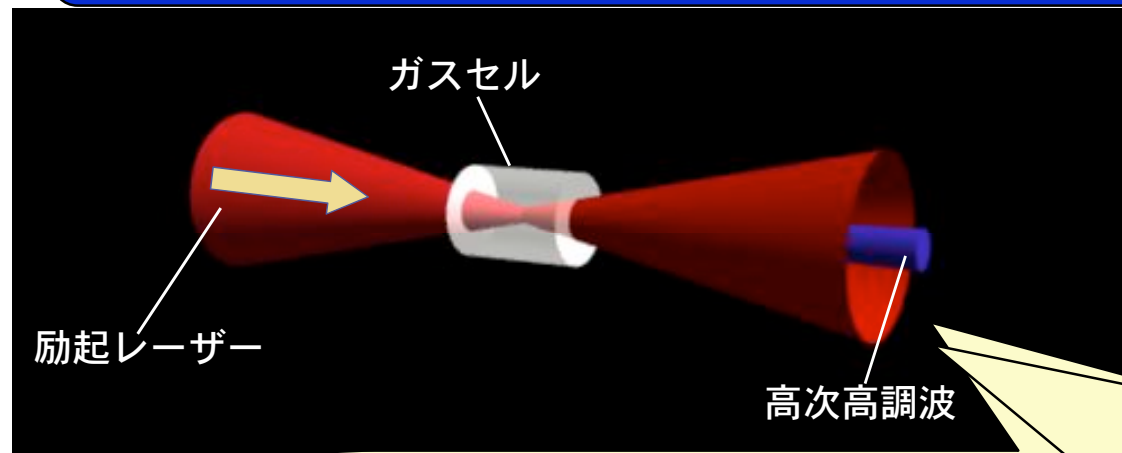
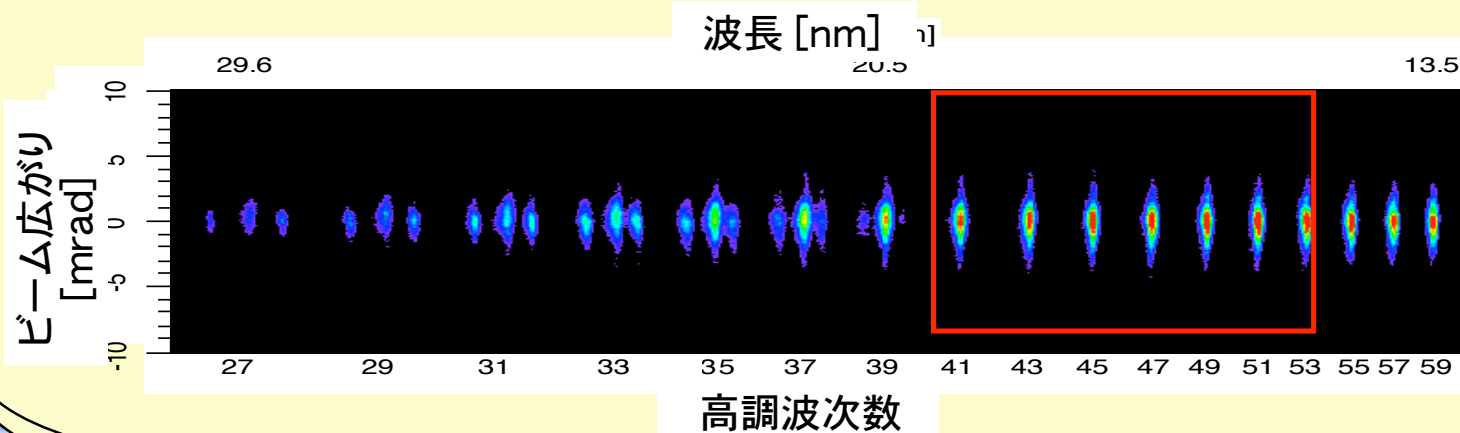


