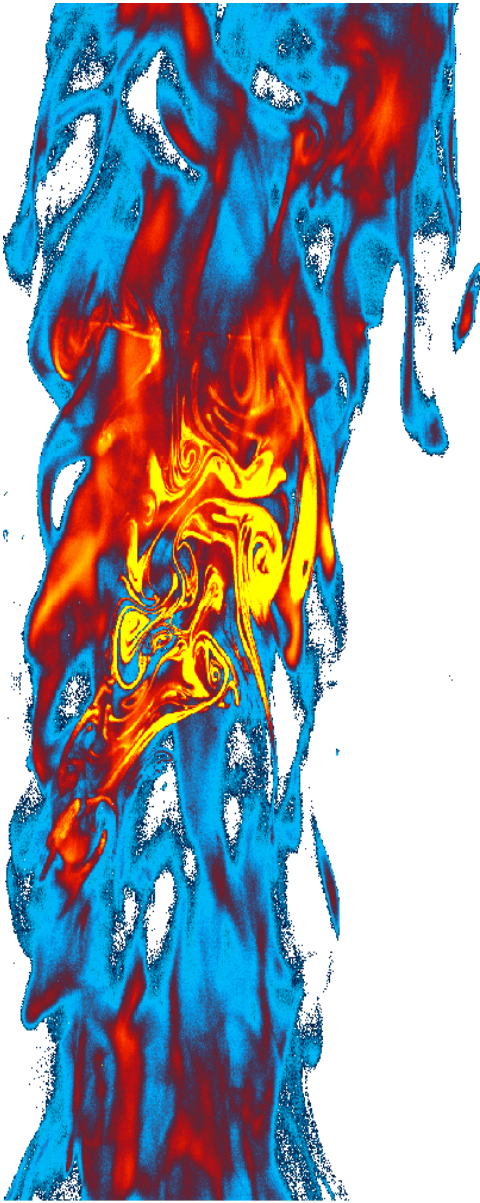




Dr. Benedetta Franzelli
CNRS Research Scientist
Laboratoire EM2C, CNRS
91190 Gif-sur-Yvette, France
benedetta.franzelli@cnrs.fr
Tel: +33 1 75 31 60 73

PhD position: study of nano-particles production in turbulent flames



The characterization of the production of nano-particles generated by turbulent flames represents a societal and industrial challenge. As an example, the creation of new materials from various nano-particles is a growing market with applications in transport, construction, energy and communications sectors. Another example is the emission of soot particles into the atmosphere as a result of incomplete combustion of hydrocarbons. This pollutant emission is characterized by a distribution of solid carbon particles with different sizes and shapes, which have negative effects on human health and environment. The control of nano-particle emissions is then necessary for environmental and economical issues and progress in numerical simulations is essential to the successful design of controlled-emission combustion systems. Unfortunately, the Large-Eddy Simulation (LES) approach for turbulent flow, which has successfully demonstrated its capacity to represent gaseous combustion processes, is far from being predictive for solid particles emission. Indeed, the production of nano-particles in turbulent flames is far from being a well-known process and many efforts are still needed in terms of characterization and modeling in this topic. In this context, the goal of the SOTUF-ERC project (http://em2c.centralesupelec.fr/ERC_Sotuf) is to provide new insights on the processes governing nano-particles production in turbulent flames in order to develop novel models.

Fig. 1 Soot light scattering in a turbulent jet flame [1].

A PhD position is available starting from September 2018:

The goal of this PhD thesis is to provide new insights on the processes governing nano-particles production in turbulent flames through novel well-controlled experiments employing advanced space-time resolved optical diagnostics (LII, LIF, PIV, LIP, light scattering). During the PhD, these diagnostics, classically applied to purely gaseous and sooting flames, will be adapted to the investigation of solid nano-particles to obtain a quantitative experimental database, essential to the validation of the numerical modeling.

The EM2C CNRS Laboratory is seeking for highly qualified candidates for a PhD fellowship in the area of **experimental characterization of solid nano-particles production in turbulent flames**. The successful candidate will have access to the most advanced experimental equipments for the investigation of solid particles production in turbulent flames. He/she will also profit of the presence of many experienced scientists (Dr. B. Franzelli, Ing. P. Scouflaire, Dr. Denis Veynante, Pr. N. Darabiha and Pr. S. Candel) and of the active collaborations with experts in experimental activities on laminar flames from Institut Jean Le Rond d'Alembert at Sorbonne University in Paris.

