

Editorial

Ultrafast Science to Capture Ultrafast Motions

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To reflect blooming interest in ultrafast dynamics, we are launching a new journal to publish top-quality research in the field. *Ultrafast Science* is now open for your submissions.

We are living in a dynamic world, where all matter is in a vibrant process, whether it is a giant celestial body or a small atom. Being able to observe, analyze, and manipulate these dynamic processes is undoubtedly essential for scientific discoveries and technical innovations. The evolution of any physical quantity (e.g., displacement, mass, electromagnetic fields, intensity, phase, and spectra) with time gives rise to different time-varying phenomena—some are slow, some are fast, and some are ultrafast, in view of what human beings can sense. With the modern smartphone or camera, fast motions within the microsecond time scale can now be recorded in daily life. However, when we enter into the micro/nanoscale world, what happens often becomes ultrafast. For example, atomic diffusion occurs in a nanosecond (10^{-9} s) time scale. Molecular rotation, charge transfer relaxation, and magnetization reversal happen in picoseconds (10^{-12} s). Molecule and lattice vibrations can happen even faster, occurring in femtoseconds (10^{-15} s). Looking into the depths of an atomic system, electrons move orders faster to the attosecond (10^{-18} s), which is currently the fastest process that human beings can observe. Furthermore, when we explore the nucleus of an atom, we will find the ultrafast dynamics happening in zeptoseconds (10^{-21} s). These ultrafast processes, which eventually govern the property of matter, need special pulsed probing sources, methods, and instruments to investigate. The related ultrafast technologies play important roles for research and applications in fundamental physics, chemistry, materials, biology, energy, and information science.

Ultrafast science is a general term referring to a knowledge system to investigate and explore the phenomena and laws of ultrafast changes in the universe. It involves various disciplines including atom and molecule physics, condensed matter physics, mechanics, optics, chemistry, biology, material science, and information science. Thus, ultrafast science has developed rapidly in the past decades. The Nobel Prize in chemistry was awarded for femtosecond laser chemistry in 1999. The Nobel Prize in physics was awarded for optical frequency comb laser precision spectroscopy in 2005. The 2018 Nobel Prize in physics was awarded for ultrashort super-intense laser pulse technology—chirped pulse amplification. In the last 10 years, over 50,000 research articles have been published in over 1,000 journals, as analyzed by Web of Science using the keyword of “ultrafast.” However, there lacks a specific high-impact journal that focuses on ultrafast science. This is the motivation for launching the *Ultrafast Science* journal. After over 1 year of preparation and discussion with the American Association for the Advancement of Science (AAAS), we reached a consensus that ultrafast science is an emerging and important direction which covers very broad and leading research fields.

In 2020, *Ultrafast Science* became a Science Partner Journal distributed by the AAAS in collaboration with Xi'an Institute of Optics and Precision Mechanics (XIOPM), which is one of the leading organizations in ultrafast science in China, from the Chinese Academy of Sciences (CAS). *Ultrafast Science* is an Open Access Journal which publishes top-quality original research articles, comprehensive reviews, and perspectives, reflecting significant advances, breakthroughs, and novel applications with considerable potential in ultrafast science and broad interest from scientific

communities. Topics include but are not limited to ultrafast physics, ultrafast laser and application, ultrafast imaging, ultrafast spectroscopy, ultrafast measurement, ultrafast materials and devices, ultrafast terahertz photonics, ultrafast electronics, ultrafast chemical physics, and other ultrafast phenomena. Interdisciplinary research demonstrating how ultrafast technology advances physics, chemistry, biology, material science, and other disciplines is especially welcome.

We are honored to serve as the founding Editors-in-Chief and are grateful to work with the members of the Editorial Board, which currently comprise around 40 famous scientists from all over the world, including Gérard Mourou, who was awarded the Nobel Prize in physics in 2018. We believe that *Ultrafast Science* will become a high-impact journal in the near future with all of your participation and contributions, and that the journal will grow with the continuous breakthroughs in the ultrafast frontier.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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