

SUB-ATOMIC MOTIONS PROBE HUMAN HEALTH

How basic science addresses grand challenges

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Basic research rarely helps practitioners directly with their everyday concerns; nevertheless, it stimulates new ways of thinking that have the potential to revolutionize and dramatically improve how practitioners deal with a problem in the future*. This lecture aims at providing an example.

At the dawn of the new millennium, attosecond metrology enabled us to capture sub-atomic motions for the first time. Couple of decades later, the new technology provides insight into sub-atomic motions of electrons and nuclei in molecules.

When triggered and captured in the molecules of human blood, these motions can reveal changes in its molecular composition and provide early signs of unfolding health aberrations.

Cost-effective monitoring of human health will address several grand challenges of our time.

*https://en.wikipedia.org/wiki/Basic_research



Ferenc Krausz graduated in electrical engineering from the Budapest University of Technology and completed his studies in theoretical physics at the Eötvös Loránd University in 1985. He earned his doctorate in laser physics from the Technische Universität Wien (1991), where he became professor in 1998. In 2003-2004, he was appointed director at the Max-Planck-Institute of Quantum Optics in Garching and chair of experimental physics – laser physics at the Ludwig-Maximilians-Universität and established “Attoworld” at these two sites (attoworld.de).

In a series of experiments performed between 2001 and 2004 his team succeeded in producing and measuring isolated attosecond pulses of light and applying them to observe sub-atomic motions. Attoworld has been fostering the proliferation of the emerging field, attosecond science, and – since 2015 – exploring its utility for probing human health. For his contributions to establishing the field of Attosecond Science, Ferenc Krausz has been awarded the King-Faisal International Prize for Science (2013), the Wolf-Prize in Physics (2022), the BBVA Frontiers of Knowledge Award (2023) and the 2023 Nobel Prize in Physics.