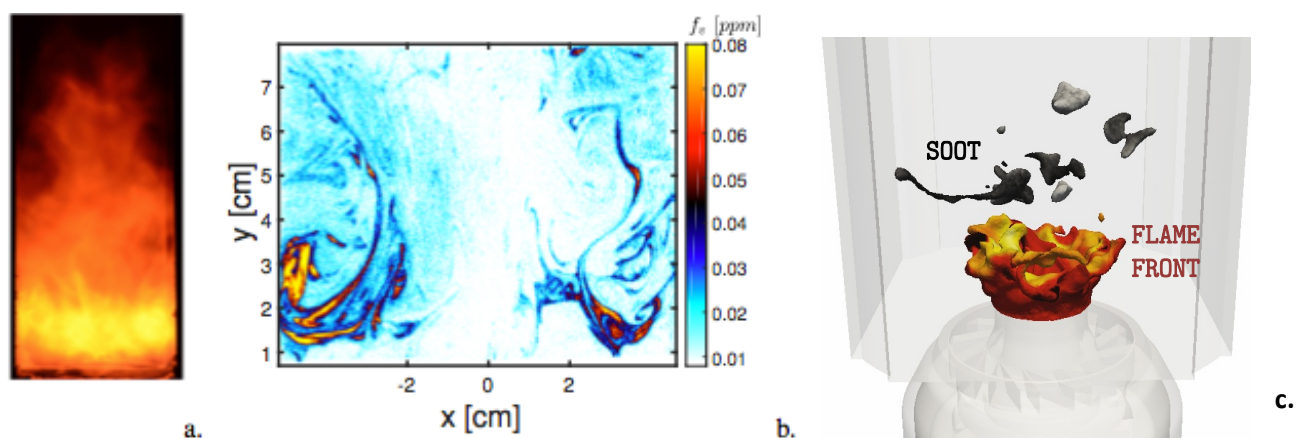


Fig. 2. a) Swirled turbulent perfectly-premixed turbulent rich flame EM2SOOT [2]. b) Instantaneous soot volume fraction field obtained via LII in the EM2SOOT flame [3]. c) Large Eddy Simulation of soot production in a turbulent non-premixed turbulent flame [4,5].

How to apply:

Applicants should hold a M.Sc. degree in Mechanical Engineering/Energetics. The position requires:

- Strong skills in Fluid Mechanics, Turbulence, and Thermodynamics.
- Strong willing to develop experimental skills in the combustion field.
- Good oral and written communication skills to report, to present in congress and to write articles for scientific journals.

Send the following documents to Dr. Benedetta Franzelli at benedetta.franzelli@cnrs.fr:

1. One-page motivation letter
2. One-page summary of master's thesis
3. CV with names and contact details of at least two referees
4. Copies of degree and academic transcript (with grades and rankings)
5. Reference letters sent separately by the referees
6. Copy of passport

Stipend:

This work is supported by the SOTUF - ERC Starting Grant (http://em2c.centralesupelec.fr/en/ERC_Sotuf). The total net salary per month, calculated after deduction of employer contributions, mandatory health insurance and retirement (income tax still have to be paid), is 1400 €.

[1] B. Franzelli, P. Scoufflaire, S. Candel, *Time-resolved spatial patterns and interactions of soot, PAH and OH in a turbulent diffusion flame*, *Proc. Comb. Inst.* 35, 1921-1929 (2015).

[2] M. Roussillo, P. Scoufflaire, N. Darabiha, S. Candel, B. Franzelli, *A new experimental database for the investigation of soot in a model scale swirled combustor under perfectly premixed rich conditions*, *ASME Turbo Expo paper GT2018-76205*, Oslo, Norway (2018).

[3] M. Roussillo, P. Scoufflaire, S. Candel, B. Franzelli, *Experimental investigation of soot production in a confined swirled flame operating under perfectly premixed rich conditions*, *Proc. Comb. Inst.*, submitted.

[4] B. Franzelli, E. Riber, B. Cuenot, M. Ihme, *Towards the prediction of soot in aero-engine combustors with large eddy simulation*, *ASME Turbo Expo paper GT2015-43630*, Montreal, Canada (2015).

[5] P. Rodrigues, B. Franzelli, R. Vicquelin, O. Gicquel, N. Darabiha, *Coupling an LES approach and a soot sectional model for the study of sooting turbulent non-premixed flames*, *Comb. Flame* 190, 477-499 (2018).