Miniproject outline: Granular segregation

with Ellák Somfai (Physics and Complexity)

Granular segregation is a process in which a non-uniform granular mixture separates into regions of different composition under shaking or flow. It is a very ubiquitous process: one encounters examples in geological systems, as well as many industrial applications: mining, building, pharmaceutical, food, etc., in addition to well documented controlled experiments. In some industrial applications segregation is desirable, but in others quite the opposite: perfect mixing is required. Understanding and controlling segregation is therefore rather important and has a clear potential usage base.

However, at present many of the fundamentals of granular segregation are not known: is there a smooth of sharp transition from mixed to segregated state as the control parameter changed? How are the various mechanisms relate to each other, which is dominant? What is the role of noise?

In this miniproject we will use a simple, particle based model to look at the phenomena. We will concentrate on one driving mechanism: the differential acceleration of particles, and focus on the question of whether the mixed and segregated state are separated by a sharp transition of a phase-transition-like nature, or the change is more gradual.

The miniproject will involve running simulations of granular media, using (and modifying) existing C code, as well as processing data.

In case of mutual interest, this miniproject has the potential to be developed into a Ph.D. project.

See below a selection of papers describing the phenomena:

[1] N Burtally, P J King, M R Swift; Science **295**, 1877 (2002)

[2] T Mullin; Phys. Rev. Lett. 84, 4741 (2000)