Organic Materials for Non-Linear Optics

S&T Campaign: Materials Research
Photonics
Sensor Protection

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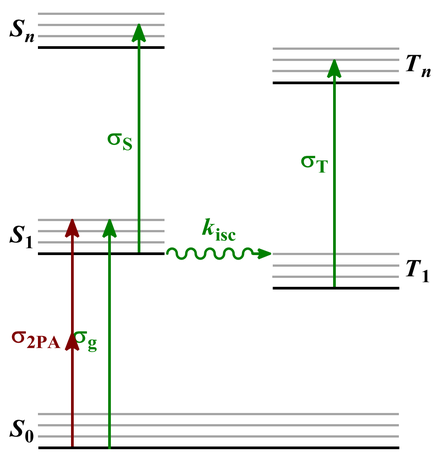
Research Objective

- **Characterize novel organic materials with tailored optical parameters.**
- **Synthesize both inorganic and organic materials that have large two-photon absorption and/or excited state absorption characteristics across a wide wavelength spectrum**



Five-level model for excited-state absorption

Challenges

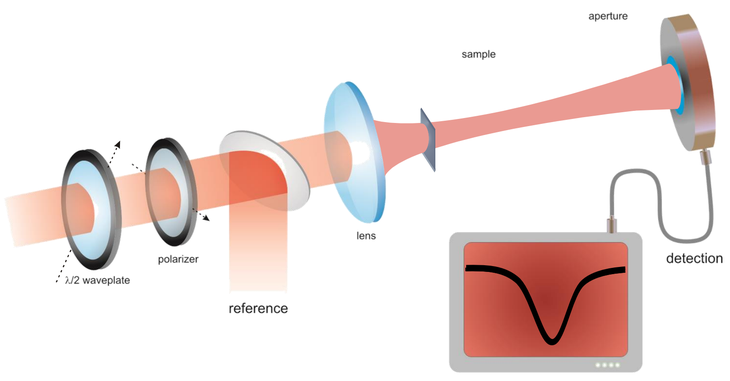
- **No singular material exists that encompasses broadband nonlinearities required for wide array of Army systems**
- **Materials need to exhibit large two-photon absorption and/or excited-state absorption cross sections in multiple wavelength bands**
- **Materials must be color neutral for Army systems.**

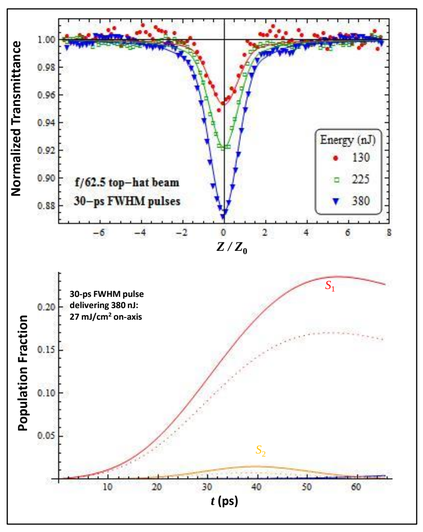
ARL Facilities and Capabilities Available to Support Collaborative Research

- **Wavelength tunable lasers at different pulsewidth regimes, fs, ps, ns**

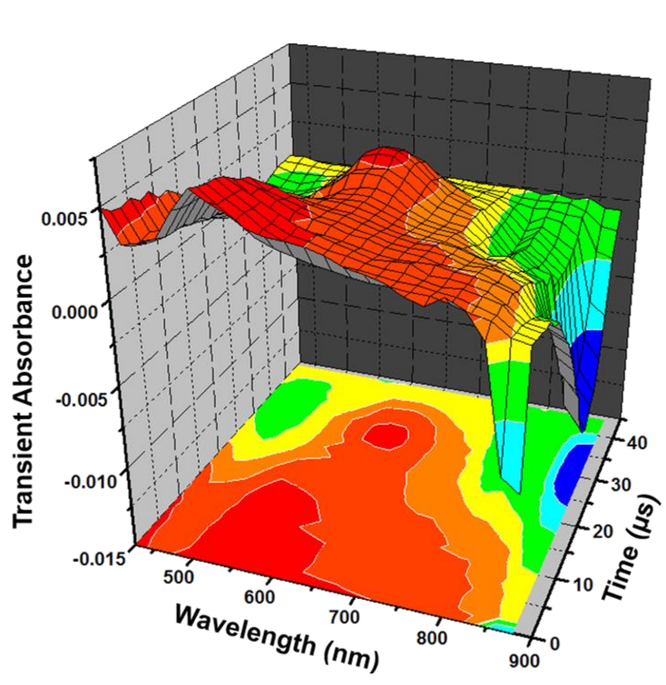
	Wavelength Range (nm)	Pulse-width (FWHM)
Ekspla (1064nm, 1 J)	400 – 2400	3 – 5 ns
Ekspla (1064nm, 50 mJ)	400 – 2400	25 ps
Ekspla (532nm, 2 mJ)	N/A	10 ns
FemtoLasers (780nm, 500 mW)	N/A	9 fs
Spectra-Physics (800nm, 3.5 mJ)	285 – 2800	100 fs
Pranalytica (QCL, 100mW)	8.1 µm - 12 µm	Quasi-CW