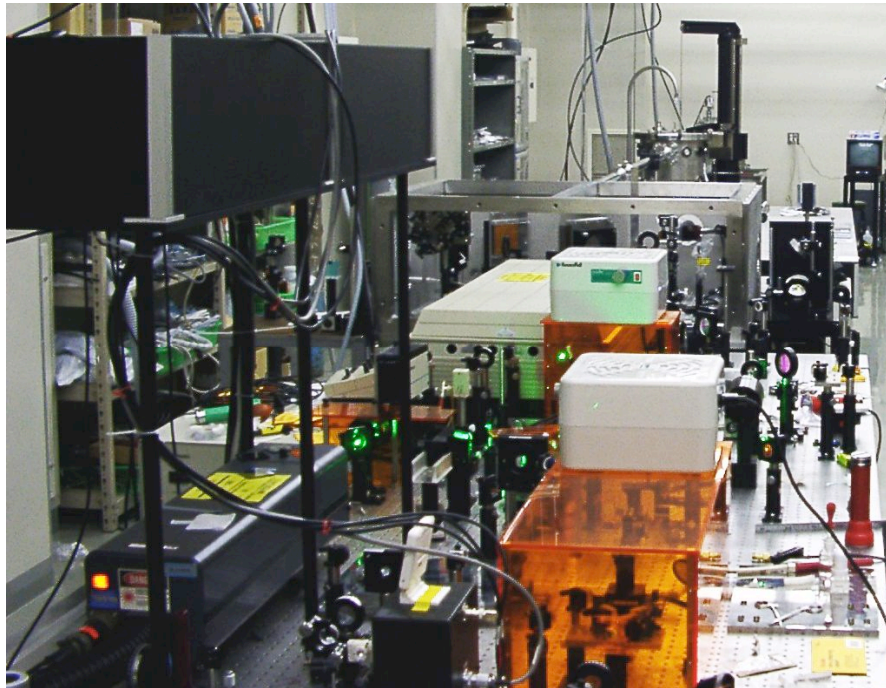
高次高調波によるコヒーレント軟X線の発生



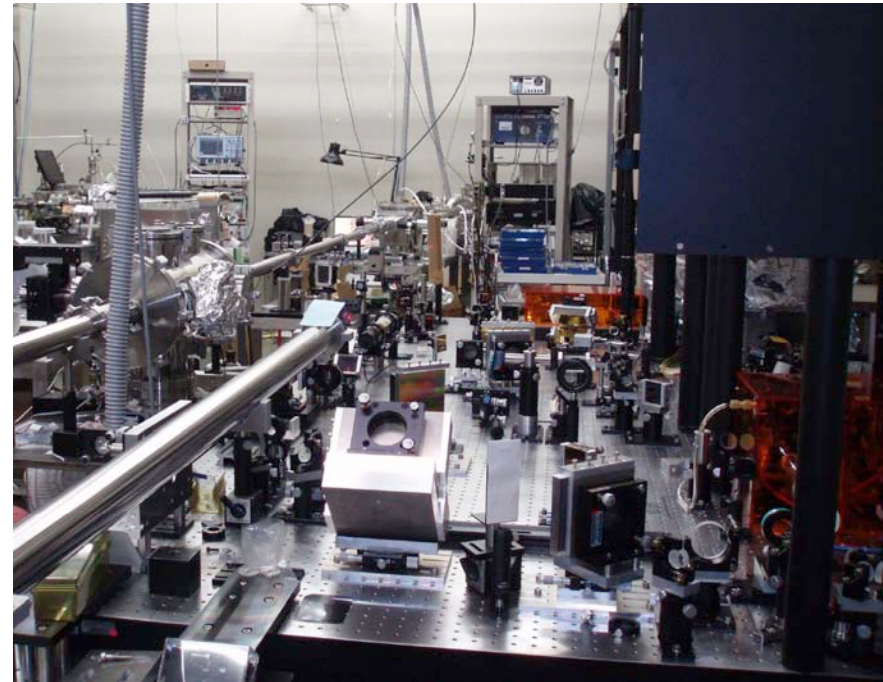
レーザー光と同じ性質のコヒーレント軟X線



Ti:Sapphire CPA Lasers for Intense High-Harmonic Generation



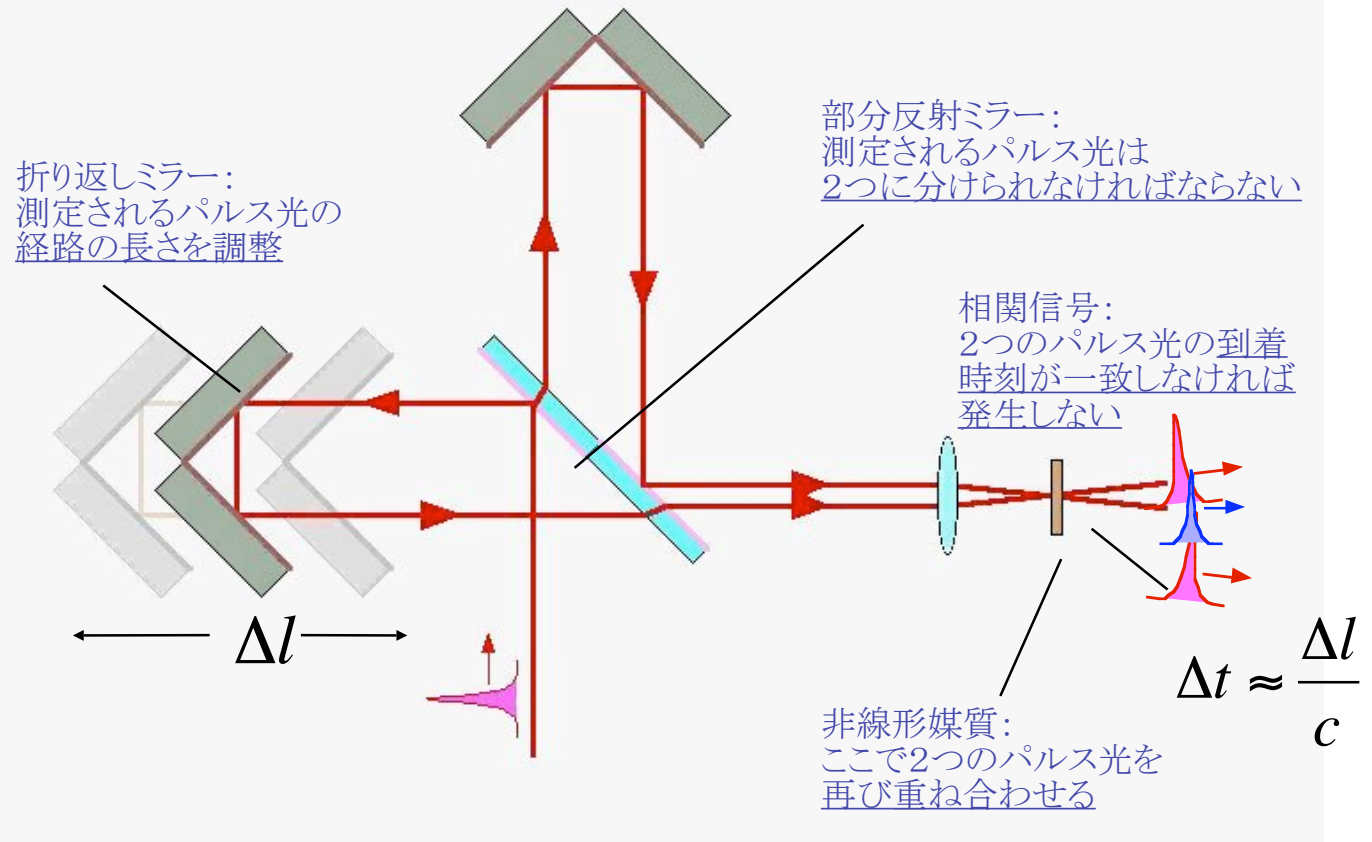
30 fs, 200 mJ
for HHG experiment



