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Internship opportunity

Title: Interaction among flame spreads over cylindrical samples in microgravity.

Terms: Applicants should be motivated individuals and pursue a graduate degree in Mechanical Engineering and/or Physics.
The position is expected to start from the beginning of 2016 and will last 6 months.
The monthly allowance is 450 Euro.
A PhD may follow this internship.

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Topic context: The main objective that drives the current projects dealing with fire safety for manned spacecraft is to create a comprehensive data set to enable a suitable paradigm for fire safety in spacecraft and space infrastructure. To face this challenge within the context of the future manned mission to Mars, a topical team gathering experts from NASA, CNES, JAXA, ESA, and ROSCOSMOS, has started working on the definition of a complete series of demonstration and validation experiments.[1] These experiments must capture the fundamental science of ignition, spread and extinction of a flame in both normal and microgravity and enable demonstration of the fire sensing and growth prediction tool that will be developed along the project. The experimental investigation aims for a final validation data set gathered in-situ through a series of large-scale experiments that are being designed for the Cygnus Spacecraft.

Scientific objectives: The specific internship objective is to assess the interaction that concomitant spreads can experience when flames are established over a set of cylindrical wires in microgravity. Soot is especially expected to play a major role due to its contribution to radiative heat transfer that govern flame spread in microgravity.[2] Therefore, soot concentration needs to be mapped along the spread. To this end, a light extinction technique will have to be set up. Experiments conducted in microgravity will have to be contrasted with those performed at normal gravity.

Expected progress: The student will join a team of experimentalists at Institut Jean le Rond d'Alembert (Université Pierre et Marie Curie-Paris 6) to take part into a parabolic flight campaign scheduled in May 2015. The experimental core of this work is a rig that has been developed at Institut d'Alembert.[3] It especially enables the study of flame spread over cylindrical wires onboard the Airbus ZeroG. The student will have to conduct experiments in microgravity and at normal gravity.

References:

[1] G. Jomaas, J.L. Torero, C. Eigenbrod, J. Niehaus, S.L. Olson, P.V. Ferkul, G. Legros, C. Fernandez-Pello, A.J. Cowlard, S. Rouvreau, N.N. Smirnov, O. Fujita, J.S. T'ien, G.A. Ruff, and D.L. Urban. Fire Safety in Space - Beyond Flammability Testing of Small Samples, to appear in *Acta Astronautica* (2015).

[2] G. Legros, J.L. Torero, Phenomenological model of soot production inside a non-buoyant laminar diffusion flame, Proc. Combust. Inst. 35 (2014) in press.

[3] See the story of the UPMC rig's 1st parabola perfomed in October 2014: http://www.dalembert.upmc.fr/home/legros/index.php/component/content/article/14-articles-exemples/75-flame-propagation-in-microgravity-small-scale-experiments