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E-lecture series on combustion

Dr. Andrea Giusti

Imperial College, London,

United Kingdom

Electromagnetic interactions and engineered fuels to deliver flames on demand

DATE: April 26th, 2024

TIME: 12:00 CET

Link: Zoom Meeting

Belgian Section of the Combustion Institute

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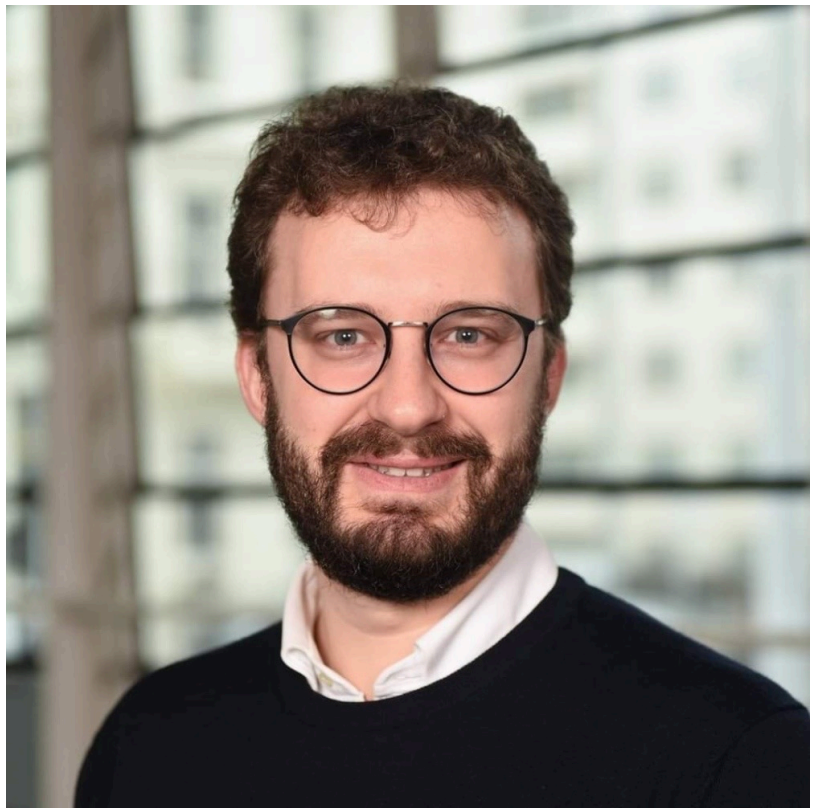

Belgian Section of the Combustion Institute

Dr. Andrea Giusti

Andrea Giusti is a Lecturer in Thermofluids at Imperial College, London, UK, in the Department of Mechanical Engineering. He obtained his PhD in 2014 at the University of Florence, Italy. Then, he joined the Engineering Department at the University of Cambridge, UK, as Rolls-Royce Research Associate. He was appointed as Lecturer by Imperial College in October 2018. At Imperial, Dr. Giusti leads a research group in multi-physics combustion and engineered fluids to propose sustainable solutions for the energy and transportation sectors. Dr. Giusti is currently Editor-in-Chief of the International Journal of Spray and Combustion Dynamics, a member of the committee of the International Workshop on Turbulent Combustion of Sprays, a committee member of the British Section of the Combustion Institute, and a Bye-Fellow of Fitzwilliam College in Cambridge.

Abstract

The use of electromagnetic fields and nanotechnologies to fully control the reaction process is proposed as a new paradigm for next-generation hybrid thermal-electric propulsion systems. The vision is first presented in the context of electrification of transportation and sustainability of hard-to-decarbonise sectors. The effect of electrostatic fields on the reaction kinetics is investigated using molecular dynamics and quantum mechanics simulations. Systems with different levels of complexity are presented, ranging from gaseous combustion to the use of nano and micro metal powders both as fuel additives and fuel substitutes. Electrostatic modulation of charged droplet trajectories is then introduced as a novel technology for the control of mixing. Non-reacting high-fidelity simulations are discussed to analyse the competing effects of drag and electrical forces on the trajectory of evaporating droplets and the resulting vapour-air mixing. Concluding remarks on challenges and open questions close the lecture.

Organizing committee

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Belgian Section of the Combustion Institute.

Hosted by:

- Prof. Salvatore Iavarone (salvatore.iavarone@ulb.be; salvatore.iavarone@centralesupelec.fr)
- Prof. Alessandro Parente (alessandro.parente@ulb.be)
- Prof. Ward De Paepe (ward.depaepe@umons.ac.be).

Any questions may be directed to Prof. Salvatore Iavarone.