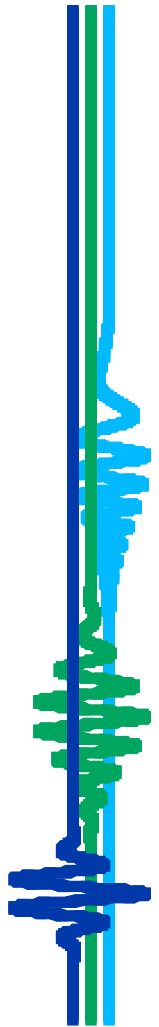
30 fs, 50 mJ
for HHG applications



フェムト秒パルス幅の測定 —自己相関法—



アト秒自己相関法：
全く新しい自己相関計と 10^6 倍の強度



非線形光学効果：2光子励起の特徴

励起領域の限定と低い散乱ノイズ

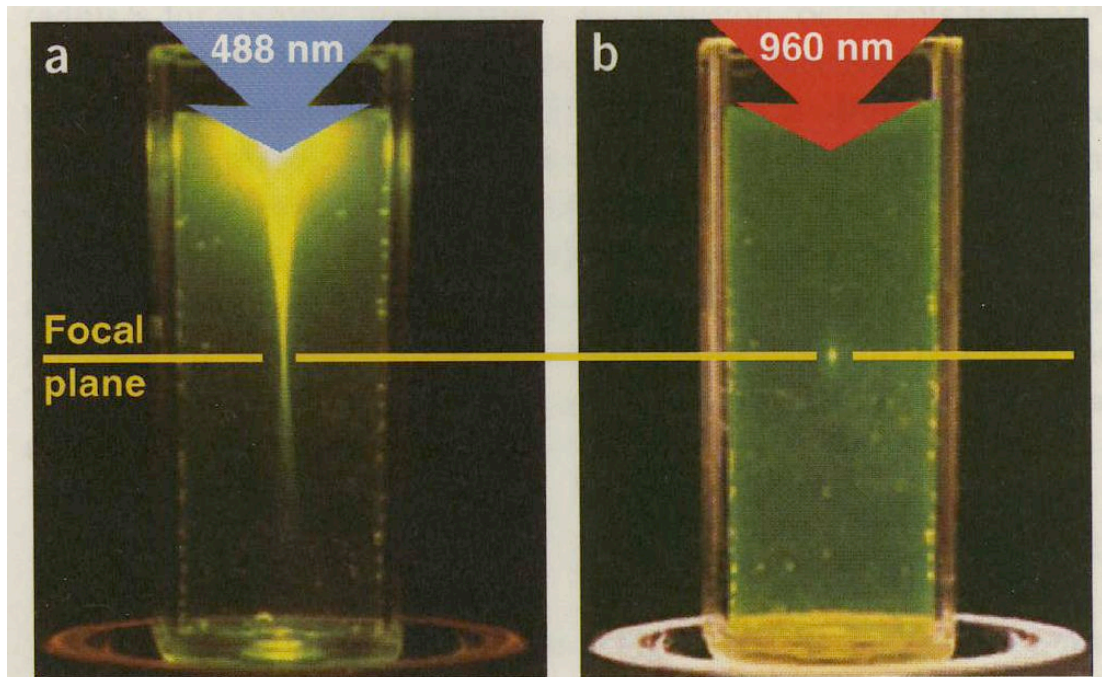
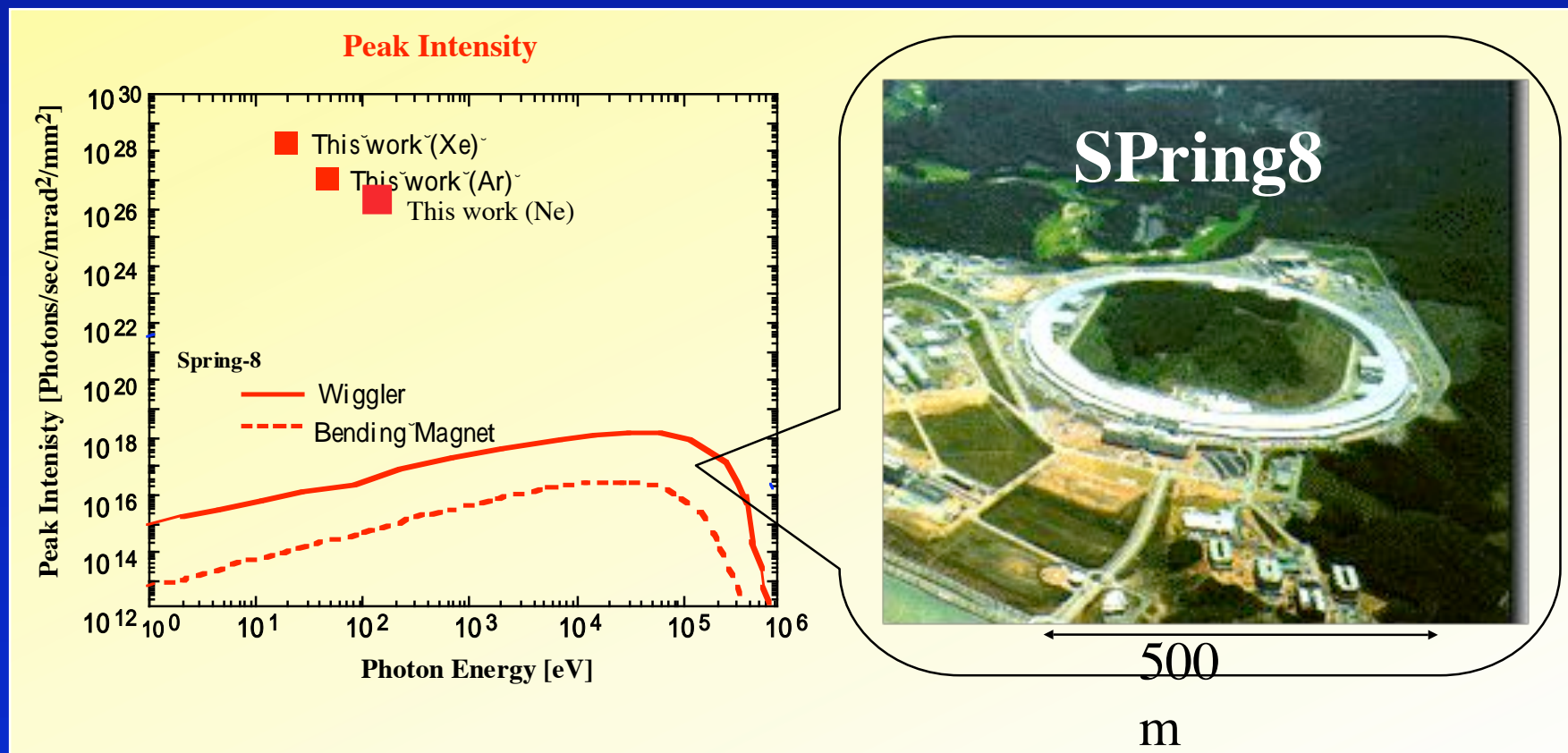


