

**Instructor** Professor Shane Ardo (ardo@uci.edu)  
*Office Hours: Mon. @ 8 – 9 am (all remote via Zoom, through and including M5/8)*

### Meeting Times

*Lecture:* T/Th @ 9:30 – 10:50 am in SSTR 101 (*no class on T4/11, Th4/13, Th5/4, Th5/11, Th5/18, T5/23; Zoom link should be used when feeling ill; video-recorded lectures available*)  
*Discussion:* Fri. @ 11 – 11:50 am in HICF 100N (*remote on F5/5, F5/19 via Zoom; no class on F4/14*)  
*(Presentations: Last three meeting periods (remote on T6/6, Th6/8, F6/9 via Zoom))*

### Course Objectives

- To understand and explain the theory behind fundamental photophysical and photochemical processes
- To be able to design, perform, troubleshoot, and analyze photochemical experiments and data
- To quantitatively and qualitatively assess problems, and empirical data from the peer-reviewed literature
- To summarize and explain seminal and recent photochemical peer-reviewed literature and processes

### Required Resources

Chemistry and Light by Paul Suppan (<https://books.rsc.org/books/monograph/1222/Chemistry-and-Light/>)  
ISBN: 978-0-85186-814-1; *plus supporting information from other textbooks*  
Peer-Reviewed Journal Articles and Additional Problems (<http://www.chem.uci.edu/~ardo/photochem.html>)

### Topics Covered (tentative)

- W1-2 Review+** (Förster cube, Square schemes, Schrödinger equation, Internal energy, Free energy, Chemical potential, Equilibrium, Solid-state physics, Continuity of mass, Mass action, Microscopic reversibility, Activation energy, Rate-determining step, Mass transfer / Transport, Steady state)
- W3-4 Thermal Reactions** (Eyring–Polanyi–Evans equation, Marcus–Hush theory, Transition-state character, Reorganization energy, Linear free energy relationships, Huang–Rhys factor, Tunneling, Superexchange, Outer/inner sphere, Robin–Day classification, Self-exchange reactions, Marcus cross relations, Butler–Volmer equation, Fermi’s golden rule, Marcus–Gerischer theory)
- W5-6 Photophysics** (Blackbody radiation, Photon properties, Conservation laws, Einstein coefficients, Jablonski diagram, Nuclear terms, Spin multiplicity, Internal conversion, Intersystem crossing, Thexi state, Kasha–Vavilov rule, Stokes shift, Franck–Condon principle, Transition dipole moment operator, Beer–Lambert law, Luminescence processes, Selection rules, Spin–orbit coupling, Heavy atom effect, E–k diagrams, Jortner energy gap law, Conical intersections, Energy transfer processes, Exciplex/Excimer, Photoluminescence spectroscopy, Inner filter effects, Emission quantum yield)
- W7-8 Photochemistry** (Excited-state electron/proton transfer, Förster cycle, Stern–Volmer static and dynamic quenching, Rehm–Weller equation, Diffusion-limited processes, Length/Time scales, Electromagnetic spectrum, Pump–probe transient spectroscopies, Statistical mechanics distributions, Detailed balance analysis, Photoelectrochemistry, Load line analysis)

### Grading (10% of lowest score will be dropped, leaving 90% for course grade determination)

- 30% *Synchronous Participation:* journal article reading and critical assessments  
20% *Asynchronous Exam A (24 hours; available Wed. 5/10 @ noon through Thurs. 5/18 @ noon)*  
30% *Asynchronous Exam B (24 hours; available Sat. 6/10 @ noon through Sun. 6/18 @ noon)*  
20% *Synchronous e-Presentation (~15 min per student; occurs during the last week of classes (Tues. 6/6, Thurs. 6/8, and Fri. 6/9))*

### Course Policies

Late assignments and make-up exams are not accepted, although *I will regrade exams upon specific request.*  
Add/Drop Info (use WebReg): <https://www.reg.uci.edu/calendars/quarterly/2022-2023/quarterly22-23.html>  
UCI Chemistry Enrollment-Related Questions: <https://www.chem.uci.edu/studentaffairs/>, or [chemistry@uci.edu](mailto:chemistry@uci.edu)  
UCI Laptop Requirements for Students: <https://www.oit.uci.edu/undergrads/laptop-requirements-students/>  
UCI Policy on Academic Integrity and Honesty: <https://aisc.uci.edu/policies/academic-integrity/>  
UCI School of Physical Sciences COVID-19 Student Resources: <https://uci.edu/coronavirus/students/>