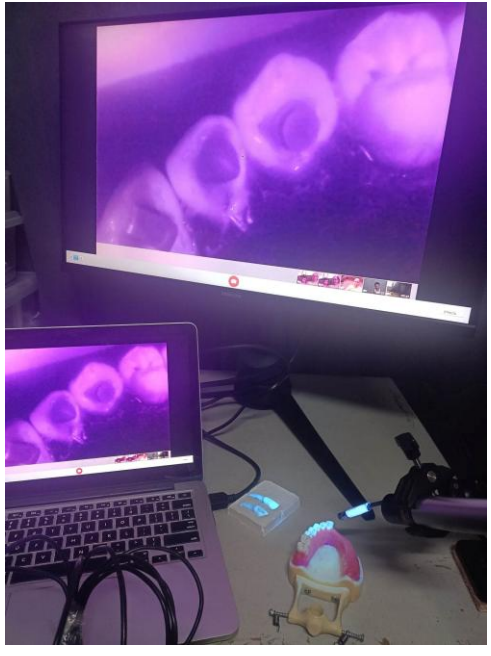
UV Imaging IR Imaging

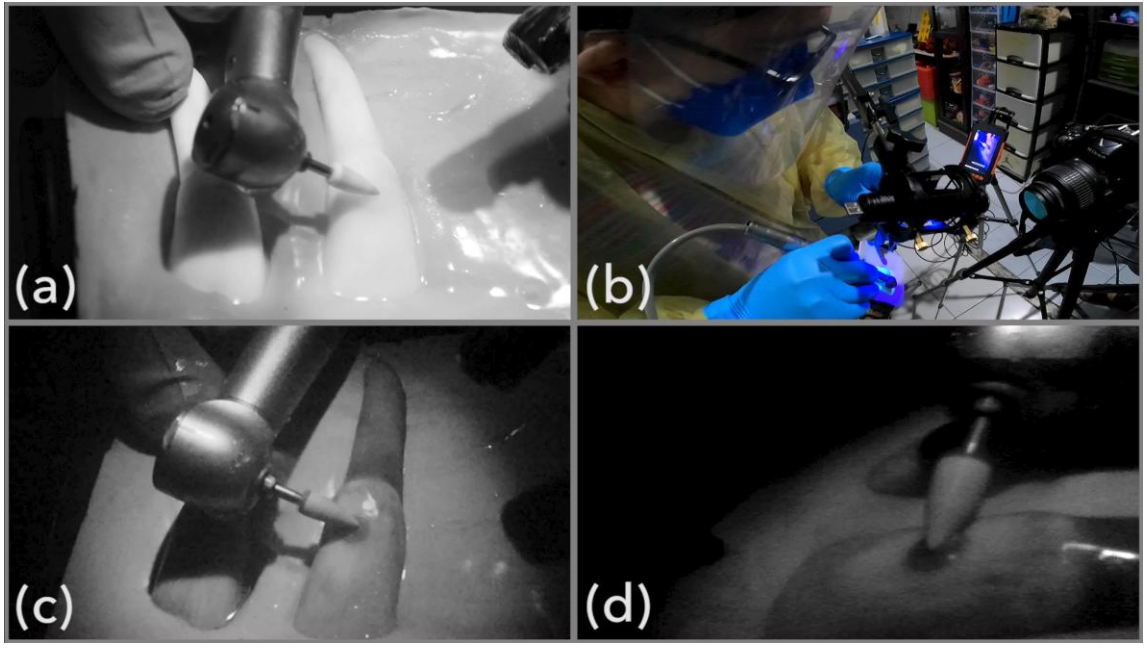
https://youtu.be/ozdB9L7Cjb4

Bioimaging under UV, Visible, and Infrared Light Using a Modified Camera



Enhanced Removal of Dental Composite Remnants Using Multi-Wavelength Imaging in Miniaturized Endoscope to Fit the Oral Cavity





*A Carlos, C Laureta, and PF Almoro, “Enhanced Detection of Orthodontic Attachment Remnants Using UV Absorption Imaging”, 35th Annual Scientific Meeting, IADR-SEA Division, December 9, 2021, Hong Kong, online.

