# Postdoc position at PC2A

## Study of the formation of nitrogen oxides ($NO_x$) during dihydrogen ($H_2$) combustion

In 2021, the French government launched a broad investment plan "France 2030", in connection with the ecological transition. This plan aims to decarbonize French industry in order to reduce greenhouse gas emissions by 35% by 2030. Hydrogen combustion is a promising energy source to reach the carbon neutrality in many applications, including transport, industrial processes and energy conversion. In particular, the French acceleration strategy on decarbonized hydrogen is supported by the Priority Research Program and Equipment (Programme et Equipements Prioritaires de Recherche) PEPR-H2 of the plan "France 2030".
The MONTHY project is funded by PEPR-H2 for a period of 4 years. This project brings together three French laboratories internationally recognized for their research in combustion (CORIA, EM2C, PC2A) and allows the recruitment of several PhD and postdocs on fundamental research on $H_2$ combustion.
The objectives of MONTHY project are to **understand** through a joined experimental and numerical analysis the **nitrogen oxides formation** in an environment representative of future hydrogen-air industrial combustion chambers. Results will lead to the **first understanding and modeling of the impacts of $H_2$ fuel dilution by $H_2O$ on NOx production in a turbulent reactive flow.**

PC2A laboratory is offering an 18-24 month postdoc position, mainly experimental, on topics related to NO formation in laminar premixed $H_2/O_2/N_2$ flames. Although the kinetic pathways responsible for the NO formation in hydrogen flames are known: thermal-NO at high temperature and NNH and $N_2O$ pathways occurring at intermediate temperature, the latter two pathways are affected by large uncertainties while having a large contribution in turbulent flames. Thus, there is a crucial need to validate a detailed kinetic model for NO formation in a wide range of hydrogen flames.
By implementing an original experimental strategy based on advanced laser diagnostics to quantitatively detect radicals and atoms in hydrogen flames and on an optimal selection of flames allowing to emphasize one NO pathway over the others, the objective of this postdoc position is to contribute to the elucidation of the NOx formation pathways in hydrogen flames. The experimental work will consist in acquiring a unique experimental quantitative database of NO formation in laminar $H_2$-air flames using in-situ advanced laser diagnostics (laser-induced fluorescence (LIF) and cavity ring-down spectroscopy (CRDS)) and probe sampling techniques (FTIR), detecting challenging trace species like NH and HNO to clarify the NNH-route of NO formation, and finally assess the consistency of $H_2O$ dilution as a primary NOx reduction strategy for $H_2$-air flames. LIF and CRDS techniques are already well mastered in the PC2A laboratory (https://pro.univ-lille.fr/nathalie-lamoureux/publications/#descr) but never applied in $H_2/O_2/N_2$ premixed flames. Depending on the candidate profile, he/she can be involved in the kinetic simulation work to identify the formation pathways of NOx and $N_2O$ emissions.

**Keywords**: Combustion, Chemical kinetic, NOx emissions, Laser-based spectroscopic diagnostics

**Academic requirements**: PhD in the field of chemistry, chemistry-physics, and a strong aspiration to perform experimental work are required. Knowledge in the field of combustion chemistry and laser techniques are appreciated.

**How to apply?** Send a letter to the postdoc supervisors (Pascale Desgroux and Nathalie Lamoureux) before the 30 th of January 2023, CV and motivation letter, and recommendation letters.

**Laboratory:** PC2A https://pc2a.univ-lille.fr/
**Supervisors:** Pascale Desgroux, Nathalie Lamoureux,
**Duration:** 18-24 months, from February/March 2023
**Funding**: 100% PEPR MONTHY.
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