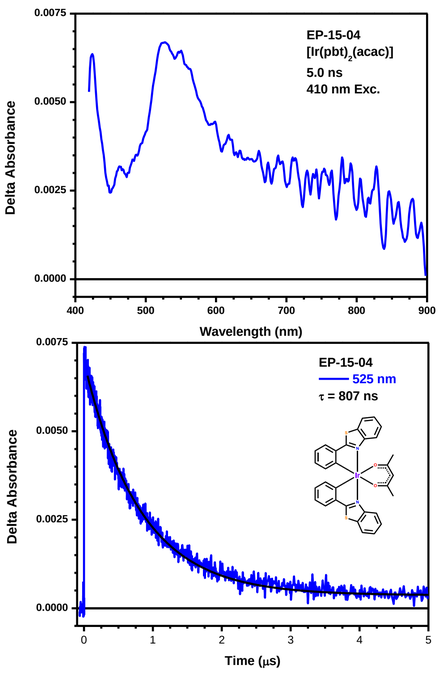
- **Z-scan technique to measure non-linear absorption and refraction.**



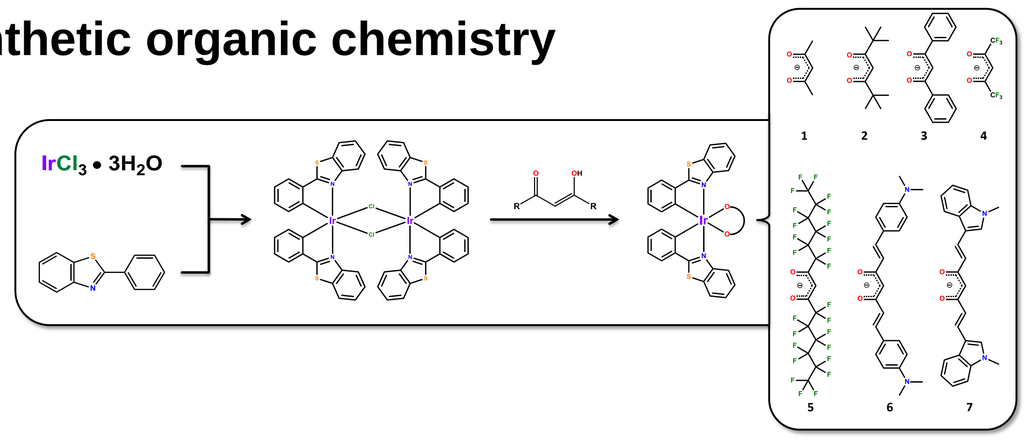


- **Visible and near-infrared transient absorption spectrometers to measure excited-state dynamics.**

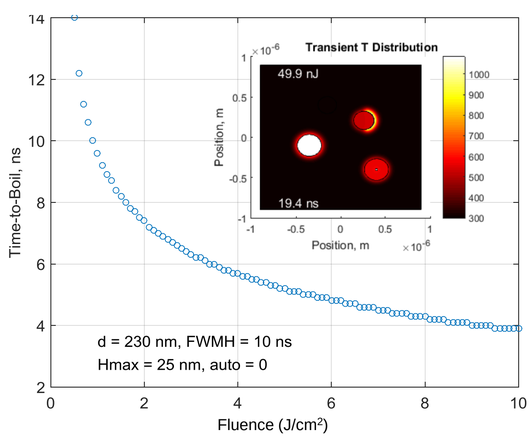




- **UV-Vis spectrometer to characterize linear absorption spectrum.**
- **Synthetic organic chemistry**



- **Thermal, electrical and optical modelling of materials containing nanoparticles**
- **Finite element analysis, finite difference frequency/time domain simulations**



Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- **Density Functional Theory (DFT) modelling of inorganic compounds and Time-Dependent DFT (TD-DFT) of molecular excited states.**
- **Cyclic voltammetry (CV) and spectroelectrochemical characterization.**