Early Plant Stress Diagnosis Using Multi-Wavelength Imaging

UV

VISIBLE

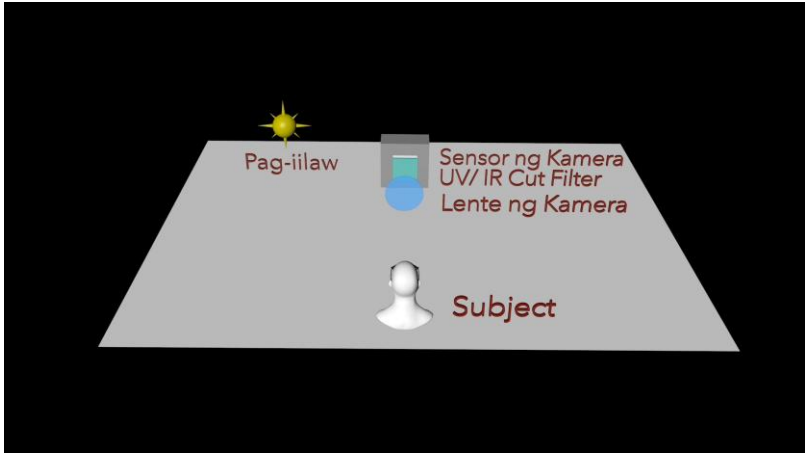
IR

UV - IR

Evaluation of Commercial Sunscreen Effectiveness Using Multi-Wavelength Imaging

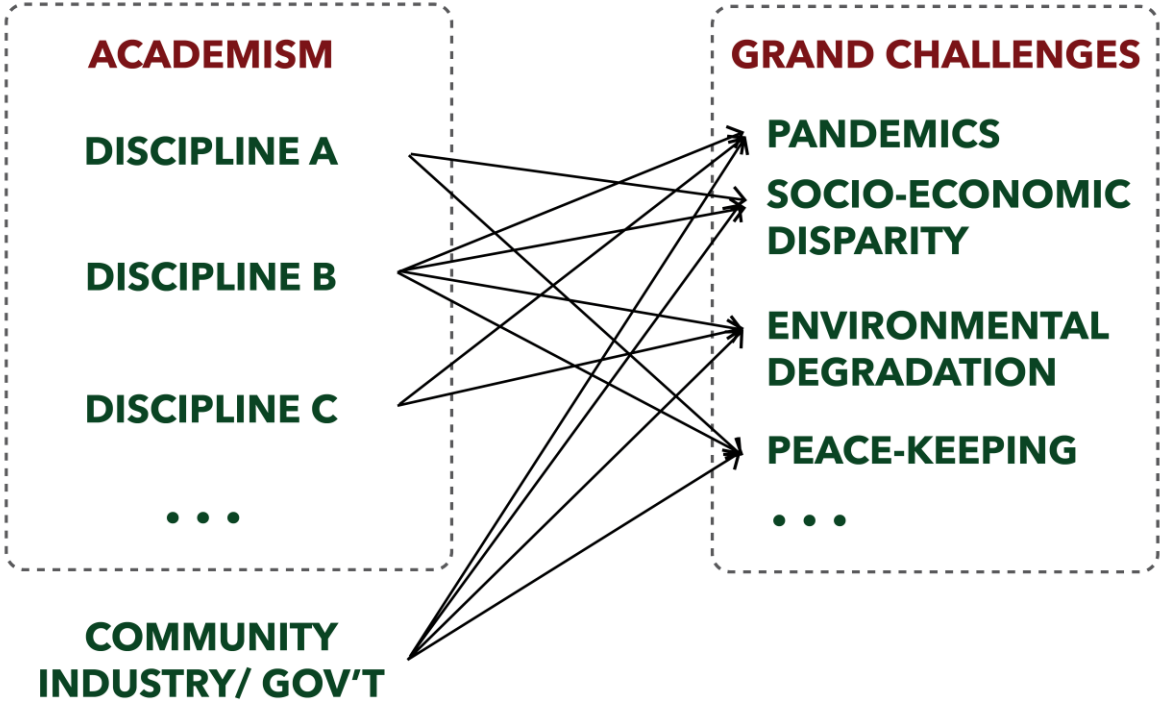
Transparent: NOT effective

Dark: Effective



https://youtu.be/rWoHtZDK4_w

HOW CAN THE UNIVERSITY OVERCOME THE GAP BETWEEN "ACADEMISM" AND THE "GRAND CHALLENGES"?



STRATEGY: ENHANCE INTER/ TRANSDISCIPLINARY COLLABORATIONS FOR INNOVATIVE SOLUTIONS

Types of Collaboration

- **Multidisciplinary:** Disciplines work together on a common problem, each maintaining its own perspective.

- **Interdisciplinary:** *Integrates* knowledge and methods from various disciplines to solve a problem or create a design.

- **Transdisciplinary:** *Transcends* disciplinary limits, often involving non-academic stakeholders, providing a broader perspective.

Where do we look?

- **Individual?**
- **Perhaps, research programs…**

Thematic Areas: Wood Transformation

1. Mapping Moisture Migration During Seasoning and Drying Using Multiwavelength Imaging

Collaborative Theme: Apply IR thermography and hyperspectral imaging to study how moisture moves through wood during drying or seasoning.

Innovation: Real-time imaging of moisture movement for energy-efficient drying systems.

Community Benefit: Increases productivity and income for small- to medium-scale lumber processors by reducing drying time and energy consumption.

2. Non-Destructive Testing (NDT) of Wood Using Multiwavelength Imaging

Collaborative Theme: Develop advanced NDT protocols using infrared (IR), ultraviolet (UV), and hyperspectral imaging to assess internal defects, moisture gradients, and decay in wood.

Innovation: Real-time, non-invasive diagnostics of wood integrity.

Community Benefit: Reduces construction risk in housing and public buildings; helps local carpenters and engineers ensure material safety.

