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Equipartition of energy for a gas-fluidized grain. A.R. ABATE, U. of Pennsylvania, Dept. of Physics, D.J. DURIAN — The dynamics of a sphere rolling in a nearly-levitating upflow of air are described perfectly by the Langevin equation [1]. Surprisingly, statistical mechanics is applicable and can be exploited to infer the nature of the forces at play in this driven mechanical system. To probe the flexibility of statistical mechanics we perturb the original experiment in three ways: first, we break the circular symmetry of the confining potential by using a stadium-shaped trap and observe if the velocity distributions remain circularly symmetric; second, we fluidize multiple grains of different density to check if each has the same effective temperature; and third, we fluidize two grains of different size and check to see whether statistical mechanics remains applicable. It is found that the velocity distributions are unresponsive to asymmetry in the trapping potential and that the effective temperature is independent of grain mass-density, so that statistical mechanics remains applicable. When grains differ in size beyond a critical ratio, however, statistical mechanics breaks down. [1] Ojha et. al., Nature 427, 521 (2004).

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