Principles and Application of Time-Resolved Spectroscopy

Wednesday, May 20th, 2009 (8:00 AM to 3:00 PM): *CERMACS09 Workshop and Open House*, Center for Chemical Dynamics, Department of Chemistry, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106.

Sponsored by the Center for Chemical Dynamics, CWRU; Coherent, Inc.; IMC/Photo-Sonics, Inc., Optronis Streak Cameras; Spectra Physics, Newport, Corp.; and Ultrafast Systems, LLC.

I. Talk Presentations, Room Clapp 305, 8:00-10:55 AM

8:00-8:25 AM

1. **Femtosecond Transient Absorption: The Pump-Probe Technique.** Alexei Gusev, Ultrafast Systems LLC (20-25 min.)

Main principles, capabilities, and limitations of the technique will be discussed. A description of the instrumentation involved and data samples will also be presented.

8:30-8:55 AM

2. **Ultrafast Lasers as Enabling Tools: From Terahertz Spectroscopy to Attosecond Physics.** Marco Arrigoni, Director of Marketing, Scientific Market Segment, Coherent Inc. (20-25 min.)

Ultrafast lasers are the only tools that enable observation of atomic, molecular or lattice dynamics on a subpicosecond scale. The availability of femtosecond and even sub-femtosecond pulses of light over a wavelength range of a few nanometers up to 20 microns and into the Terahertz region goes hand in hand with the development of newer and more sophisticated techniques for time-resolved spectroscopy studies. In this presentation we will describe several variations of basic time-domain and pump & probe spectroscopy techniques, including THz spectroscopy, attosecond spectroscopy, time and frequency resolved studies and how these drive the requirement for advanced laser sources.

9:00-9:25AM

3. **Time-Resolved Luminescence Spectroscopy: Fluorescence Up-Conversion and Time-Correlated Single Photon Counting (TCSPC) Methods.** Alexei Gusev, Ultrafast Systems LLC (20-25 min.)

Main principles, capabilities, and limitations of the technique will be discussed. A description of the instrumentation involved and data samples will also be presented.

9:30-9:55 AM

4. **Scientific Lasers Systems.** Alan M. Del Gaudio, Field Sales Engineer, Mid-Atlantic and Ohio Valley Regions, Spectra-Physics/Newport Corporation (20-25 min.)

The talk will outline various technology areas of scientific lasers offered by the Newport Corporation's Spectra-Physics laser division. These include High Resolution CW [ring] lasers,

Tunable nanosecond systems, Optical Parametric Oscillators and Dye lasers as well as Ultrafast femtosecond and picosecond systems ranging from high repetition rates to high energy platforms.

10:00-10:25 AM

5. **Streak Camera Imaging Technology: Operation of the Optronis Optoscope SC-10.** Frank Kosel, IMC/Photo-Sonics, Inc., Representing Optronis, GmbH (20-25 min.)

We will discuss the basic operations and theory of Streak Tubes, Streak Imaging, with discussions on Technical Time Resolution, Time Windows, Sensitivity and optimizing data from the streak camera. We will also discuss the setup and operation of the Optronis Optoscope SC-10 Streak Camera System.

10:30-10:55 AM

6. **Ultrafast Spectroscopy Applications.** Alan M. Del Gaudio, Field Sales Engineer, Mid-Atlantic and Ohio Valley Regions, Spectra-Physics/Newport Corporation (20-25 min.)

The talk provides details for a number of experimental kits developed by the Technology and Application Center (TAC) at Newport Corporation using many of the company's products: Optical laser-based systems including; Ti/Sapphire Oscillators and Amplifiers, Optical Parametric Amplifiers and the Helios Transient Absorption Spectrometer are used for TAC experiments encompassing: (1) Amplitude and Phase Characterization; (2) Four Wave Mixing Experimental Setup; (3) Broadband Supercontinuum Generation Solution; and (4) Coherent Anti-stokes Raman Spectroscopy.

II. Open House and Hands-On Demonstrations, Millis Science Center, 11:00 AM to 1:00 PM

The attendees of the workshop will be divide in groups of 5-7 persons and will have the opportunity to participate in a open house and hands-on demonstrations that will given in the Center for Chemical Dynamics in the Department of Chemistry at Case Western Reserve University. The center consists of three contiguous laboratories located in the basement of the *Millis Science Center*, rooms *G08*, *G13*, and *G14*. Each group will rotate between these three laboratories, where the hands-on demonstrations on different time-resolved setups will be given. Each demonstration will take 20-30 minutes. The attendees will also have the opportunity to ask questions and obtain information about the latest products from the representatives of Coherent, Spectra Physics/Newport, Optronis Streak Cameras, Ultrafast Systems, and others.

Room G08: *Femtosecond Transient Absorption. The Pump-Probe Technique*, Alexei Gusev, Christian Reichardt, and Chengwei Wen. (30 min.)

Description: Presentation and description of a femtosecond transient absorption apparatus and its extension to the microsecond and millisecond time domain. Practical demonstration of the theoretical principles, data acquisition and analysis as described in the preceding talk.

Room G13: *Time Correlated Single Photon Counting (TCSPC)*, Brendan Meany and Alan M. Del Gaudio. (30 min.)

Description: Presentation and description of a TCSPC apparatus: data acquisition and analysis as described in the preceding talk.

Room G14: *The Streak Camera System*, Frank Kosel, Greg Taft, Doane Tennyson, and Mark Chuang. (30 min.)

Description: The use of streak camera system to measure time-resolved emission spectroscopy.

III. Get Together, Room Millis 123, 1:00 PM to 3:00 PM

A light lunch (pizza and soft drinks) will be available in Clapp 305 for the attendees of the workshop. This will be a great opportunity to informally talk to the representatives of the companies that are sponsoring the workshop, and interact with students and other faculty members chairing common areas of research interest.

IV. Directions

The Center for Chemical Dynamics is located in Millis Science Center, 2074 Adelbert Road, Case Western Reserve University (http://www.case.edu/visit/map/flash/). Advance reservation is appreciated. Please, contact Prof. Carlos E. Crespo-Hernández at 216-368-1911 or at carlos.crespo@case.edu to reserve a space for the workshop.

Renaissance Hotel to Millis Science Center: Take the Health Line down Euclid Avenue. The all-day pass is $4.50 (you will need exact change). The drop off point is east of Adelbert Road on Euclid Avenue (see map below). From there it's a 5 minute walk to Millis Science Center. Walk west on Euclid Avenue, cross at Adelbert Road, and walk up Adelbert to the Millis Science Center Bldg. (http://www.case.edu/visit/map/flash/).

The Health-Line Bus Schedule