Figure 2 Localization of excitation by two-photon excitation. (a) Single-photon excitation of fluorescein by focused 488-nm light (0.16 NA). (b) Two-photon excitation using focused (0.16 NA) femtosecond pulses of 960-nm light.

W. R. Zipfel, et al. Nature Bio. 21, 1369 (2003).

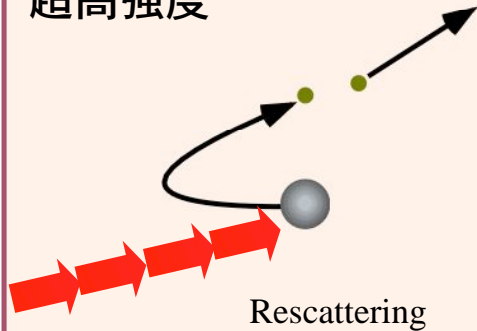
各種コヒーレントX線源の明るさの比較



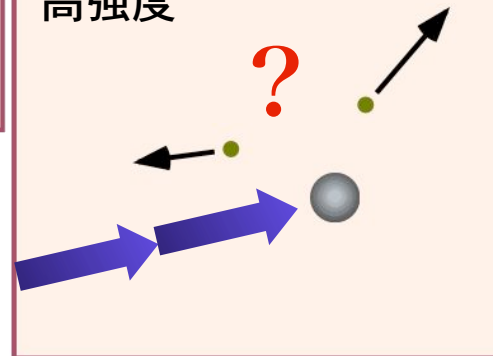
光による原子・分子の 2電子同時電離

