

# Maxwell's devilishly clever idea moves close to reality

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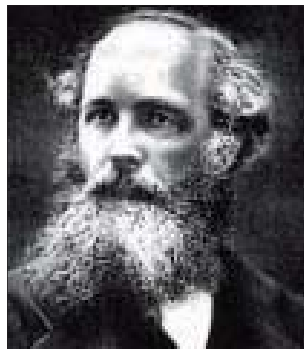
A DEVILISH idea conceived by one of the world's greatest physicists nearly 150 years ago has finally been realised by Scottish scientists.

The work by a team at Edinburgh University could eventually lead to a laser which can move objects from a distance. Their discovery was inspired by a classic experiment of 1867, by Scottish physicist James Clerk Maxwell.

He is bracketed with Isaac Newton and Albert Einstein for his contributions to science. In particular, Maxwell helped usher in the era of modern physics by laying the foundation for the theories of special relativity and quantum mechanics.

In his 1867 experiment, he conjured up a "demon" who could capture molecules, by making them move against their natural gradient. The imaginary demon guarded a trapdoor between two gas-filled compartments.

The creature lets only fast-moving molecules pass from



JAMES CLERK MAXWELL: He helped shape modern physics.

left to right, and slow-moving molecules from right to left. Over time, one compartment fills with fast-moving molecules and becomes hot, while the other contains slower-moving molecules and is cooler.

Now a team led by Professor David Leigh, of Edinburgh's department of chemistry, has been able to create such a machine for the first time, with its own "demon" inside it to ensnare the molecules.

The demon is a specially engineered molecule, known as a rotaxane. This tiny

"molecular machine", powered by laser light, is capable of moving molecules.

Professor Leigh has already used the machine to move droplets of water uphill. In future, he predicts the capacity of moving much larger objects, using laser-powered nanomachines. The Ministry of Defence is keenly interested in his work.

Professor Leigh said: "This is the first time that a system has been devised to trap molecules as they move in a certain direction under their natural motion. Once the molecules are trapped, they cannot escape.

"In nature, plant and animal cells use molecular machines for everything from photosynthesis to energy storage. Life is built on driving molecules against a gradient.

"In contrast, mankind, for all our technology, uses molecular machines for nothing. Our machines only harness the normal, static properties of molecules. Harnessing molecular machines will transform our capabilities."

