



Seminari del Corso di Dottorato

## Falling clouds of particles

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**Abstract:** A falling cloud composed of particles can be regarded as an effective medium of excess mass and the problem can be related to that of the sedimentation of a spherical drop of heavy fluid in an otherwise lighter fluid solved by Hadamard and Rybczynski in 1911. However, the cloud is unstable even in the complete absence of inertia and without needing to perturb its initial shape. It has been observed first to remain roughly spherical with a leakage of particles in a vertical tail and then to evolve into a torus which breaks up into two droplets in a repeating cascade. The discrete nature of the particles is fundamental in the understanding of these instabilities. Simple simulations using a point-particle approach, which contains the minimal physics of the long-range interactions, capture this dynamics. Faster breakup is observed for clouds of anisotropic particles such as fibers due to the self motion of the anisotropic particles. When inertia is finite, the cloud also deforms into a flat torus that eventually destabilizes and breaks up into a number of secondary droplets but particle leakage is much weaker. While this evolution resembles that observed in the Stokes regime, the physical mechanisms involved are qualitatively different. The cloud evolution can be strongly determined by the importance of wake-mediated interactions.

This work has been done in collaboration with J. E. Butler, M. L. Ekiel-Jezewska, B. Metzger, M. Nicolas, J. Park, F. Pignatel.

References:

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**CV:** Elisabeth Guazzelli is director of CNRS (Centre National de la Recherche Scientifique). She is also fellow of APS(American Physical Society) and EUROMECH. Her research interests focus on mobile particulate systems and more generally fluid dynamics and soft-matter physics. Prof. Guazzelli has published more than 70 papers in international peer-reviewed journals, several books and book chapters. She has organized many scientific conferences (e.g. ICTAM) and has also given plenary, keynote and invited talks in the most important international fluid mechanics conferences. Prof. Guazzelli is currently serving as Associate Editor of the Journal of Fluid Mechanics, Editorial Committee Member of the Annual Review of Fluid Mechanics, and Member of major scientific panels (PESC, ESF, ANR, DAMTP, APS). In 2012 Prof. Guazzelli received the Legion d'Honneur, the highest decoration in France, with the degree of Chevalier.



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