Seminar in Laboratoir de Spectrochimie Infrarouge et Raman
Universite de Lille, France
November 4, 2013

Exploration, elucidation, and application of femtosecond laser-induced phenomena in molecular and bio systems

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1960
Laser oscillation was demonstrated.

Late 1960s
3 lasers were introduced to physical chemistry laboratories in Japan.

1967
Norrish, Porter, Eigen were awarded Nobel Prize due to their fast kinetic study of chemical reaction.

1968
Masuhara shifted to Mataga laboratory as the 1st year Ph. D student of Osaka University and this autumn a Ruby laser was set there. Masuhara belongs to the first generation who had a chance to use lasers for Ph. D works.

1968

Prof. Mataga said to Masuhara that
all light sources would be replaced by lasers in future, so new chemistry would be opened by lasers.

I understood that my Ph. D would be given when I would demonstrate something new as photochemistry.

Practically I set up and measured nanosecond absorption spectroscopy of CT complex for the first time, which received much attention. But I knew it just followed Porter's way and was far from exploratory research.

My initial trial was to improve time-resolution of electronic absorption spectroscopy of solution.
Nanosecond, picosecond, and femtosecond

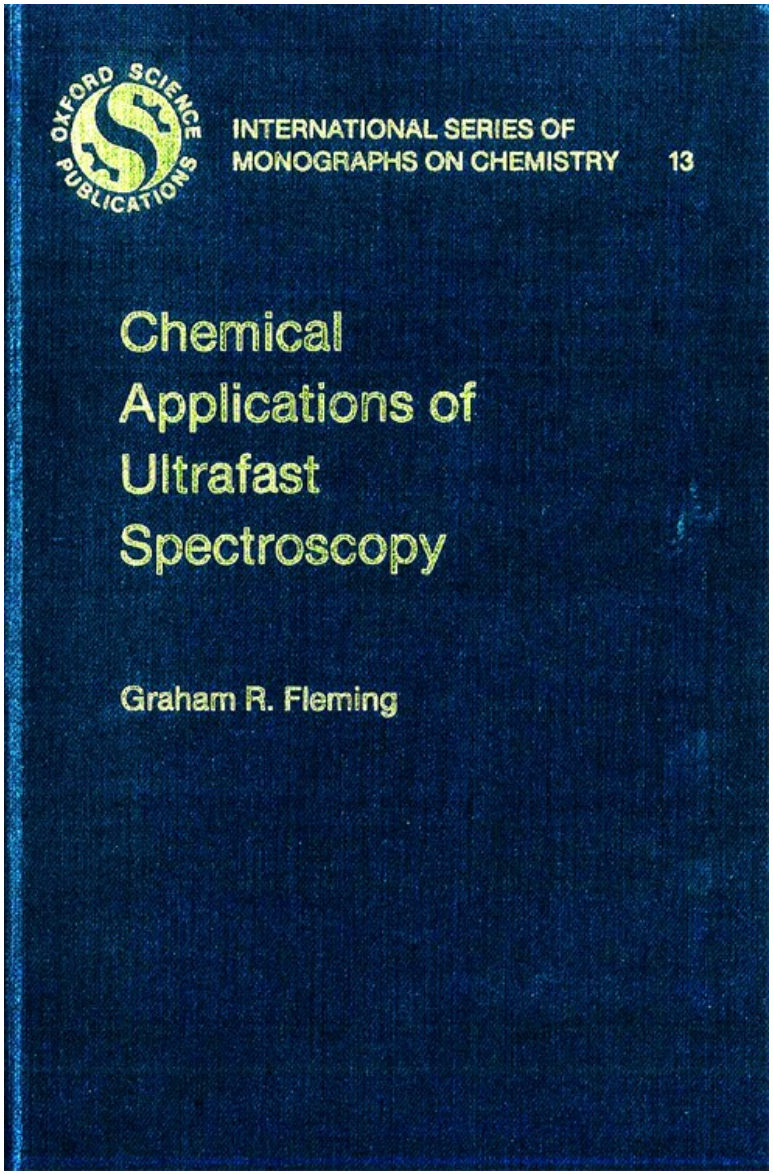
The second trial was to develop time-resolved reflection spectroscopy for films and powders.
Diffuse, specular, and total internal reflection

Still I felt that we were following Porter's way

The third trial was to develop time-resolved spectroscopy under confocal microscope.
Picosecond, femtosecond

Then shifted to transient grating spectroscopy, near field fluorescence microscopy, single nanoparticle spectroscopy, and so on.

