PRINCETON-CEFRC-CI

2016 SUMMER SCHOOL

JUNE 19 – JUNE 24, 2016

https://www.princeton.edu/cefrc/

Combustion Physics
Prof. Chung K. Law, Princeton University

Chemical Kinetic Modeling for Combustion
Prof. Henry J. Curran, National University of Ireland, Galway

Combustion Dynamics
Prof. Sébastien M. Candel, École Centrale Paris

Advanced Laser Diagnostics in Combustion Research
Prof. Mark A. Linne, University of Edinburgh

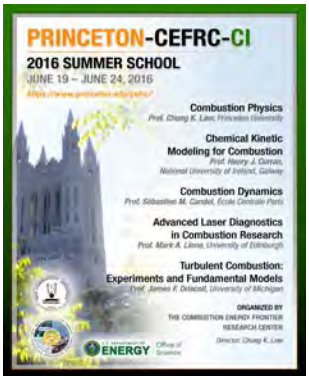
Turbulent Combustion: Experiments and Fundamental Models
Prof. James F. Driscoll, University of Michigan

ORGANIZED BY

THE COMBUSTION ENERGY FRONTIER RESEARCH CENTER

Director, Chung K. Law

U.S. DEPARTMENT OF ENERGY | Office of Science



Our Mission

To provide the next generation of combustion researchers with a comprehensive knowledge in the technical areas of combustion theory, chemistry, experiment, computation and applications.

The 2016 Session

The 2016 **Princeton-CEFRC-Combustion Institute** Summer School on Combustion, scheduled for **June 19 to June 24, 2016,** will offer the following courses: (1) Combustion Physics; (2) Chemical Kinetic Modeling for Combustion; (3) Combustion Dynamics; (4) Advanced Laser Diagnostics in Combustion Research; & (5) Turbulent Combustion: Experiments and Fundamental Models.

Application Materials

Submit application at www.princeton.edu/cefrc by March 18, 2016. Acceptances will be communicated by April 1, 2016.

Program Dates

Arrival & Welcome Dinner: Sunday, June 19, 2016; dinner at 6:30pm
Class Schedule: Monday, June 20, 2016 to Friday, June 24, 2016
Celebration Dinner: Thursday, June 23, 2016
Departure/Check Out: Friday, June 24, 2016

Course Description

Combustion Physics Lecturer: **Prof. Chung K. Law**, Princeton University

This course presents combustion as a rigorous scientific discipline that is characterized by the canonical formulation of the theoretical foundation; the strong interplay between experiment, theory, and computation; and the description of combustion phenomena from the unified viewpoint of fluid mechanics and chemical kinetics. The course consists of three parts, namely: (1) the basic scientific components of chemical thermodynamics, chemical kinetics and transport phenomena; (2) the foundational concepts of premixed and diffusion flames, the limit phenomena of ignition, extinction and flame stabilization, and the aerodynamics of flames; (3) combustion in turbulent, boundary-layer, two-phase, and supersonic flows.

Chemical Kinetic Modeling for Combustion Lecturer: **Prof. Henry J. Curran**, National University of Ireland, Galway

This course provides an introduction to the development of detailed chemical kinetic mechanisms to describe the oxidation of hydrocarbon and oxygenated hydrocarbon fuels. It includes a tutorial on the importance of thermochemistry and the use of group additivity to estimate/calculate thermodynamic parameters for species using the THERM program. There will be a detailed discussion on the important general classes of reactions associated with fuel oxidation and the calculation/estimation of the important rate constants associated with these reactions. The importance of good experimental data which are used as validation targets will also be discussed.

Combustion Dynamics Lecturer: **Prof. Sébastien M. Candel**, École Centrale Paris

This course provides an introduction to the analysis of combustion dynamics problems. It includes a tutorial on acoustics and on early combustion instability models and deals with perturbed flame dynamics, flame transfer functions, nonlinear flame dynamics, flame describing function methods, swirling flames, spray flames, azimuthal coupling in annular combustors, passive and active control of instabilities. Concepts will be illustrated with experimental data and numerical simulations.

Advanced Laser Diagnostics in Combustion Research Lecturer: **Prof. Mark A. Linne**, University of Edinburgh

This course will begin by introducing the basic topics underlying laser diagnostics; including development of commonly used expressions from the equation of radiative transfer, selected topics in physical optics, an introductory explanation of quantum mechanics and molecular structure, transitions, transition strengths and transition line shapes. Following that a selection of diagnostics is presented in the same context. Techniques to be discussed will include absorption, absorption tomography, cavity enhanced techniques, laser induced fluorescence, spontaneous Raman scattering, and new approaches to coherent anti-Stokes Raman spectroscopy. The class will conclude with examples from combustion engine research.

Turbulent Combustion: Experiments and Fundamental Models Lecturer: **Prof. James F. Driscoll**, University of Michigan

Simple stretched flamelet ideas are first discussed to understand premixed turbulent flames, leading to the concepts of turbulent burning velocity and flame surface density. Modern ways to model and measure these quantities are reviewed for different regimes when broadened flamelets and distributed reactions occur. For non-premixed turbulent flames, recent measurements and models of mixture fraction and scalar dissipation rate are considered along with challenges for future research.

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Further inquiries on the academic program or logistics of participation may be made by contacting Prof. Chung K. Law, director of the CEFRC, cklaw@princeton.edu, 609.258.5271, or Dr. Abhishek Saha, program coordinator, asaha@princeton.edu, 609.258.4083. Visit us online at **WWW.PRINCETON.EDU/CEFRC**.