光強度

可視・近赤外光
超高強度

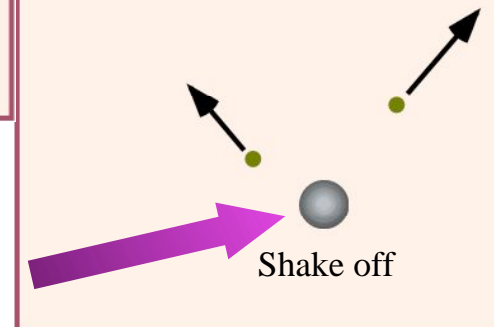


極端紫外・軟X線
高強度



1光子2電子電離

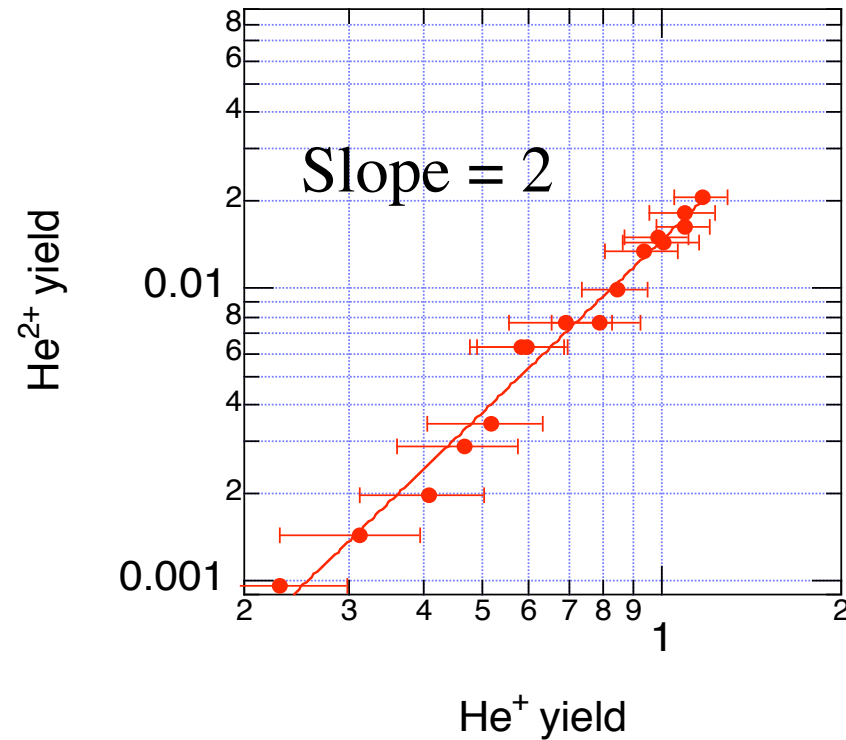
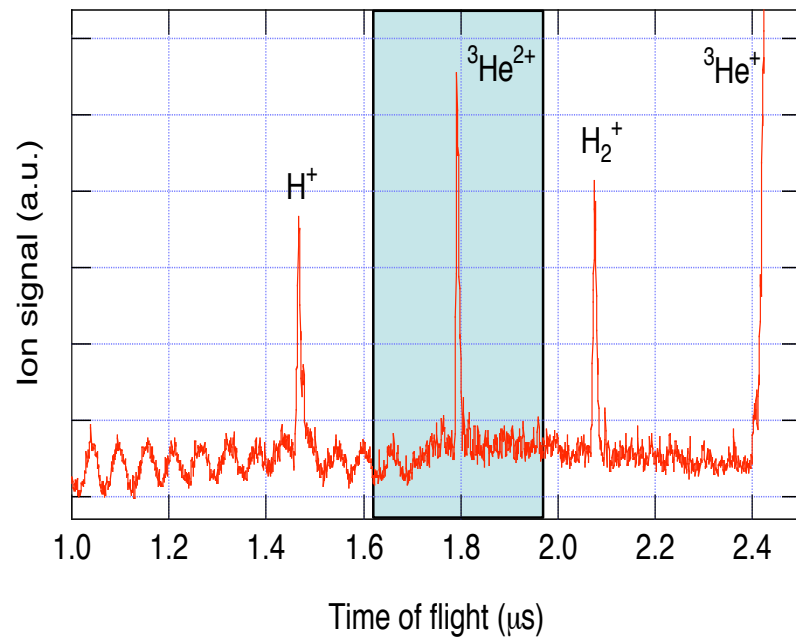
X線・γ線
低強度



1光子エネルギー



^3He TOF spectra and Intensity dependence of $^3\text{He}^{2+}$

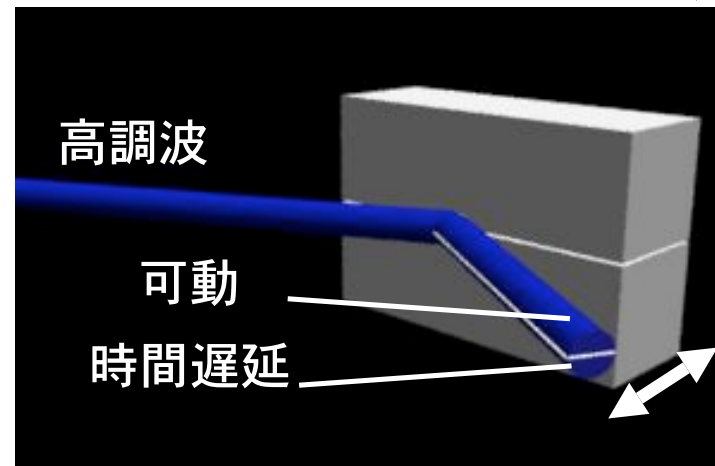
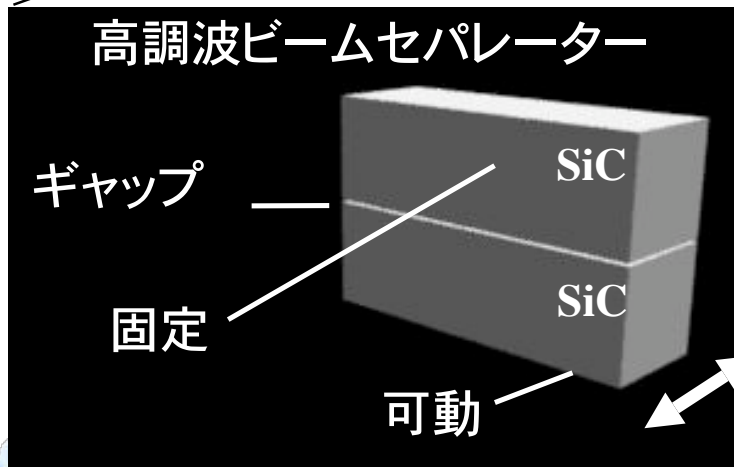
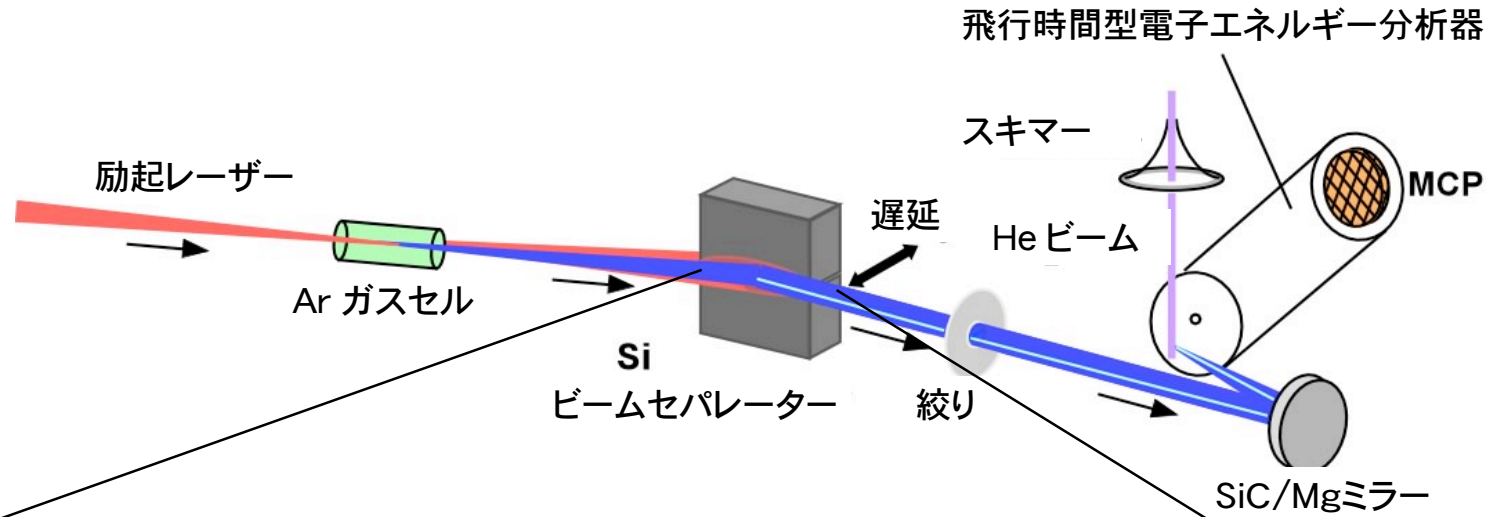


