Minicolloque n° MMM11 🔑 **Oral** 🔑 **Poster**

Disk on plane model of avalanche precursors

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A slowly inclined granular bed will suddenly start to flow when a critical angle is reached. Before the avalanche, it seems at first that nothing happens, but careful observations [1,2,3] reveal that many small events occur as the bed is inclined. Particularly remarkable are avalanche precursors: small, nearly periodic movements of the entire surface of the bed.

The experimental conditions necessary for observing precursors have been relatively well determined, but they have not been clearly observed in numerical simulations. The nature of precursors, therefore, remains elusive.

Recently, a one-dimensional model of a line of blocks linked by springs and a rod on a frictional inclined plane has been shown to exhibit precursor-like events [4]. In this contribution, we present a two-dimensional version of this model that is closer to the physical system, and also removes certain difficulties with the one-dimensional model.

Disks, interacting via classical granular discrete element forces, are placed on a frictional inclined plane. As the inclination is gradually increased, quasi-periodic compaction events are observed. We interpret these events as precursors.

[1] N. Nerone et al, Phys. Rev. E. **67** 011302 (2003)
[2] S. Keisegen de Richter et al, J Stat Phys (2010)
[3] S. Keisgen de Richter et al. J Stat Phys (2012)
[4] A. Amon et al, Phys. Rev E 96 033004 (2017)

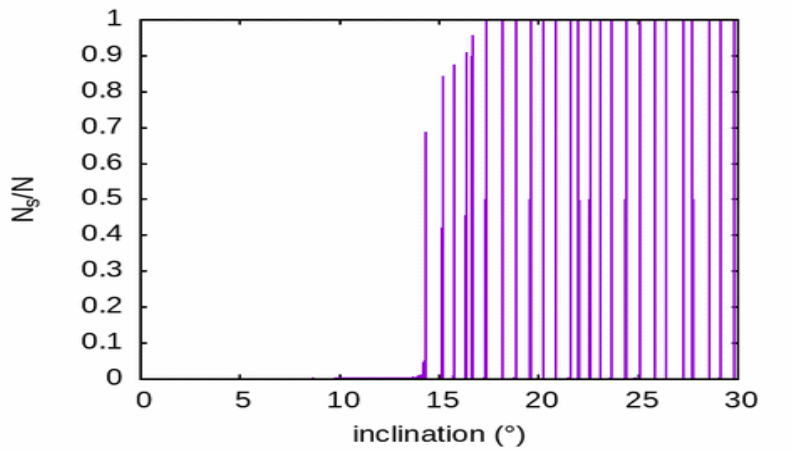

Figure 1 : Example of a simulation: fraction of grains that slide on the plane as a function of inclination (degrees). The precursors are visible as vertical lines. Simulation avec 32684 grains.