Stopping atoms

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With atoms and molecules in a gas moving at thousands of kilometres per hour, physicists have long sought a way to slow them down to a few kilometres per hour to trap them.

A paper, published today in the Institute of Physics' *New Journal of Physics*, demonstrates how a group of physicists from The University of Texas at Austin, US, have found a way to slow down, stop and explore a much wider range of atoms than ever before.

Inspired by the coilgun that was developed by the University's Center for Electromechanics, the group has developed an "atomic coilgun" that slows and gradually stops atoms with a sequence of pulsed magnetic fields.

Dr. Mark Raizen and his colleagues in Texas ultimately plan on using the gun to trap atomic hydrogen, which he said has been the Rosetta Stone of physics for many years and is the simplest and most abundant atom in the periodic table.

Work on slowing and stopping atoms has been at the forefront of advancement in physics for some time. In 1997, there were three joint-winners for the Nobel Prize in Physics for their combined contribution to laser cooling - a method using laser light to cool gases and keep atoms floating or captured in "atom traps".

These important advances had limited use because they only applied to atoms with 'closed two-level transition', excluding important elements

such as hydrogen, iron, nickel and cobalt. In contrast, nearly all elements and a wide range of molecules are affected by magnetic forces, or are paramagnetic, which means that this latest research has much wider applicability.

Professor Raizen said, "Of particular importance are the doors being opened for our understanding of hydrogen. Precision spectroscopy of hydrogen's isotopes, deuterium and tritium, continues to be of great interest to both atomic and nuclear physics. Further study of tritium, as the simplest radioactive element, also serves as an ideal system for the study of Beta decay. "

Having successfully designed and used an 18-coil device to slow a supersonic beam of metastable neon atoms, the team is now developing a 64-stage device to further slow and stop atoms.

Source: Institute of Physics