
Lecturers

Prof. Dr. Nasser Ashgriz

Department of Mechanical and Industrial Engineering,
University of Toronto

Prof. Dr. Dieter Bothe

Institute of Mathematical Modeling and Analysis,
TU Darmstadt

Prof. Dr.-Ing. Günter Brenn

Institute of Fluid Mechanics and Heat Transfer,
TU Graz

Prof. Dr. Sanjeev Chandra

Department of Mechanical and Industrial Engineering,
University of Toronto

Prof. Dr.-Ing. Udo Fritsching

Department Multiphase Flow, Heat- and Mass-Transfer,
Leibniz Institute for Materials Engineering (IWT) Bremen

Dr.-Ing. Philippe Leick

Engineering Combustion System,
Robert Bosch GmbH Stuttgart

Prof. Dr. Fabrice Lemoine

Laboratoire d'Energétique et de Mécanique Théorique et Appliquée,
Université de Lorraine, Nancy

Prof. Dr. Ilia V. Roisman

Institute for Fluid Mechanics and Aerodynamics,
TU Darmstadt

Prof. Dr. Eran Sher

Faculty of Aerospace Engineering,
Technion – Israel Institute of Technology

Prof. Dr.-Ing. Peter Stephan

Institute for Technical Thermodynamics,
TU Darmstadt

Prof. Dr.-Ing. Cameron Tropea

Institute for Fluid Mechanics and Aerodynamics,
TU Darmstadt

Prof. Dr.-Ing. Bernhard Weigand

Institute of Aerospace Thermodynamics (ITLR),
University of Stuttgart

Prof. Dr. Alexander L. Yarin

Department of Mechanical and Industrial Engineering,
University of Illinois at Chicago

Who should attend?

This course is directed towards practicing engineers, researchers involved in R&D and the application of spray systems, and graduate students performing research on the subject of sprays and atomization. For those with little previous background, the course begins with fundamentals of atomization and proceeds through theoretical, experimental, numerical and application topics.

Course platform and delivery

Pre-recorded lectures will be provided using Webex, integrated with the Moodle learning management system. The lecturer will be available during and after the lecture and questions and discussions with lecturers will be moderated through the chat function during the lecture. All lecture slides are available for download and all lectures can be streamed from their time of airing until two weeks after the course closes.

Fees and registration

- **Industry:** 250 EUR
- **Academia:** 150 EUR

Course fees are VAT exempt according to article 132 (i) Council Directive 2006/112/EC. Included is live and download access to all lectures during the week and all accompanying documentation (slides).

Registration for this four-day short course can be made online starting November 2021 on the course website:

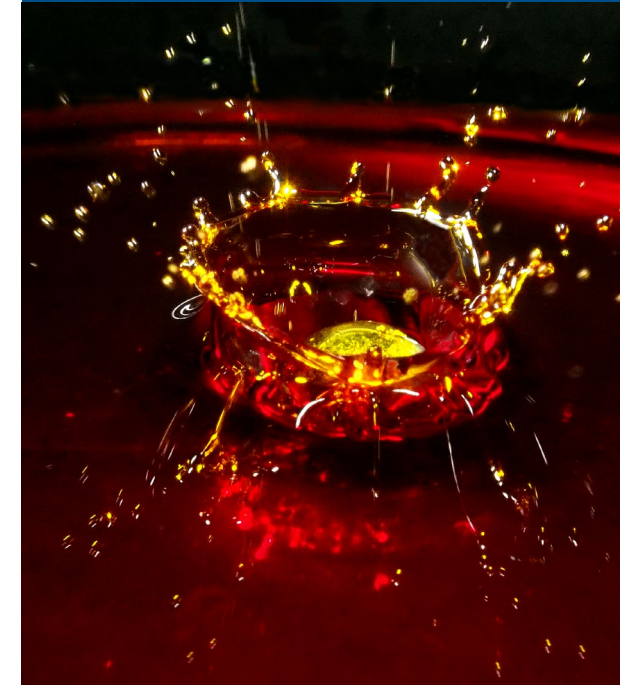
www.tfi.tu-darmstadt.de/as2022

The number of participants will be limited to 100 on a first-come-first-serve basis. For further information, please refer to the course website or contact Prof. Cameron Tropea at:

atomization@sla.tu-darmstadt.de

Short Course on Atomization and Sprays

14 – 18 February 2022
Technical University of Darmstadt
Darmstadt, Germany



Offered by the Research Area
Thermo-Fluids & Interfacial Phenomena
in cooperation with DFG CRC/TRR 75