Y. Nabekawa et al., Phys. Rev. Lett. 94, 043001 (2005).

H. Hasegawa et al., Phys. Rev. A 71, 023407 (2005).



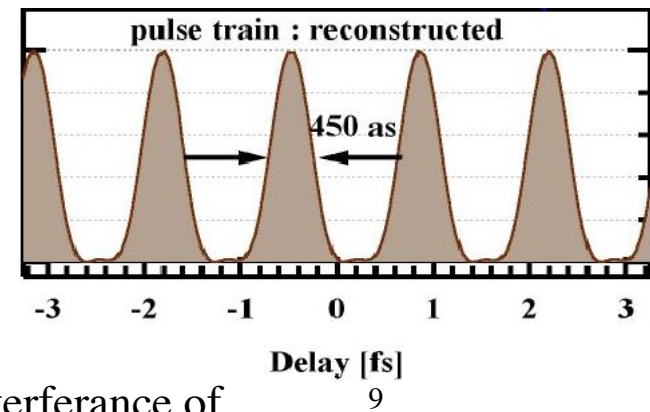
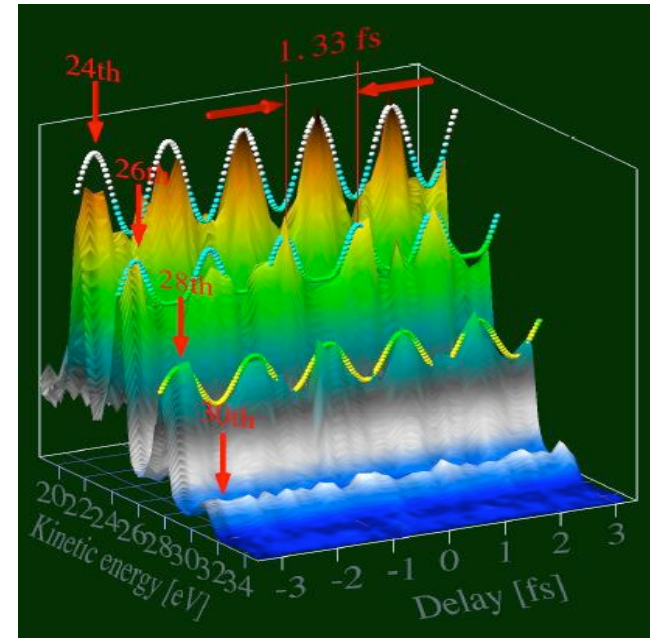
全反射型アト秒自己相関計測器



New Creature "PANTHER"



Photoelectron Analysis of Non-resonant Two-photon ionization for Harmonic Electric-field Reconstruction

