ASHIHARA LAB.

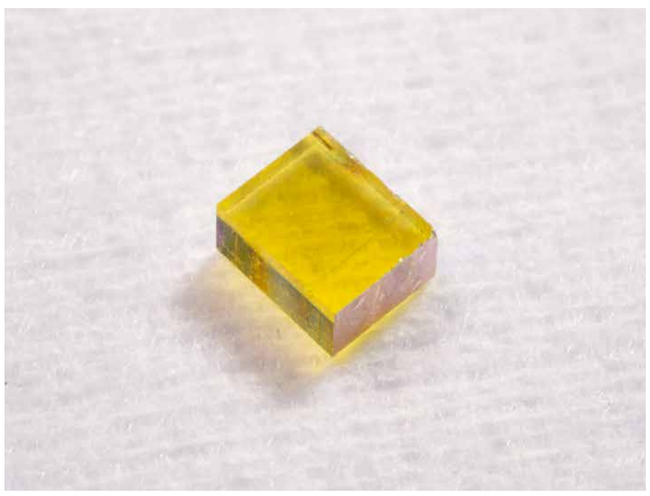
Ultrafast & Nano Optical Science

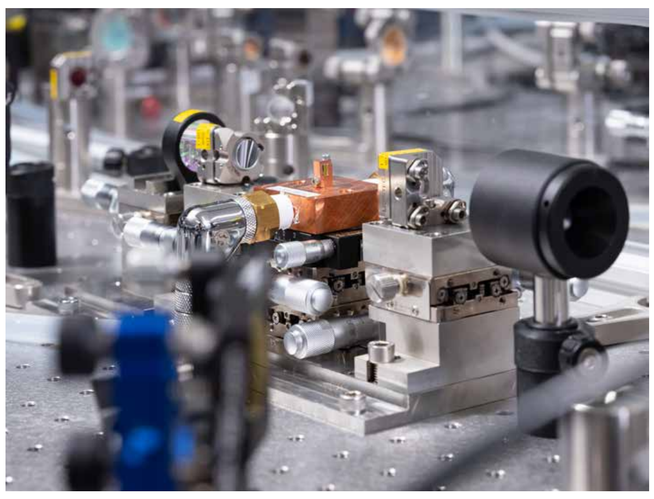
Department of Fundamental Engineering

Ultrafast Optics
Department of Applied Physics, Graduate School of Engineering http://www.ashihara.iis.u-tokyo.ac.jp

We study optical science aiming at creating new value for light. In particular, paying attention to the potential of infrared light, we are developing a state-of-the-art laser that emits a strong flash of infrared light. Using this ultrashort infrared light, we create a new method for identifying and manipulating the microscopic structures of matter. Prospects include applications to ultrasensitive molecular detection, chemical analysis imaging, chemical reaction control, and ultrafast optoelectronics.

Infrared Femtosecond Lasers

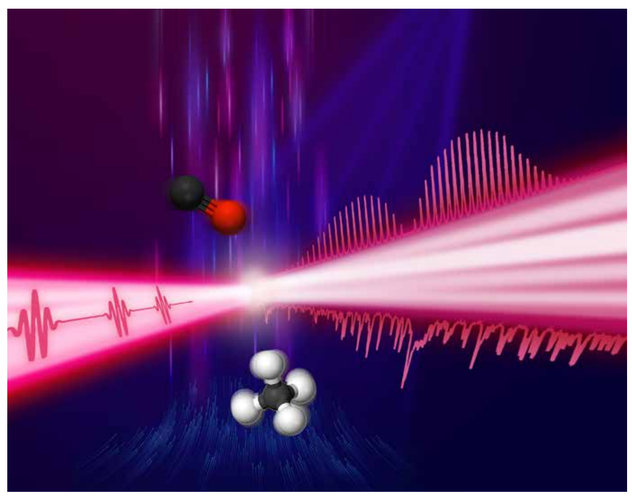


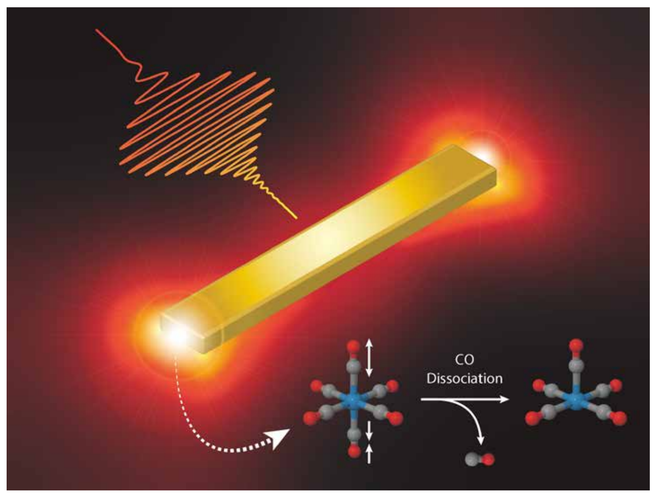


The ultrafast optical pulse is an electromagnetic wave that has a temporal duration of hundreds of femtoseconds. Mid-infrared ultrafast optical pulses consist of coherently superposed, or ‘mode-locked’ infrared electromagnetic waves, bringing high peak intensity and broadband spectrum.

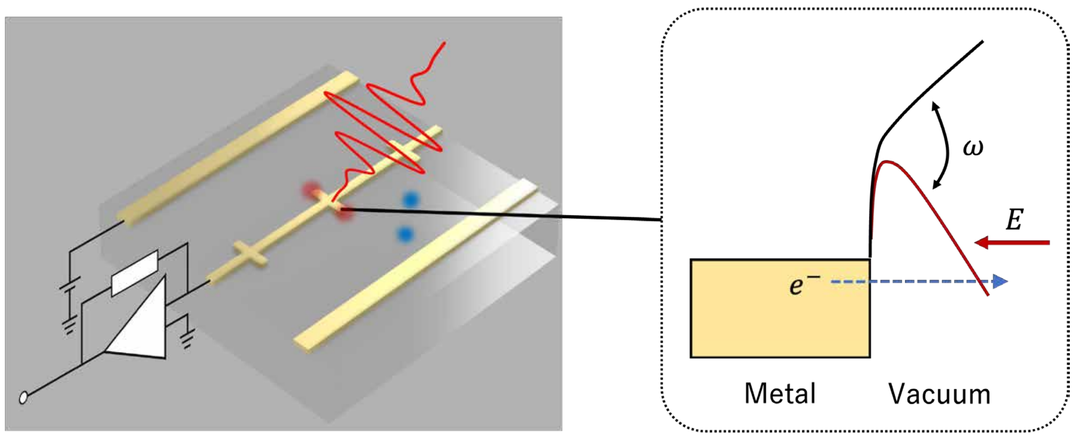
Spectroscopy & Reaction Control

Infrared light can directly excite molecular vibrations, which enables us to investigate molecular structures and to control chemical reactions. We are developing novel molecular measurement and control methods utilizing state-of-the-art optical technologies including infrared ultrashort pulsed lasers.





Optical-Field-Driven Electronics



The intense optical field of infrared ultrashort pulses can control electron wave packets on the attosecond scale. We are developing a detector that can catch up with optical frequencies beyond 100 THz in combination with the field enhancement properties exhibited by metallic nanostructures.