Institut Pascal (UMR6602 UCA/CNRS) - Group Mechanics, Mechanical Engineering, Civil Engineering, Industrial Engineering (M3G)

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Title of the PhD thesis : *Experimental and numerical study of air flow and pollutant dispersion in a ventilated and differentially heated room.*

Summary:
The knowledge of the air movements in buildings covers energetic and environmental stakes. On the energetic level, understanding the nature and dynamics of airflows allows to optimize ventilation systems. On the environmental level, the issue is the inddor air quality, a public health issue. In this context, the objective of the thesis is the experimental and numerical study of the air flow and the trajectory of particles transported by the air, in an experimental room at scale 1, whose boundary conditions are controlled in temperature, humidity, air speed and injected pollutants. From an experimental point of view, the thesis aims at using complementary and new methods, in particular 2D large scale particle image velocimetry and 3D Lagrangian particle tracking (developed at UCA within the framework of the ANR TRAQ), to understand the nature, the dynamics and the topology of the flows in presence. From a numerical point of view, if the direct simulation of turbulence by DNS (Direct Numerical Simulation) remains for the moment inaccessible, the thesis should take advantage of recent advances in LES (Large Eddy Simulation) modeling and the Boltzmann lattice method (LBM) for air flows in buildings. Based on the experimental data, a particular question will be to define subgrid models with or without wall laws, adapted to the building application.
The thesis should be an incremental contribution to the understanding and modeling of air flows and pollutant dispersion in buildings. It should lead to a series of recommendations to address societal expectations in terms of energy efficiency, environment and health. It should also inaugurate a new collaboration between the University of Clermont Auvergne, the University of Tangier in Morocco, and the University of Rennes I.