



Front-line Researchers

- Hiroshi Sawada, Senior Distinguished Researcher, NTT Communication Science Laboratories

Rising Researchers

- Yu Sasaki, Distinguished Researcher, NTT Social Informatics Laboratories

Feature Articles

The Frontiers of Ultrafast Optical Physics Research

- Prospects for the Frontiers of Ultrafast Optical Physics Research: Engineering Petahertz Waves
- Megahertz-repetition-rate 1.7-cycle Intense Pulse Sources for Future Bright Attosecond Spectroscopy
- Topological High-harmonic Generation from Solids
- Attosecond Time-resolved Spectroscopy for Light-electron interaction in Solid-state Materials
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Global Standardization Activities

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Practical Field Information about Telecommunication Technologies

- OTDR Waveform Evaluation Tool Enabling Automatic Identification of Location and Cause of Faults

Front-line Researchers

Hiroshi Sawada, Senior Distinguished Researcher, NTT Communication Science Laboratories

▼Abstract

Optimization problems involve expressing the problem to be solved as a mathematical formula and finding the best solution from all feasible solutions. They are used to solve a wide range of problems, such as creating shift schedules that even out work frequencies and times of employees and determining the optimum production volume of a product to maximize profits, and there are a variety of approaches to solve them. As artificial intelligence (AI) becomes more prevalent, more opportunities to use AI to solve optimization problems will arise. Optimization problems are also applied to machine learning in AI. Hiroshi Sawada, a senior distinguished researcher at NTT Communication Science Laboratories, has been achieving new results by incorporating a long-standing optimization method into his research on two themes: audio source separation and a method for training hardware-oriented neural networks. We spoke with him about his research approach and results concerning these themes as well as the importance of building connections with other fields on the basis of one's technical expertise.



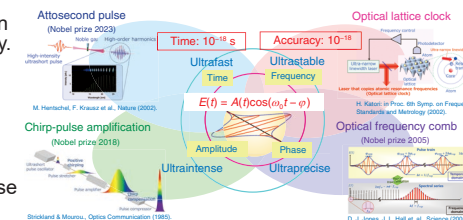
Feature Articles

The Frontiers of Ultrafast Optical Physics Research

Prospects for the Frontiers of Ultrafast Optical Physics Research: Engineering Petahertz Waves

▼Abstract

The Nobel Prize in Physics in 2023 was awarded for the generation and measurement techniques of an attosecond (an attosecond is 1×10^{-18} second) pulse, which has a temporal duration in the attosecond range in wavelength typically from extreme ultraviolet to soft x-ray. The duration of an attosecond pulse is shorter than the period of typical light waves, and on this timescale, light can be reinterpreted as an electric field oscillating at sub-petahertz (PHz = 10^{15} Hz) frequencies. This article provides an overview of attosecond pulse generation techniques that have paved the way for the era of "attosecond science" and introduces the attosecond pulse laser technologies advanced by NTT Basic Research Laboratories, as well as the latest research and prospects of ultrafast optical physics focusing on petahertz electric field-electron interaction.



Regular Articles

Proposal of a Transdermal Iontophoresis Patch and Sheet Mask Using the Principle of Magnesium-air Batteries

▼Abstract

To develop an iontophoresis technology that does not require a large power supply, this study focused on magnesium-air batteries, which use atmospheric oxygen and magnesium, a metal with a low incidence of allergic reactions. We thus propose a transdermal iontophoresis patch and sheet mask using the principle of magnesium-air batteries. To verify the feasibility of the transdermal iontophoresis patch and sheet mask, we conducted an evaluation using time-of-flight secondary ion mass spectrometry. Ion mapping of the active ingredient and analysis of its line profile revealed that the use of our iontophoresis patches enhanced active-ingredient penetration by approximately twice that of patches without iontophoresis. These findings indicate that the patch and sheet mask technologies contribute to the development of a highly portable and user-friendly transdermal iontophoresis patch and sheet mask that can be easily used at home.

