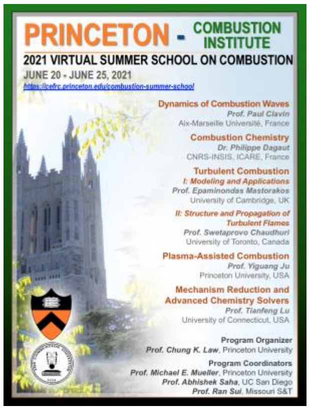

Our Mission

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 2021 Virtual Session

The 2021 **Princeton-Combustion Institute** Virtual Summer School on Combustion, scheduled for **June 20 to June 25, 2021,** will offer the following courses: (1) Dynamics of Combustion Waves; (2) Combustion Chemistry; (3) Turbulent Combustion: Modeling and Applications & Structure and Propagation of Turbulent Flames; (4) Plasma-Assisted Combustion; (5) Mechanism Reduction and Advanced Chemistry Solvers.

Application

Submit application at https://cefrc.princeton.edu/combustion-summer-school by May 15, 2021. Acceptance will be communicated by May 31, 2021.

Course Description

Dynamics of Combustion Waves (Monday-Friday)

Lecturer: **Prof. Paul Clavin**, Aix-Marseille Université, France

Course Content: The purpose of this course is to present advances in the theory of unsteady combustion waves in premixed gases: flames, detonations and explosions. Attention will be focused on fundamental aspects. The basic approximations of the conservation equations will be discussed first in the context of the structure of the planar waves. The lectures will then cover a large variety of phenomena occurring in many applied fields, ranging from safety in nuclear power plants to rocket and car engines: ignition, quenching, thermo-acoustic instabilities, cellular and turbulent flames, combustion noise, direct and spontaneous initiation of detonations, deflagration-to-detonation transition, Mach-stem formation on shock wave, galloping and cellular detonations.

Combustion Chemistry (Monday-Friday)

Lecturer: **Dr. Philippe Dagaut**, CNRS-INSIS, France

Course Content: The course provides an introduction to the development of detailed chemical kinetic mechanisms to describe the oxidation of hydrocarbons, commercial fuels, and biofuels. The course will present experimental techniques for models assessment, thermodynamics, and kinetics. The importance of good experimental data used as validation targets will also be discussed. Reaction mechanisms involved in hydrogen oxidation, in autoignition chemistry, in pollutants formation and reduction, and in combustion control will be discussed in more detail.

Turbulent Combustion, *Part I: Modeling and Applications* (Monday-Thursday)

Lecturer: **Prof. Epaminondas Mastorakos**, University of Cambridge, UK

Course Content: Turbulent combustion sits at the intersection of chemistry and turbulence, both non-linear phenomena and both topics of extensive research. Modelling is needed in order to provide some predictive capability for this practically-important reacting flow problem. In these lectures, the usual models are reviewed, with focus on their theoretical justification and applicability to various situations showing finite-rate kinetic effects such as ignition, extinction, and pollutant formation. In addition to the theory, case studies from spark-ignition, diesel, and gas turbine engine combustion modelling are discussed extensively in order to show the strengths and limitations of each modelling approach. A brief overview of some pertinent topics from classical turbulence studies is included to enhance the student's understanding of turbulent combustion modelling.

Turbulent Combustion, *Part II: Structure and Propagation of Turbulent Flames* (Friday)

Lecturer: **Prof. Swetaprovo Chaudhuri**, University of Toronto, Canada

Course Content: 1. Local structure and propagation of turbulent premixed flames; 2. flame front instability and turbulence interaction; 3. turbulent flame speed; and 4. turbulent flame blowoff and role of local flame extinction by stretch.

Plasma-Assisted Combustion (Monday-Wednesday)

Lecturer: **Prof. Yiguang Ju**, Princeton University, USA

Course Content: This course will provide an overview of the fundamentals of cool flame and hot flame dynamics and chemistry, non-equilibrium plasma discharge, plasma enhancement of ignition and flame propagation, plasma chemistry for combustion and low carbon chemical reforming, plasma thermal-chemical instability, diagnostics and modeling, and perspectives of technical challenges and future research.

Mechanism Reduction and Advanced Chemistry Solvers (Thursday-Friday)

Lecturer: **Prof. Tianfeng Lu**, University of Connecticut, USA

Course Content: This course will provide an introduction to mechanism reduction based on sensitivity, connectivity and timescale analyses, and strategies to systematically identify the chemical kinetic processes controlling such critical flame behaviors as ignition, extinction and premixed reaction front propagation in laminar and turbulent environments. Strategies to control reduction errors and to accelerate simulations involving complex chemistry will also be discussed.

2021 PRINCETON-CI VIRTUAL
Summer School on Combustion

Further inquiries on the academic program may be made by contacting Prof. Chung K. Law, the Program Organizer, cklaw@princeton.edu, or the Program Coordinators, Profs. Michael E. Mueller (muellerm@princeton.edu), Abhishek Saha (asaha@eng.ucsd.edu) and Ran Sui (rsui@mst.edu). Visit us online at https://cefrc.princeton.edu/combustion-summer-school.