Our Mission

To provide the next generation of combustion researchers, engineers and technologists with a comprehensive fundamental knowledge of the fluid mechanics and chemical kinetics of reacting flows, for application in issues related to energy and the environment.

The 2024 Session

The 2024 session will offer the following four courses:

- Combustion Physics
- Combustion Chemistry and Modeling
- Advanced Laser Diagnostics in Turbulent Combustion
- Model Reduction and Computational Flame Diagnostics

Intended Participants

Graduate students, postdocs and faculty members in universities; combustion professionals in research organizations; R & D engineers in industries.

Program Dates

Arrival & Welcome Reception: Registration desk will be open on Sunday, July 7, 2024, from 11:00 am to 6:00 pm at Tsinghua University. This will be followed by an orientation and welcome reception in the evening at 6:00 pm.
Class Schedule: Classes will be held daily from Monday, July 8 to Friday, July 12, 2024
Conference Dinner: A farewell dinner will be held on Thursday evening, July 11, 2024
Departure: Lodging check out on Saturday, July 13, 2024

Application

Application is to be made online at http://www.cce.tsinghua.edu.cn/en/Outreach/Combustion_Summer_School/Overview.htm starting from Monday, April 8, 2024 to Saturday, April 27, 2024. Admission decisions will be sent by Monday, May 27, 2024. Admitted applicants will be notified of the date by which the registration fee is due to complete the registration. Late applications may be considered depending on space availability.

Expenses

Registration: 2200 RMB for students and 2500 RMB for all other participants.

Note on Course Selection

The courses on Combustion Physics and Combustion Chemistry and Modeling are the foundational combustion courses, suggested to be taken by first-timers especially first-year students. The others are advanced, enrichment courses.

Further Inquiries

For inquiries on the academic program or the logistics of participation, please contact the program administrator, Ms. Hong Tian, (86)10-62796768, ccess@tsinghua.edu.cn, or the program co-organizer, Prof. Yu Cheng Liu, ycliu7@mail.tsinghua.edu.cn

Course Descriptions

Morning Sessions (please select one of the following two courses)

Combustion Physics

Lecturer: Prof. Chung K. Law, Princeton University, USA

Course Content: 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.

Model Reduction and Computational Flame Diagnostics

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

Course Content: This lecture will discuss methods for systematic reduction and modeling of complex combustion chemistry, including graph based methods, sensitivity analyses, timescale analyses, lumping and machine learning; advanced chemistry solvers based on dynamics stiffness removal, dynamic adaptive hybrid integration, analytic Jacobian, and finite state methods; and computational diagnostics of limit phenomena and critical flame features based on chemical explosive mode analysis and bifurcation analysis, as well as their applications in laminar and turbulent flames.

Afternoon Sessions (please select one of the following two courses)

Combustion Chemistry and Modeling

Lecturer: Prof. Henry Curran, University of Galway, Ireland

Course Content: This course introduces the development of detailed chemical kinetic mechanisms to describe the oxidation of hydrocarbon and oxygenated hydrocarbon fuels and ammonia. 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.

Advanced Laser Diagnostics in Turbulent Combustion

Lecturer: Prof. Andreas Dreizler, Technische Universität Darmstadt, Germany

Course Content: This course discusses important laser-based methods that can be used to study turbulent combustion processes in detail. After outlining the requirements for benchmark experiments, the following diagnostics are presented: particle-based velocimetry, gas-phase and surface thermometry, gas-phase concentration measurements, 4D imaging, and application examples ranging from generic configurations to near-realistic combustion devices.