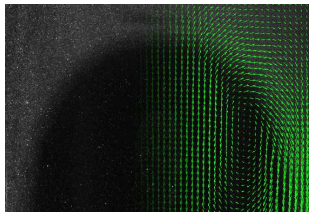
Postdoc Position in Hydrogen Combustion

The Combustion and Fluid Mechanics Group at ETSI Aeronáutica y del Espacio (Universidad Politécnica de Madrid https://blogs.upm.es/labcmf/) conducts cutting-edge research in reactive flows, with a particular focus on clean-combustion technologies, combustion at the micro-scale, and compressible flows. The group's research activities span theoretical, experimental, and numerical simulation analyses, aimed at understanding physical processes that combine fluid mechanics, heat and mass transfer, and chemical kinetics.





The group's research methods include asymptotic scaling and perturbation methods, in-house-developed numerical simulation tools, and specifically designed experimental setups built in our state-of-the-art production lab.

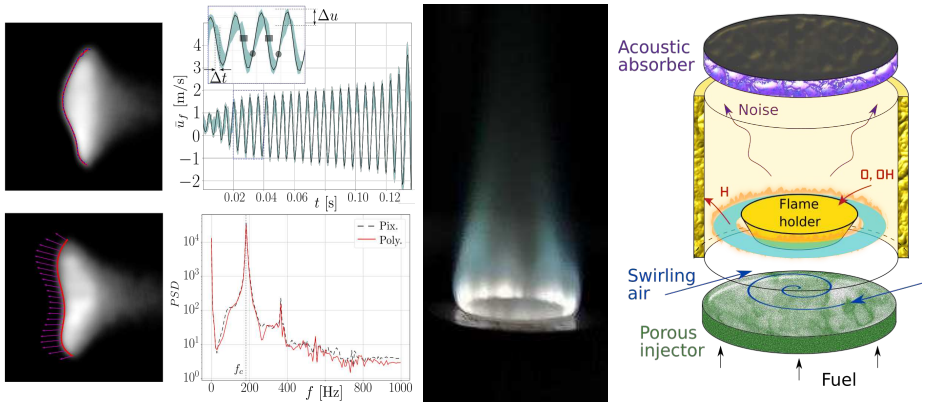
Motivation

The Climate Emergency has imposed a decarbonization plan in Europe that involves reducing Green House Gases emissions to 55% by 2030 and reaching carbon neutrality (zero-emissions) by 2050. Most sectors can benefit from a complete electrification and power generated from renewable sources (solar and wind mainly). However, **aviation, stable power-generation and high-enthalpy industry** cannot rely on the utilization of electricity to provide their services while avoiding pollutant emissions. Therefore, there is a need in Europe for devices that can burn pure hydrogen, mixtures of hydrogen and other carbon-neutral fuels.

This fuel substitution represents a big challenge: the special characteristics of hydrogen (low ignition energy, wide flammability limits, high mass diffusivity) make it an extremely complex fuel to burn in a stable and safe way. All things considered, there is a need for fundamental research on H_2 combustion to enable the required technological advances in this field.

Project

The **Green-H2-Combustion project** aims to explore the dynamics of H_2 combustion and characterize the technological challenges arising from its use as a carbon-free fuel. The final goal is to develop a 100% H_2-ready, fully-premixed, low-NOx burner for the transition from 100% natural gas to 100% hydrogen, and the demonstration of its safe and stable operation. Specific areas in need of further research include: stable injection, mixing and ignition of H_2-containing mixtures through the design and construction of a burner prototype with specifically tailored porous and acoustic absorbent materials.



Experimental results on thermoacoustic instabilities - Flores Montoya et al. *Combustion and Flame,* 2022 (left), premixed hydrogen-air flame with porous injector (center) and concept burner components (right).

Position

The postdoc researcher will join the Fluid Mechanics and Combustion Group at ETSIAE (Universidad Politécnica de Madrid) and receive a salary as a R2/R3 researcher. Candidates are expected to engage in full-time face-to-face research and study.

Academic details

A solid background in Fluid Mechanics, Heat Transfer, Acoustics, Porous Materials, Absorbing Surfaces and either Experimental or Numerical Methods will be considered in the selection process.

Duration

1 year (full time, and extendable to a 2nd year based on needs and performance). Starting date: September 2023.

Contact

Please, email Daniel Martínez Ruiz (daniel.mruiz@upm.es, ☎+34 910 675 822)

Financiado por la Unión Europea NextGenerationEU
Plan de Recuperación, Transformación y Resiliencia
Comunidad de Madrid VICEPRESIDENCIA, CONSEJERÍA DE EDUCACIÓN Y UNIVERSIDADES

This project is funded by MCIN (Spain) and the Regional Government of Madrid with funding from European Union NextGenerationEU (PRTR-C17.I1).