MCFIP - The discovery of the ability to reduce attospeed rates when used in conjunction the other new technology, as outlined in the documents affixed to the article, enable all that has been known in cellular physiology to change.

https://phys.org/news/2020-08-electron-movements-liquid-super-slow-motion.html

AUGUST 21, 2020

Electron movements in liquid measured in super-slow motion

by Fabio Bergamin, ETH Zurich

Electrons are able to move within molecules when they are excited from outside or in the course of a chemical reaction. For the first time, scientists have now succeeded in studying the first few dozen attoseconds of this electron movement in a liquid.

To understand how chemical reactions begin, chemists have used super-slow-motion experiments for years to study the very first moments of a reaction. These days, measurements with a resolution of a few dozen attoseconds are possible. An attosecond is $1x10^{-18}$ (one quintillionth) of a second, i.e., a millionth of a millionth of a millionth of a second.

"In these first few dozen attoseconds of a reaction, you can already observe how electrons shift within molecules," explains Hans Jakob Wörner, professor at the Laboratory of Physical Chemistry at ETH Zurich. "Later, in the course of about 10,000 attoseconds, or 10 femtoseconds, chemical reactions result in movements of atoms up to and including the breaking of chemical bonds."

Five years ago, the ETH professor was one of the first scientists to detect electron movements in molecules on the attosecond scale. However, up to now, such measurements could be carried out only on molecules in gaseous form because they take place in a high-vacuum chamber.

Delayed transport of electrons from the liquid

After building novel measuring equipment, Wörner and his colleagues have now succeeded in detecting such movements in liquids. To this end, the researchers made use of photoemission in water: They irradiated water molecules with light, causing them to emit electrons that they could then measure. "We chose to use this process for our investigation because it is possible to start it with high temporal precision using laser pulses," Wörner says.

The new measurements also took place in high vacuum. Wörner and his team injected a 25-micrometer-thin water microjet into the measuring chamber. This allowed them to discover that electrons are emitted from water molecules in liquid form 50 to 70 attoseconds later than from water molecules in vapor form. The time difference is due to the fact that the molecules in liquid form are surrounded by other water molecules, which has a measurable delay effect on individual molecules.

Important step

"Electron movements are the key events in chemical reactions. That's why it's so important to measure them on a high-resolution time scale," Wörner says. "The step from measurements in gasses to measurements in liquids is of particular importance, because most chemical reactions—especially the ones that are biochemically interesting—take place in liquids."

Among those, there are numerous processes that, like photoemission in water, are also triggered by light radiation. These include photosynthesis in plants, the biochemical processes on our retina that enable us to see, and damage to DNA caused by X-rays or other ionizing radiation. With the help of attosecond measurements, scientists should gain new insights into these processes in the coming years.

When interfaced with the new existing single-particle cryo-electron microscopy, attosecond reduction of rates will be the key for the new generation of cellular science for cellular physiology.

Quantum biology (QB) has been perceived to be only theoretical because interactions between epigenetic molecules could not be supported with visualization of assertions made using QB for causes of chronic diseases.

Reference is made to quantum biology (QB); an algorithm for epigenetic activity. The website for MCFIP, Inc. (www.MCFIP.net) is a novel tutorial created to provide **scientifically verifiable** non-commercial explanation for the algorithm. To easily navigate the volume of information, a concise overview can be accomplished from 1st, 3rd, 7th and 8th links in the following tab from the website. Note. The 8th link uses DIY formats from several of dozens of causal paths for chronic diseases selected as proof-of-concept for the viability of the QB algorithm. https://www.mcfip.net/Quantum-Biology.html

The QB algorithm provides the in silico (wet lab) theories than can be verified by the researchers based on models created by qualified computational biologists.

https://phys.org/news/2020-08-attosecond-industrial-laser.html

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Researchers generate attosecond light from industrial laser

by University of Central Florida

University of Central Florida researchers are making the cutting-edge field of attosecond science more accessible to researchers from all disciplines.

Their method to help open up the field is detailed in a new study published today in the journal *Science Advances*.

An attosecond is one billionth of a billionth of a second, and the ability to make measurements with attosecond precision allows researchers to study the fast motion of electrons inside atoms and molecules at their natural time scale.

Measuring this fast motion can help researchers understand fundamental aspects of how light interacts with matter, which can inform efforts to harvest solar energy for power generation, detect chemical and biological weapons, perform medical diagnostics and more.

"One of the main challenges of attosecond science is that it relies on world-class laser facilities," says Michael Chini, an assistant professor in UCF's Department of Physics and the study's principal investigator. "We are fortunate to have one here at UCF, and there are probably another dozen worldwide. But unfortunately, none of them are truly operated as 'user facilities,' where scientists from other fields can come in and use them for research."

This lack of access creates a barrier for chemists, biologists, materials scientists and others who could benefit from applying attosecond science techniques to their fields, Chini says.

"Our work is a big step in the direction of making attosecond pulses more broadly accessible," Chini says.

"We show that industrial-grade lasers, which can be purchased commercially from dozens of vendors with a price tag of around $100,000, can now be used to generate attosecond pulses."

Chini says the setup is simple and can work with a wide variety of lasers with different parameters.

Attosecond science works somewhat like sonar or 3-D laser mapping, but at a much smaller scale. When an attosecond light pulse passes through a material, the interaction with electrons in the material distorts the pulse. Measuring these distortions allows researchers to construct images of the electrons and make movies of their motion.

