Master 2: ***International Centre for Fundamental Physics***

INTERNSHIP PROPOSAL

Laboratory name: LEGI/INRAE
CNRS identification code: UMR5519
Internship director'surname: Rastello
e-mail: marie.rastello@legi.cnrs.fr Phone number:
Web page: http://www.legi.grenoble-inp.fr/people/Marie.Rastello/
Internship location: Grenoble

Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: ANR

Title : Towards improving avalanche barriers and deflectors efficiency for powder-snow avalanches ?

Summary

Powder Snow Avalanche
(Sionne test site - 2003)

Powder snow avalanches (PSA) are highly destructive flows. As they rush down the mountains, they interact with many types of obstacles (trees, rocks, buildings, barriers and deflectors…), causing severe damages and loss.

Studying PSA on the field is extremely hazardous and time consuming for a ratio results/time involved frequently pretty poor. Laboratory experiments are a good way to dig in the physics of the processes involved with much more levers in hand.

Through experiments in a 2D channel immersed in a 20m3 tank we will address how a finite size volume of heavy fluid (compositional or particle suspension) (lab avalanche) rushing down a slope (0° to 45°) is affected by the multiple obstacles it encounters on its way. Flows, slopes and obstacles will be varied to cartography the impact of the different parameters on the flow characteristics, from the macroscopic ones (size, front velocity, shape…) to the local processes (impact on the turbulence and small scale quantities). A specific and more detailed attention will be given to the settings that reduce the turbulent processes within the Lab avalanche so as to propose more efficient avalanche barriers and deflectors.

3D Lab avalanche (INRAE)

Experimental skills and interest are highly expected. The internship can be followed by a phd. This work is partially supported by the ANR project ANR-15-IDEX-02.

Rastello, M., & Hopfinger, E. J. (2004). Sediment-entraining suspension clouds: a model of powder-snow avalanches. *Journal of fluid mechanics*, *509*, 181-206.
Naaim-Bouvet, F., Naaim, M., Bacher, M., & Heiligenstein, L. (2002). Physical modelling of the interaction between powder avalanches and defence structures. *Natural Hazards and Earth System Science*, *2*(3/4), 193-202.
Zhou, J., Cenedese, C., Williams, T., Ball, M., Venayagamoorthy, S. K., & Nokes, R. I. (2017). On the propagation of gravity currents over and through a submerged array of circular cylinders. *Journal of Fluid Mechanics*, *831*, 394-417.

Condensed Matter Physics: YES Soft Matter and Biological Physics: YES
Quantum Physics: NO Theoretical Physics: NO