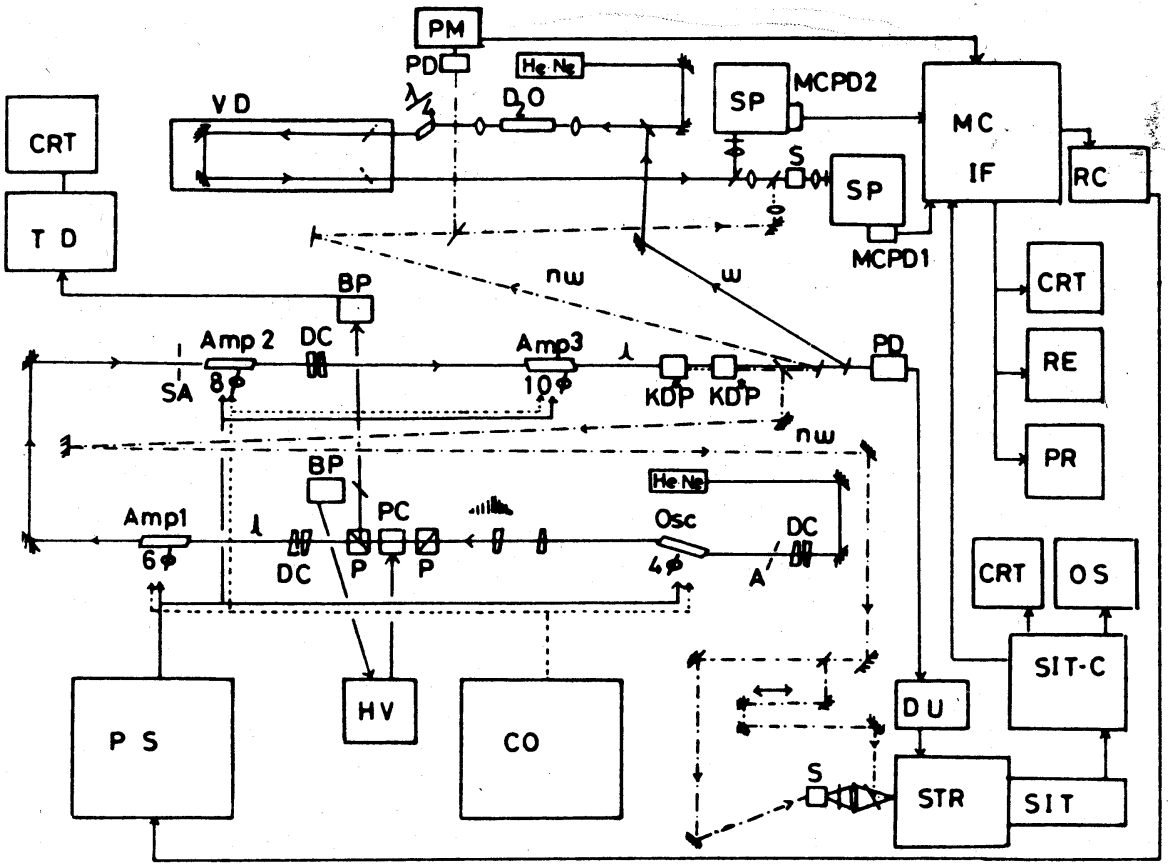
In parallel we have been exploring molecular phenomena utilizing femtosecond laser.



Chemical Applications of Ultrafast Spectroscopy

GRAHAM R. FLEMING
The University of Chicago

OXFORD UNIVERSITY PRESS *New York*
CLARENDON PRESS *Oxford*
1986



Schematic diagram of a picosecond Nd-YAG laser photolysis system. DC, dye cell; A, aperture; P, polarizer; PC, Pockels cell; BP, biplanar phototube; PD, photodiode; PM, power meter; TD, transient digitizer; VD, variable delay; SP, spectrograph; S, sample; MC, microcomputer; IF, interface; RC, remote control; RE, recorder; PR, printer; DU, delay unit; STR, streak camera; SIT, SIT camera; SIT-C, SIT camera controller; OS, oscilloscope.

