Our Mission
To provide the next generation of combustion researchers with comprehensive knowledge in the technical areas of combustion theory, combustion chemistry, and combustion-related experiments, computation, fundamentals and applications.

The 2021 Session
The 2021 session, scheduled for July 11 to July 17, 2021, will offer four courses:

- Combustion Chemistry
- Combustion Theory, Modeling, and Application
- Combustion Dynamics and Unsteady Combustion
- Advanced Laser Diagnostics in Combustion Research

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 11, 2021, from 10:00 am to 5:30 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 12 to Friday, July 16, 2021.

Farewell Reception: A farewell reception will be held on Thursday evening, July 15, 2021.

Departure: Saturday, July 17, 2021

Application
Applications should be made online at http://www.cce.tsinghua.edu.cn/en/Outreach/Combustion_Summer_School/Overview.htm starting from Thursday, April 1, 2021 to Friday, April 30, 2021. Admission decisions will be sent by Monday, May 10, 2021. 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.

Location & Accommodation
The Summer School will be held at Tsinghua University, Beijing, China. Meal plans covering breakfast, lunch and dinner are available to participants. Participants may make their own arrangements to stay and dine at nearby hotels and restaurants.

Expenses
Registration: 1,500 RMB for students and 2,000 RMB for all other participants.

Meals: Each participant will receive a Tsinghua canteen card for use within the event period. The cost of the canteen card and the conference and farewell reception is included in the registration fee.

Lodging: A limited number of on-campus lodging will be provided upon further request this year. Most participants are encouraged to make reservations at nearby hotels. A list of suggested hotels will be provided later.

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

Combustion Theory, Modeling, and Application

Lecturer: Professor Heinz Pitsch, RWTH Aachen University, Germany

Course Content: Fundamental knowledge in laminar and turbulent combustion, applications in CFD, machine learning and data analysis: laminar premixed and diffusion flame structure, flammability limits, laminar flame simulations using the FlameMaster code, introduction to turbulence, DNS and LES, turbulent combustion and modeling, CFD and numerical combustion with application to internal combustion engines and gas turbines. Focus topic: Hydrogen combustion.

Advanced Laser Diagnostics in Combustion Research

Lecturer: Professor Mark Linne, The University of Edinburgh, UK

Course Content: This course will introduce the basic structures 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. A selection of diagnostics will be presented in the same context. Techniques to be discussed will include Rayleigh and Mie scattering, particle image velocimetry (PIV) and wavelet-based optical flow velocimetry (wOFV), ballistic imaging, structured laser illumination planar imaging (SLIPI), two-photon planar laser induced fluorescence in sprays, absorption-based techniques (e.g. frequency comb spectroscopy), laser induced fluorescence for combustion species, Raman scattering, and nonlinear optics including laser induced thermal acoustics and coherent anti-Stokes Raman scattering. A lecture on lasers and laser physics will also be provided.

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

Combustion Chemistry

Lecturer: Professor Alison Tomlin, University of Leeds, UK

Course Content: Chemical kinetic processes underlie all combustion phenomena. Consequently, accurately predicting chemical changes is fundamentally important for predicting combustion within a range of devices including engines, boilers, furnaces and gas turbines. On the other hand, chemical oxidation processes, particularly for complex fuels such as biofuels, involve very large numbers of species and reactions, posing challenges for including detailed chemistry within models of practical devices. With this in mind, the course will take students on a journey from the fundamentals of reaction kinetics basics through to constructing chemical mechanisms for different fuel types, reducing them to facilitate their use in reactive flow models and finally to quantifying the impact of inherent uncertainties on their predictive quality. Topics will include: chemical mechanism structure; stoichiometry; rate equations for basic reactors; temperature and pressure dependence of rate coefficients; determination of rate constants via experimental and theoretical methods; basic thermodynamics; automatic generation of reaction mechanisms; ignition phenomena and low temperature chemistry; adiabatic flame temperature and high temperature chemistry; pollutant formation mechanisms; future fuels and challenges they pose for combustion systems; model uncertainties and sensitivity analysis; chemical model reduction methods.

Combustion Dynamics and Unsteady Combustion

Lecturer: Prof. Sébastien M. Candel, CentraleSupélec, University Paris-Saclay, France

Course Content: This course provides an introduction to the analysis of combustion dynamics. After a broad introduction to acoustics and to early combustion instability models, the following topics will be covered: perturbed flame dynamics, flame transfer functions, nonlinear flame dynamics, flame describing function methods, the validity of these methods in instability analysis, premixed swirling flames and swirling spray flames, azimuthal coupling in annular combustors, passive and active control of instabilities. Questions of ignition and flame blow out will also be examined. The various concepts will be illustrated with experimental data, computational flame dynamics and large eddy simulations and many practical examples.

Note on Course Selection
The courses on Combustion Chemistry and Combustion Theory, Modeling, and Application are the foundational combustion courses, suggested to be taken by first-timers especially first-year students. The other two are advanced, enrichment courses.

Poster Session
Applicants are encouraged to submit abstracts for the poster session, with recently published or accepted papers by the presenter related to the work. Exhibition space is limited and decision on acceptance will be made by the organizing committee.

Note on Possible Rearrangement due to Covid-19
In the event of persistent inconvenience caused by Covid-19, the Summer School arrangement might need to be revised to various extent, such as off-site of on-campus accommodation and the combination of on-site and remote lecturing. Every effort will be made to preserve classroom lecturing and promote networking. Recognizing that changes in the arrangement could also affect the amount and the date of payment of the registration fee, updated information will be communicated to the registrants as well as posted on the website of the Summer School.

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, yculiu7@mail.tsinghua.edu.cn