PROGRAM

Monday 14 February 2022

Fundamentals of Atomization

- 10:45 **Session open for joining**
- 11:00 Welcome, Introductions, Overview, Use of Webex and guidelines for discussions (*Tropea*)
- 11:30 Techniques of Atomization: Overview of Atomizers and their Applications (*Tropea*)
- 12:30 **Screen break**
- 12:45 Stability Analysis of Liquid Jets and Sheets (*Brenn*)
- 14:00 **Screen break**
- 14:30 Fundamentals of Atomization (*Roisman*)
- 15:30 **Screen break**
- 15:45 Breakup and Atomization Models (*Ashgriz*)
- 17:00 **Screen break**
- 17:15 Secondary Atomization (*Tropea*)
- 18:00 **Close of first day**

Tuesday 15 February 2022

Characterization and Diagnostics

- 9:45 **Session open for joining**
- 10:00 Spray Characterization – Quantifiers and Standards (*Tropea*)
- 10:45 **Screen break**
- 11:00 Imaging Techniques (*Leick*)
- 11:45 **Screen break**
- 12:00 Measurement Techniques (*Tropea*)
- 13:00 **Screen break**
- 13:30 Measurement of Drop Temperature and Composition (*Lemoine*)
- 14:30 **Screen break**
- 14:45 Nozzle Designs and their Spray Characteristics (*Ashgriz*)
- 15:45 **Screen break**
- 16:00 Manufacturers' Presentations
- 17:00 **Close of Second Day**

PROGRAM

Wednesday 16 February 2022

Modeling and Simulation

- 9:45 **Session open for joining**
- 10:00 A Survey on Numerical Simulation Methods for Multiphase Flows (*Bothe*)
- 10:45 **Screen break**
- 11:00 Direct Numerical Simulation of Primary Jet Breakup (*Weigand*)
- 12:30 **Screen break**
- 13:00 Volume-of-Fluid Method for Drop Collision (*Bothe*)
- 14:00 **Screen break**
- 14:15 Heat and Mass Transfer from Drops: Fundamentals (*Brenn*)
- 15:00 **Screen break**
- 15:15 Powder Production in Spray Processes (*Fritsching*)
- 16:15 **Close of Third Day**

Thursday 17 February 2022

Spray and Drop Interactions with a Wall

- 10:45 **Session open for joining**
- 11:00 Fundamentals of Modelling (*Yarin*)
- 11:45 **Screen break**
- 12:00 Drop/Wall Interactions (*Yarin*)
- 13:00 **Screen break**
- 13:15 Spray Painting (*Chandra*)
- 14:00 **Screen break**
- 14:30 Spray Coating (*Chandra*)
- 15:15 **Screen break**
- 15:30 Droplet Impingement Cooling with Evaporation (*Stephan*)
- 16:15 **Screen break**
- 16:30 Spray Cooling (*Roisman*)
- 17:15 **Close of Fourth Day**

PROGRAM

Friday 18 February 2022

Applications & Advanced Topics

- 10:45 **Session open for joining**
- 11:00 Atomizers for Fuel Injection (*Leick*)
- 12:00 **Screen break**
- 12:15 Drop Combustion (*Sher*)
- 13:00 **Screen break**
- 13:30 Atomization of Complex Fluids (*Brenn*)
- 14:15 **Screen break**
- 14:30 Flash Boiling Atomization (*Sher*)
- 15:15 **Screen break**
- 15:30 Atomization in Forensic and High Power Applications (*Yarin*)
- 16:30 **Closing Remarks**

Course description and aims

This short course has the aim to present the current understanding and state of the art of atomization fundamentals, their realization in atomizer systems and their application in a wide variety of engineering branches, including spray drying, spray coating, spray cooling, fuel injection, etc.

These aspects are first addressed theoretically in terms of hydrodynamic instabilities of liquid jets and sheets – primary atomization. This is followed by considerations about the break-up of single droplets – secondary atomization.

These fundamentals are followed by topics on diagnostics, numerical simulations, drop/wall interactions and further advanced topics and applications. In a manufacturers' session several vendors of diagnostic equipment related to atomization and sprays will make presentations and be available for discussions.

The program foresees discussions among the participants and the lecturers. The aim is to address ongoing development and application problems suggested by the participants.