3. Monitoring Wood Modification and Seasoning Processes Using Multiwavelength Imaging

Collaborative Theme: Use multiwavelength thermal and spectroscopic imaging to monitor chemical and structural changes during thermal treatment or chemical modification of wood.

Innovation: Optimized control of wood processing for enhanced durability and performance.

Community Benefit: More stable and longer-lasting wood products for local builders, reducing material waste and cost.

4. Detection of Fungal Decay and Infestation in Wood Structures Using Multiwavelength Imaging

Collaborative Theme: Develop early-warning systems using UV fluorescence and shortwave IR imaging to detect biological degradation in heritage wood and building components.

Innovation: Portable, affordable devices for preemptive preservation of wooden artifacts and homes.

Community Benefit: Safeguards cultural heritage; helps property owners and heritage caretakers extend the life of wooden assets.

5. Documentation and Preservation of Wooden Cultural Artifacts Using Multiwavelength Imaging

Collaborative Theme: Integrate imaging techniques for non-invasive documentation, damage mapping, and authentication of historical wood items.

Innovation: Multispectral documentation tools for use by conservators and museums.

Community Benefit: Protects cultural identity and heritage through modern science.

Activity: "Collaborative Mentoring"

- **Objective:** Illustrate collaborative mentoring through collective ideation
- **Materials Needed:** Polling App for displaying and voting on ideas
- **Instructions:**
  - Divide participants into 3-member groups.
  - Each group brainstorms a proposal, centered multiwavelength imaging.
  - Submit proposal title via Polling App after 2 min., format: {Grp. Name: Title…}
  - General Elements of a Title: Outcome or Main Finding, Topic, Method, Context
  - Participants vote on the most innovative and feasible ideas using Polling App; the highest-voted group wins.