Miyasaka, Masuhara, Mataga, Laser Chemistry, 1983, 1, 357

OPPORTUNITIES IN

Chemistry

Committee to Survey Opportunities in the Chemical Sciences

Board on Chemical Sciences and Technology

Commission on Physical Sciences, Mathematics, and Resources

National Research Council

1985

Pimentel Report

“Laser, SOR, and Computer will create the next chemistry”

NATIONAL ACADEMY PRESS
Washington, D.C. 1985

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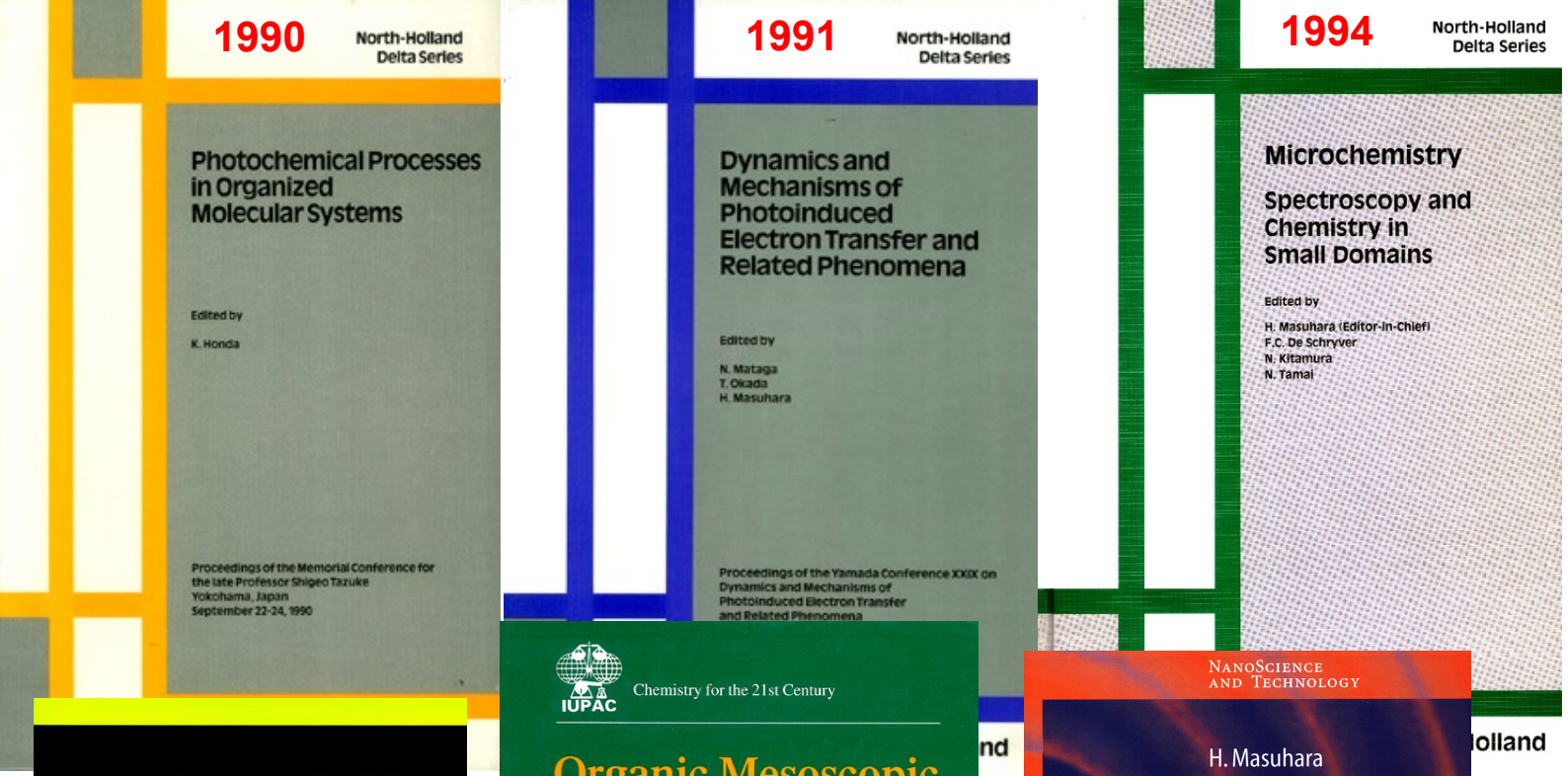
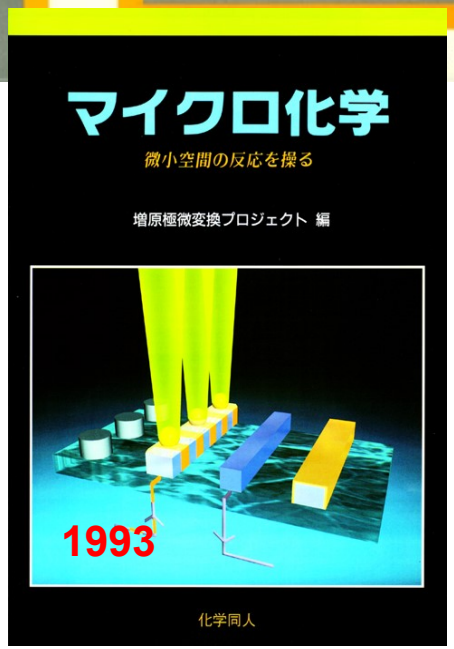
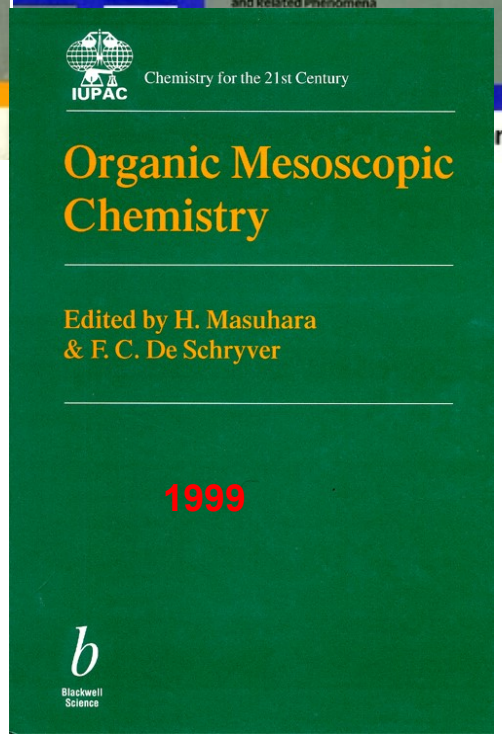
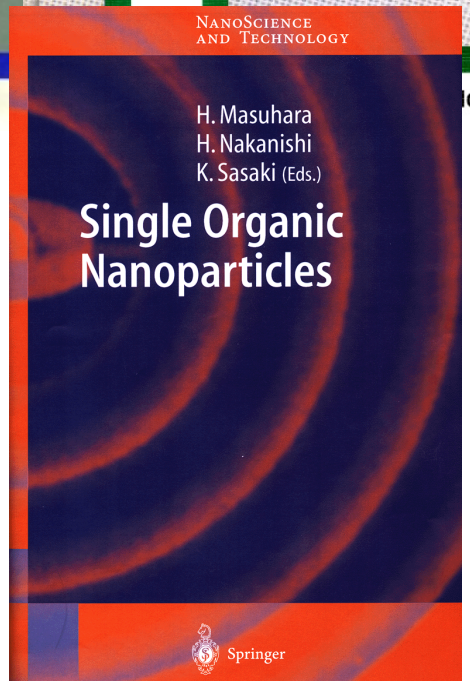