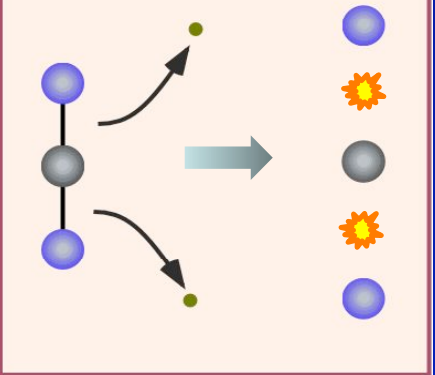


FROG: Frequency Resolved Optical Gating

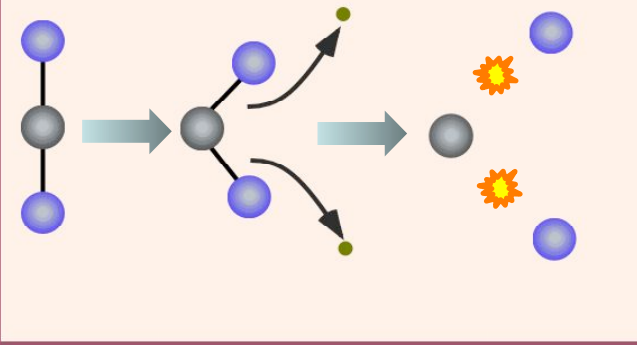
RABITT : Reconstruction of Attosecond Beating by Interference of
Two-photon Transition

