Fastest view of molecular motion

Scientists have made the fastest ever observations of motion in a molecule.

They "watched" parts of a molecule moving on an attosecond timescale - where one attosecond equals one billion-billionth of a second.

The researchers say the study gives a new in-depth understanding of chemical processes and could be used in future technologies such as quantum computing.

The study, which relies on short pulses of light from a specially built laser, was published in the journal Science.

"Understanding how something changes in time means really understanding its essence, and we are now looking at changes on a very, very fast timescale," said team member Dr John Tisch, of Imperial College London, UK.

Ultra-fast process

The researchers devised a new technique to "see" the motion of protons, one of the building blocks of an atom, in molecules of hydrogen and methane.

The technique involves firing a very short but intense laser pulse at a molecule, which rips an electron away, leaving the molecule in an excited ionised state.

The electron is then drawn back to the molecule, and when it collides a very short burst of x-rays is released.

"That has encoded information within it about the state of the molecule at the point of re-collision, and can give us information about the motion of the protons in this molecule," Dr Tisch told the BBC News website.

The process is ultra-fast, and the team was able to observe the effect the laser had on motion in the molecules with an accuracy of 100 attoseconds - the fastest ever recorded.

The team said being able to see detailed molecular motion would help scientists understand how molecules behaved in chemical processes, thus providing possibilities for controlling molecules.

"Control of this kind underpins future technologies, such as control of chemical reactions, quantum computing and high brightness x-ray light sources for material processing," said Professor Jon Marangos, another Imperial College author on the Science paper.

"We now have a much clearer insight into what is happening within molecules and this allows us to carry out more stringent testing of theories of molecular structure and motion."