



Laws of thermodynamics do not prevent the possibility of extracting work from systems that are isothermic and in a stationary state as long as these are not at equilibrium. These states require something similar to a spontaneous breaking of symmetry and these pertain to the realm of Brownian motors.

Macroscopic realizations have been developed in the field of granular mechanics, a field of great relevance both industrially [due to the ubiquity of granular materials (GMs)] and theoretically (for the challenging properties and behavior generally exhibited by GMs).

A [new realization of a granular ratchet](#) has been completed in collaboration with A. Puglisi and A. Gnoli at the Physics Dept. of the University La Sapienza ([Gnoli et al. Phys. Rev. Lett. **110**, 120601 \(2013\)](#) , [Phys Rev. E **87**, 052209, \(2013\)](#))

Previously we had realized in our laboratory, in collaboration with R. Balzan and V. Loreto from La Sapienza, an experimental apparatus ([Balzan et al., Phys Rev. E **83**, 031310 \(2011\)](#)) in which a ratchet probe is immersed in a vibrated dense granular, in order to study how chaotic granular motion can indeed propel an asymmetric probe in a persistent direction. More recently, in collaboration with A. Gnoli (ISC Tor Vergata) and A. Puglisi (ISC La Sapienza) a gas granular version of the experiment has been realised and is currently under investigation. See the [movie](#)