Typically, scientists have used complex laser systems, requiring large laboratory facilities and clean-room environments, as the driving lasers for attosecond science.

Producing the extremely short light pulses needed for attosecond research—essentially consisting of only a single oscillation cycle of an electromagnetic wave—has further required propagating the laser through tubes filled with noble gases, such as xenon or argon, to further compress the pulses in time.

But Chini's team has developed a way to get such few-cycle pulses out of more commonly available industrial-grade lasers, which previously could produce only much longer pulses.

They compress approximately 100-cycle pulses from the industrial-grade lasers by using molecular gases, such as nitrous oxide, in the tubes instead of noble gases and varying the length of the pulses they send through the gas.

In their paper, they demonstrate compression to only 1.6 cycles, and single-cycle pulses are within reach of the technique, the researchers say.

The choice of gas and duration of the pulses are key, says John Beetar, a doctoral student in UCF's Department of Physics and the study's lead author.

"If the tube is filled with a molecular gas, and in particular a gas of linear molecules, there can be an enhanced effect due to the tendency of the molecules to align with the laser field," Beetar says.

"However, this alignment-caused enhancement is only present if the pulses are long enough to both induce the rotational alignment and experience the effect caused by it," he says. "The choice of gas is important since the rotational alignment time is dependent on the inertia of the molecule, and to maximize the enhancement we want this to coincide with the duration of our laser pulses."

"The reduction in complexity associated with using a commercial, industrial-grade laser could make attosecond science more approachable and could enable interdisciplinary applications by scientists with little to no laser background," Beetar says.

Facts outlined in the following article, establish the foundation for the application of the Theory of Relativity to cellular physiology; i.e. vibrations created as light passes through matter between or within cells, create oscillation (vibration) that creates energy at attoscale exists but has not been able to be seen can be verified.

“**Oscillation** is the repetitive variation, typically in time, of some measure about a central value (often a point of equilibrium) or between two or more different states. The term **vibration** is precisely used to describe mechanical **oscillation”** (Wikipedia)

With near certainty, the discipline of computational biology using verifiable and replicable models will bring cellular physiology to a previously unimaginable level.

The ability of single-particle cryo-electron microscopy is explained in the attached. Prior to the work at Caltech, autophagy was perceived as “taking out the trash” and not disassembling dysfunctional organelles such as the endoplasmic reticulum that can be verified as the regulator of calcium activity required for cellular signaling.

https://www.mcfip.net/upload/Autophagy%20Visual%20(Membrane%20Protein%20Comple)%20-%20DIY.pdf

https://medicalxpress.com/news/2020-08-neuroscientists-regions-brain.html

AUGUST 21, 2020

Neuroscientists demonstrate how to improve communication between different regions of the brain

by Albert Ludwigs University of Freiburg

Selective communication among brain regions is crucial for brain function. But the weak and sparse connectivity of the brain is a big hurdle. During the last decade neuroscientists have identified various means by which this limitation can be counteracted. Now scientists from Iran, Germany and Sweden have identified a new role of bi-directional connections in accelerating the communication between brain regions. They have now presented their results in the scientific journal *PLoS Computational Biology*.

There are essentially two ways by which weak and sparse connectivity can be countered: either by synchrony or by oscillations. In synchrony mode, many neurons spike together (synchronously) when they transmit stimulation. Together they have a stronger combined effect in the downstream network than they do individually. By contrast, in oscillation mode, network oscillations increase the effective connectivity periodically by modulating the membrane potentials of downstream neurons that are receiving the stimulation.

But the oscillations need to be synchronized in the sender and receiver networks. "It is an open question how such synchronous oscillations may occur in the brain. Some time back we proposed that the resonance property of neuronal networks can be used to generate synchronized oscillations," says Ad Aertsen from the Bernstein Center Freiburg (BCF) of the University of Freiburg. Resonance in a neuronal network means that when this network is stimulated at a specific frequency, the network starts to oscillate and the input has a much bigger impact. This idea is referred to as 'communication through resonance (CTR).'

However, CTR posed another problem. It takes several oscillation cycles to build up the resonance in the network. Moreover, such resonance needs to be created at every downstream stage. This means that communication across networks is quite slow. "We thought that synchrony and oscillations provide fast and slow communication modes, respectively. And both can be used in different situations. But we remained wary of this issue," explains Arvind Kumar from the Royal Institute of Technology (KTH) in Stockholm, Sweden.

A possible way to speed up the communication is to reduce the time it takes to build-up the resonance. To this end, the group focused on the anatomical observation of bi-directional connections among brain areas. That is, not only do neurons from the sender network project to receiver neurons, but some neurons from the receiver network also project back to the sender network. "Such bi-directional connections are few, but they are sufficient to support a loop between sender and receiver networks," explains Alireza Valizadeh of Institute for Advanced Studies in Basic Sciences in Zanjan, Iran. An important consequence of such a loop is that resonance can be established in fewer cycles. More importantly even, the loop can amplify the signal and there is no need to build-up resonance in subsequent layers. Hedyeh Rezaei, a Ph.D. student at Zanjan University and visiting student at the BCF under the auspices of her research project says, "It is remarkable that such a loop of connections between just one resonance pair of sender and receiver networks can speed up the network communication by at least a factor of two."

Ad Aertsen concludes, "These new findings provide support for the idea of 'communication through resonance.' What is important is that these results implicate bi-directional connections between brain regions in a novel function, namely, in shaping more rapid and reliable communication between them."