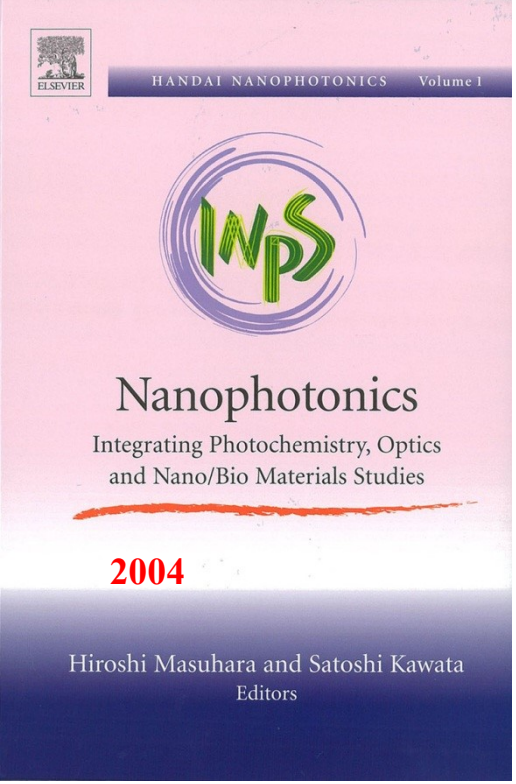


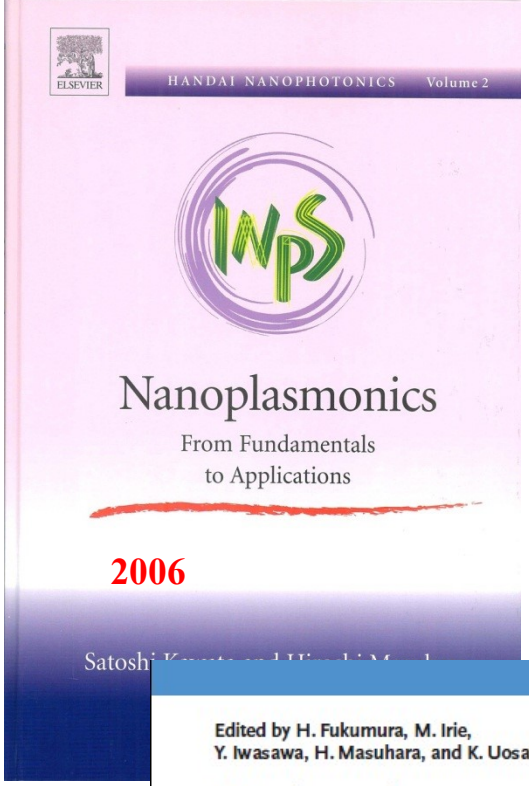


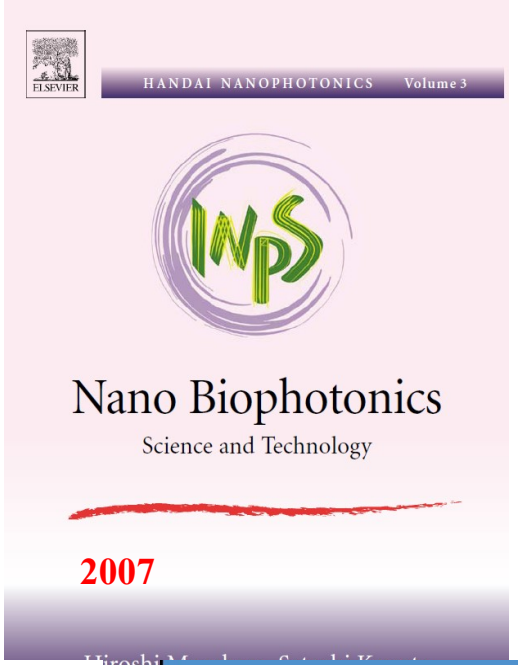
2003

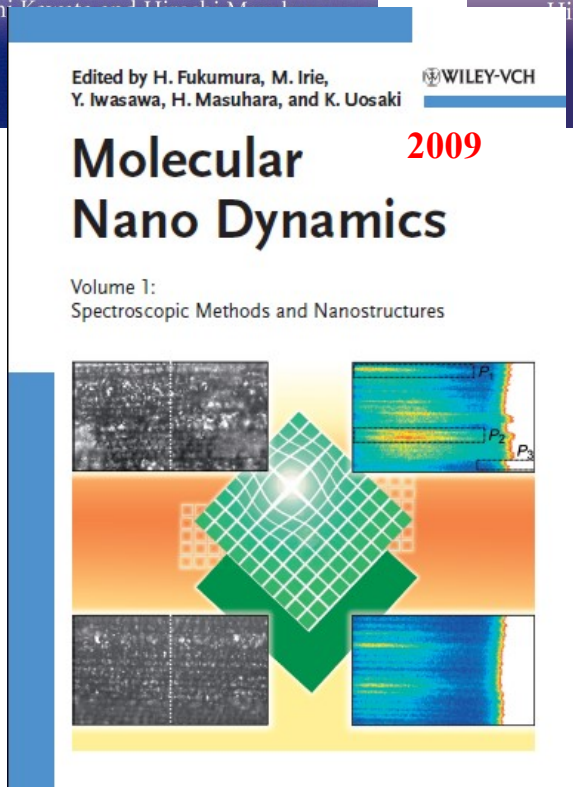
2005

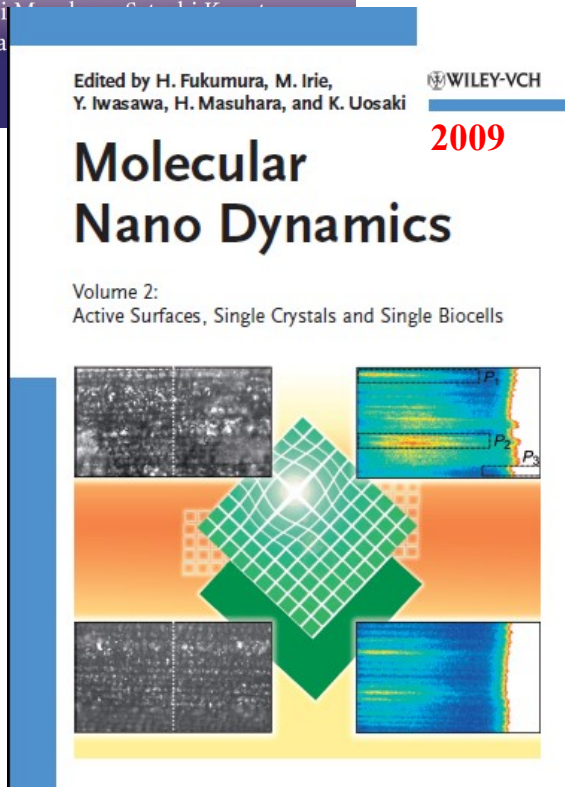
Books Edited and Written by Masuhara et al.











Books Edited and Written by Masuhara et al.

Femtosecond absorption and imaging study on laser ablation dynamics of dye thin films, proving Photo-mechanical ablation mechanism

Femtosecond laser-induced crystallization of molecules in solution

Femtosecond manipulation of living cells by indirect irradiation

Laser trapping dynamics of nanoparticles by f emtosecond laser pulses

Bull. Chem. Soc. Jpn. Vol. 86, No. 7, 755–783 (2013)

Award Accounts

The Chemical Society of Japan Award for 2005

Time-Resolved Spectroscopic and Imaging Studies on Laser Ablation of Molecular Systems: From Mechanistic Study to Bio/Nano Applications#

