THURSDAY, April 15, 2021: 3:00PM – 4:30PM EST

Lab Tours

L1 **Title:** Lightguide Based AR Displays
Group: Liquid Crystal Displays
PI: Dr. Shin-Tson Wu
Presenter: Kelly Yin
Description: We demonstrate a lightguide Augmented Reality (AR) display based on reflective polarization volume grating (PVG). In this lab tour, we will first give an introduction to the background and then dive into the principle of PVG. In addition, we will show the fabrication process and the samples of the PVG. Finial, a short video about our AR demo will be present.

L2 **Title:** HDR Head-up Display
Group: Liquid Crystal Displays
PI: Dr. Shin-Tson Wu
Presenter: Winnie Zou
Description: We demonstrate a full-color high dynamic range head-up display (HUD) based on a polarization selective optical combiner, which is a three-layer cholesteric liquid crystal (CLC) film. Our demo shows that the dark state of the new HUD is lowered by 3x and bright state is boosted by 2.5x. By applying antireflection coating to the optical components and optimizing the degree of polarization, our simulation results indicate that the dynamic range can be improved by ~50x.

L3 **Title:** High Energy Mid-IR Laser for Attosecond Physics
Group: IFAST
PI: Dr. Zenghu Chang
Presenter: Jialin Li
Description: IFAST Group has been working on generating bright attosecond sources in soft X-ray range. In this recently established lab, we are building up a novel mid-infrared source (4.1 μm) via OPA and Multi-Stage CPA with the intention of generating KeV high-flux isolated attosecond pulses.

L4 **Title:** Femtosecond Nonlinear Optics
Group: Nonlinear Optics
PI(s): Dr. Eric Van Stryland, Dr. David Hagan, and Dr. M.J. Soileau
Presenter: Nicholas Cox
Description: The Nonlinear Optics Group conducts research on a variety of nonlinear optical effects, materials, and devices including nonlinear interactions in waveguides, nonlinear signal processing, optical power limiting, and characterizing materials response at picosecond and nanosecond scales. The group has invented several new techniques for characterizing the nonlinear optical properties of materials, e.g., Z-scan, white-light continuum Z-scan, and nonlinear Beam Deflection and has pioneered advances in the understanding of the nonlinear interactions.

L5 **Title:** Living on the Oxygen K-edge; Attosecond Physics
Group: IFAST
PI: Dr. Zenghu Chang
Presenters: Quynh Le and Chase Geiger

Description: The FAST group uses attosecond laser pulses to observe vibrational, rotational, and electronic transitions in atoms and molecules on attosecond, femtosecond, and picosecond timescales. We will discuss recent laser system improvements and potential new experimental applications, such as for studying electron transport in organic photovoltaic solar cells and chemical sensors.

L6 **Title:** Few-Cycle Pulses Generation and Interaction with Optical Materials
Group: Ultrafast Laser Processing
PI: Dr. Xiaoming Yu
Presenter: Dr. Yingjie "Leo" Chai
Description: Compression of ultrashort laser pulses from 170 fs down to 10 fs is achieved in a custom-built multi-plate continuum (MPC) system. These few-cycle pulses, measured by frequency-resolved optical gating (FROG), are used in the study of laser-induced damage and the formation of ripples in ZnSe and silicon.

L7 **Title:** Generation of Femtosecond Laser Bursts In A Folded Michelson Interferometer
Group: Ultrafast Laser Processing
PI: Dr. Xiaoming Yu
Presenter: Boyang Zhou
Description: Sixteen replicas of an ultrashort laser pulse are produced in a 4-fold Michelson interferometer. We will examine the setup, explain how to control the timing and envelope of each "burst", and showcase experimentally measured bursts that can be used in laser materials processing and the generation of THz radiation.

L8 **Title:** Multiphoton Lithography with Spatial Beam Shaping
Group: Ultrafast Laser Processing
PI: Dr. Xiaoming Yu
Presenter: He Cheng
Description: We have built a multiphoton lithography system to fabricate micron-sized structures additively through two-photon polymerization. The system consists of a femtosecond laser source, a spatial light modulator, a 4-f optical relay, motion control, and an in-situ camera. Spiral-shaped structures are fabricated using the superpositions of high-order Bessel modes.

L9 **Title:** Broadband High-Resolution Molecular Spectroscopy in A Mid-IR Range
Group: Mid-Infrared Combs
PI: Dr. Konstantin L. Vodopyanov
Presenter: Dmitrii Konnov
Description: Mid-infrared spectroscopy offers unparalleled sensitivity for the detection of trace gases, solids, and liquids, based on the existence of strongest tell-tale vibrational bands in the 3-12 μm band. Our dual-comb spectroscopy system is moving-parts-free and provides fast data acquisition combined with superior spectral resolution and broadband spectral coverage, simultaneous detection of tens trace molecular species in a gas mixture, including isotopologues, with part-per-billion sensitivity.

L10 **Title**: Nonlinear Material Characterization for Mid-Infrared Generation
Group: Mid-Infrared Combs
PI: Dr. Konstantin L. Vodopyanov
Presenter: Taiki Kawamori
Description: The Mid-Infrared Combs Research Group develops groundbreaking techniques for producing mid-infrared laser sources and explores its diverse applications. The areas of research embrace generation of ultra-broadband frequency combs and high-power coherent source in the mid-infrared, and Fourier-domain mid-Infrared spectroscopy including dual-comb spectroscopy, ultrasensitive molecular detection, and spectroscopic study of dynamic processes. In this tour, the study of nonlinear optical properties in novel crystals for mid-infrared generation will be presented.

L11 **Title:** Super-Resolution Fluorescence Microscopy
Group: Optical Nanoscopy
PI: Dr. Kyu Young Han
Presenter: Chun Hung "Crystal" Weng
Description: The optical nanoscopy group focuses their research on the development and applications of novel optical tools to study essential problems in biology. Particularly, we are interested in fluorescence imaging techniques including two-photon excitation fluorescence microscopy via ultrafast semiconductor laser, single-shot volumetric image, light-sheet fluorescence microscopy, Nanobody-based SiMPull assay, etc. These techniques have enabled us to investigate subcellular structures as well as the interactions and dynamics of biomolecules in living-cells and tissues non-invasively.

L12 **Title:** Microstructured Optical Fiber and Devices
Group: Microstructured Fibers and Devices
PI: Dr. Rodrigo Amezcua Correa
Presenter: Juan Carlos Alvarado Zacarias
Description: Optical fibers are present in many different applications, ranging from telecommunications, fiber lasers for medical/industrial applications and sensing, to name a few. In this Lab tour we will showcase our fiber fabrication facilities for specialty fibers, along with the fabrication of photonic lantern devices for space division multiplexing technologies. We will also present different setups for the characterization and study of different fibers and fiber devices.