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A human-size realisation of the Feynman–Smoluchowski ratchet-and-pawl thought experiment

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We take inspiration from Feynman–Smoluchowski ratchet-and-pawl thought experiment to build experimentally a Maxwell’s demon at human-size.

We use a centimeter blade shafted to a CC-motor. Then, the blade is immersed in a granular gas made of hundreds of millimeter steel beads. The gas stands for an out-of-equilibrium heat bath, and the blade stands for a 1D Brownian particle whose speed is measured by the voltage at the motor connectors.

In Feynman–Smoluchowski thought experiment, the blade is free to rotate in one direction but the ratchet-and-pawl prevent rotation in the other direction.

To that end, in our experiment, we plug a diode and a load on the CC-motor in order to exert back-action depending on the blade speed. This demon introduces an asymmetry in the Brownian motion of the blade that thus experiences a neat motion in one well-defined direction

We analyze both dynamical and statistical properties of the particle motion. and even measure a thermodynamical quantities such as work, heat or efficiency.

Primary author: Mr LAGOIN, Marc (Laboratoire de Physique ENS de Lyon)

Presenter: Mr LAGOIN, Marc (Laboratoire de Physique ENS de Lyon)

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