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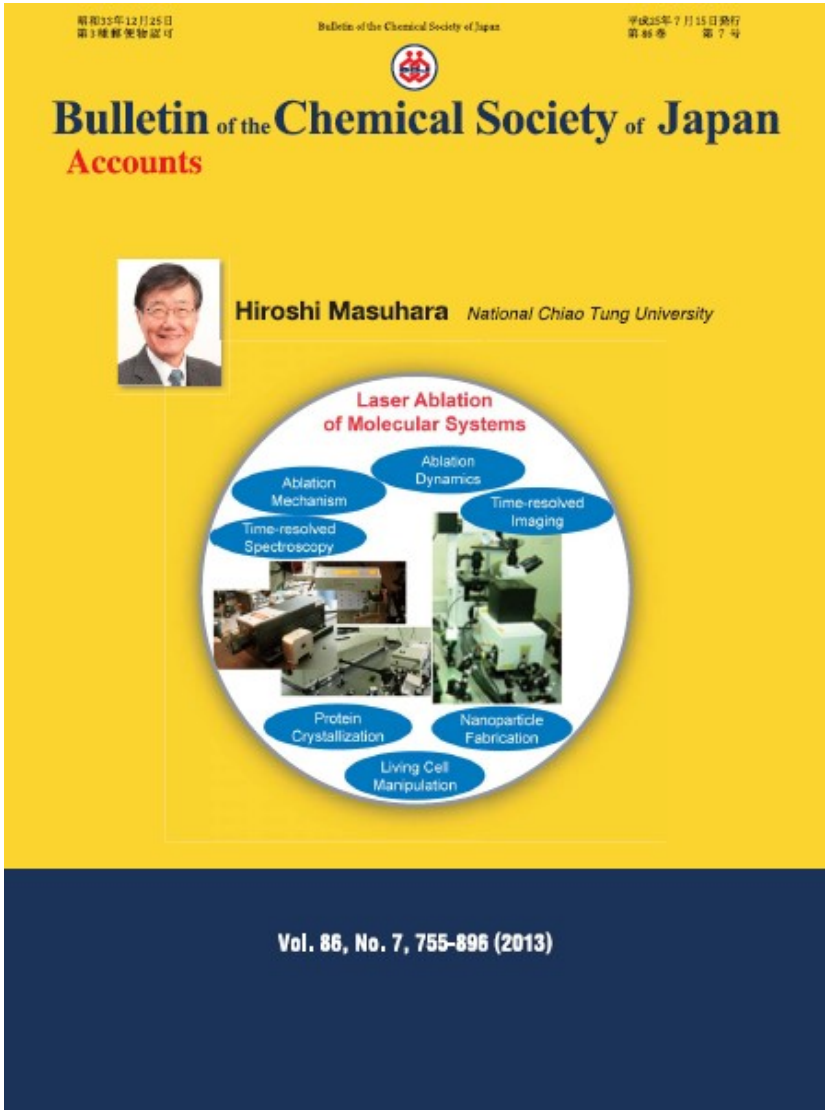
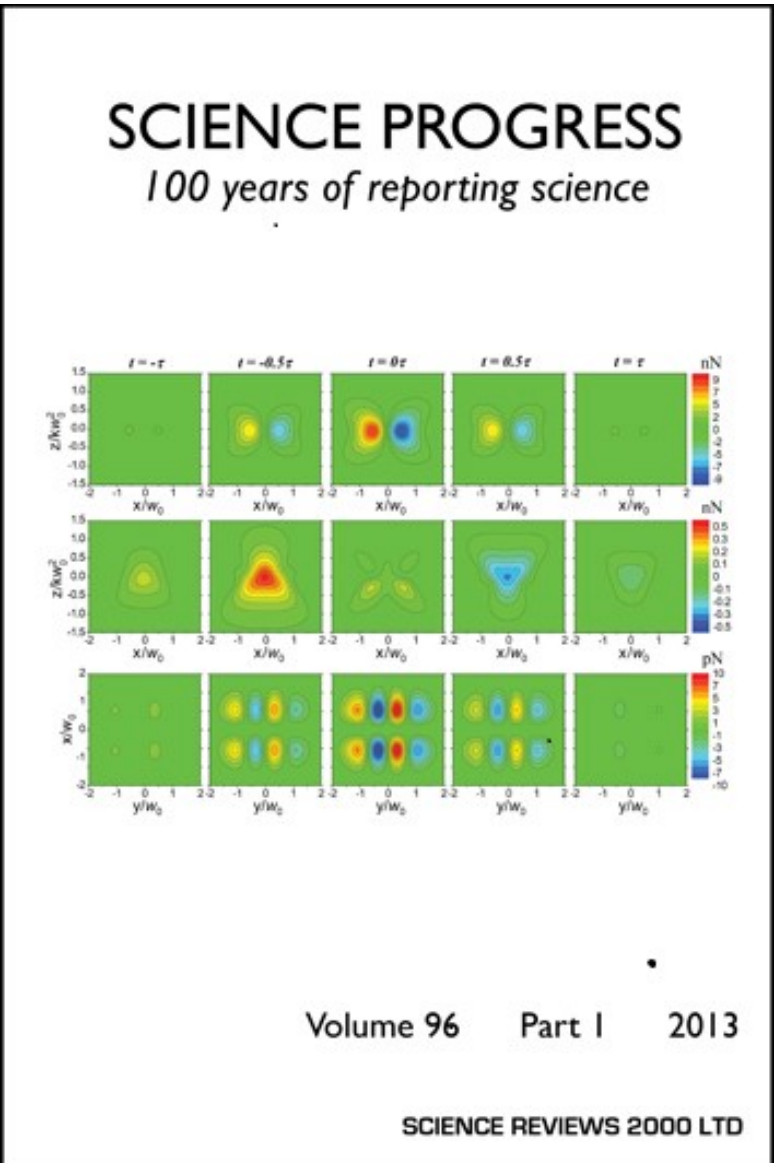
Received March 5, 2013; E-mail: masuhara@masuhara.jp

This accounts explained what I talked today.



Trapping dynamics of nanoparticles by femtosecond laser pulses are summarized in this review



Science Progress,

"Optical Trapping of Nanoparticles by Ultrashort Laser Pulses"

A. USMAN **W.-Y. CHIANG** **H. MASUHARA**

1968

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2013

Now I think that laser has given, is giving, and will give us enough exploratory chemical research.