



Department of Physics and Astronomy Presents

Canadian Association of Physicists Lecture

Exorcising Maxwell's Demon: How recent experiments resolve a century-old paradox at the heart of statistical physics



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1:40 pm, Room C620, U Hall

Abstract:

In 1867, at the dawn of statistical physics, Maxwell imagined a thought experiment that has both troubled and inspired physicists ever since. Traditional thermodynamics separates the observable macroscopic motions associated with work from the unobservable degrees of freedom associated with heat. But imagine—as can now be done experimentally on small systems where fluctuations are important—that you can observe some of these hidden degrees of freedom. Maxwell needed a “demon” to do this; now we can build it in the laboratory. The demon (experimenter) can then use the acquired information to lower entropy, extracting work from a surrounding heat bath. But what of the second law of thermodynamics? Can using information to extract work from a heat bath lead to perpetual motion machines? In 1961, Rolf Landauer proposed what is now seen as the solution to this threat to the Second Law: erasing the information acquired by the demon requires work, enough to compensate for any extracted from a heat bath. Only recently has this minimum work to erase information been measured. I will tell you how we did this, how it resolves the issues Maxwell first raised, and how this and other results are leading to a new view of thermodynamics where information is one resource among many that can be exploited to control the behaviour of microscopic systems.

EVERYONE IS WELCOME