クーロン爆発による超高速ダイナミックイメージング

軟X線・極端子外光

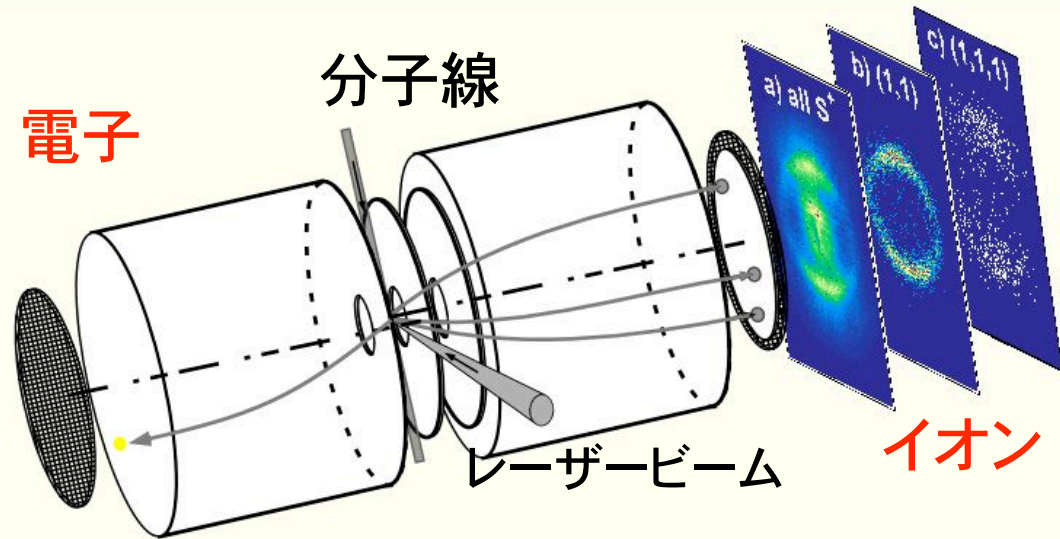


近赤外線・可視光



電子

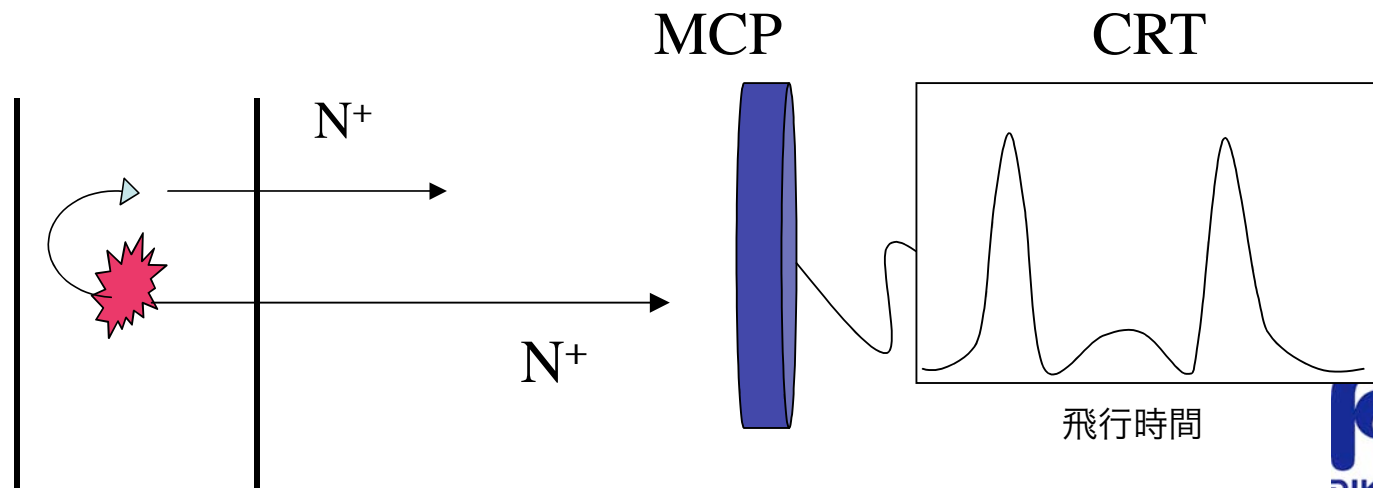
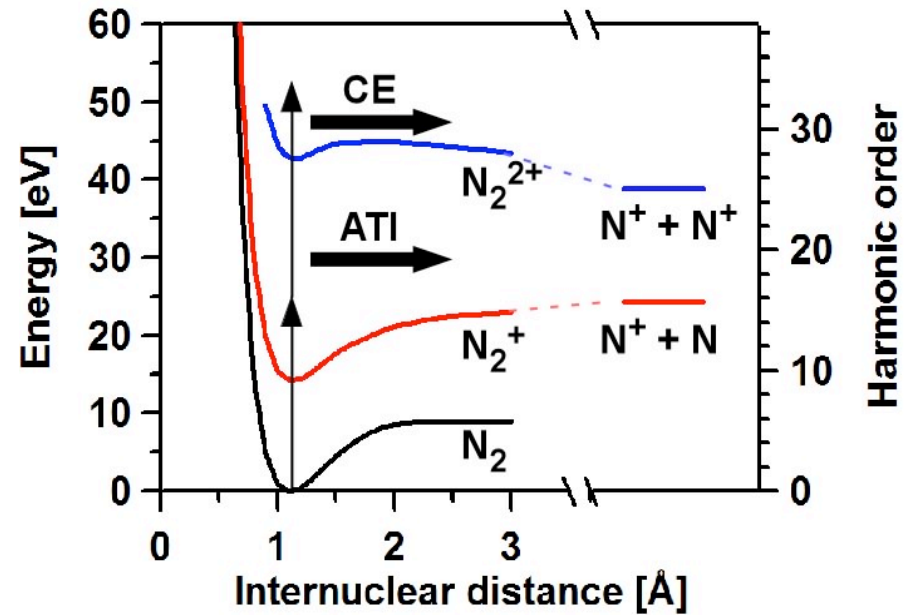
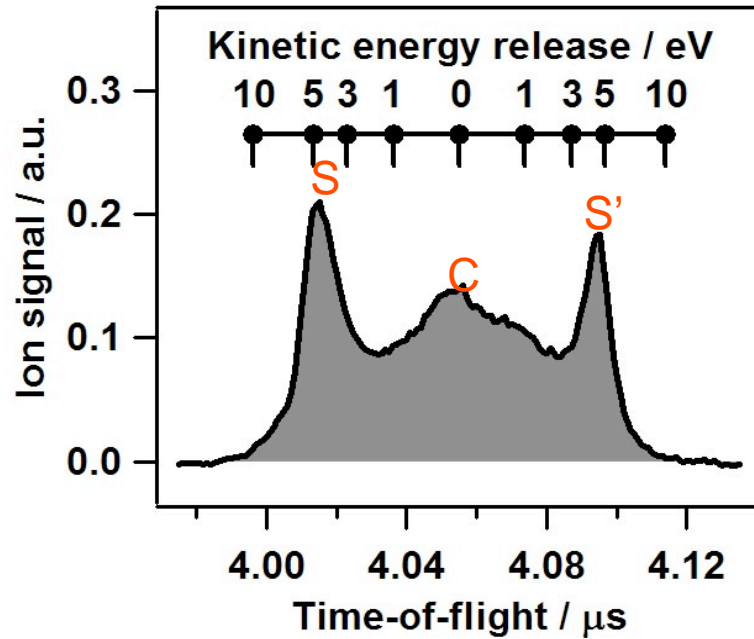
分子線



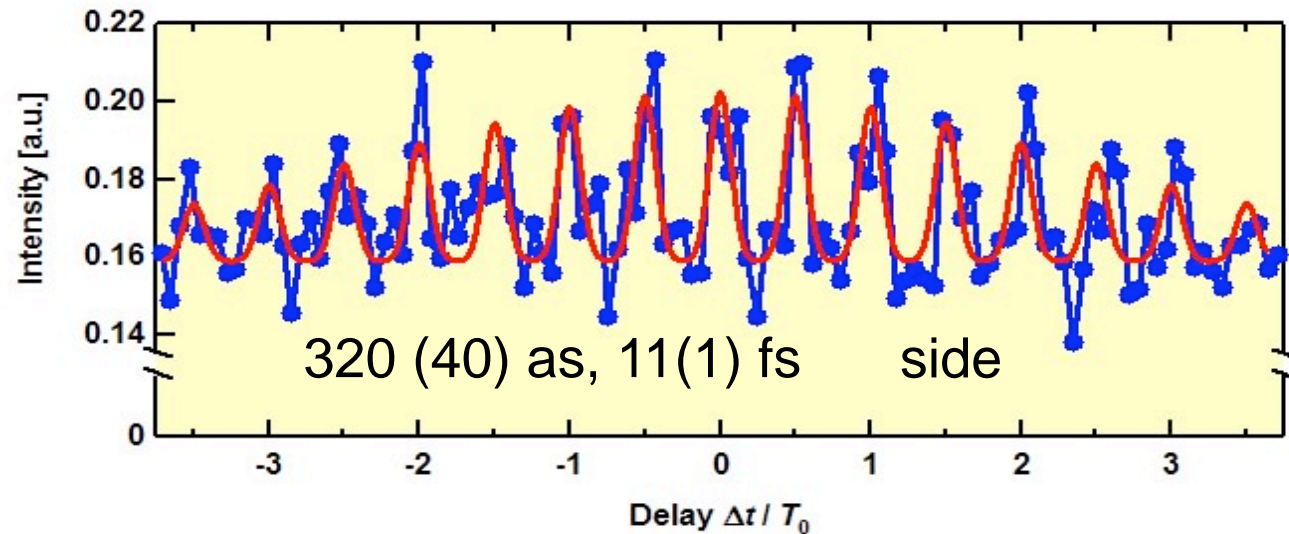
2次元電荷
分布計測器
(CCD)

イオン

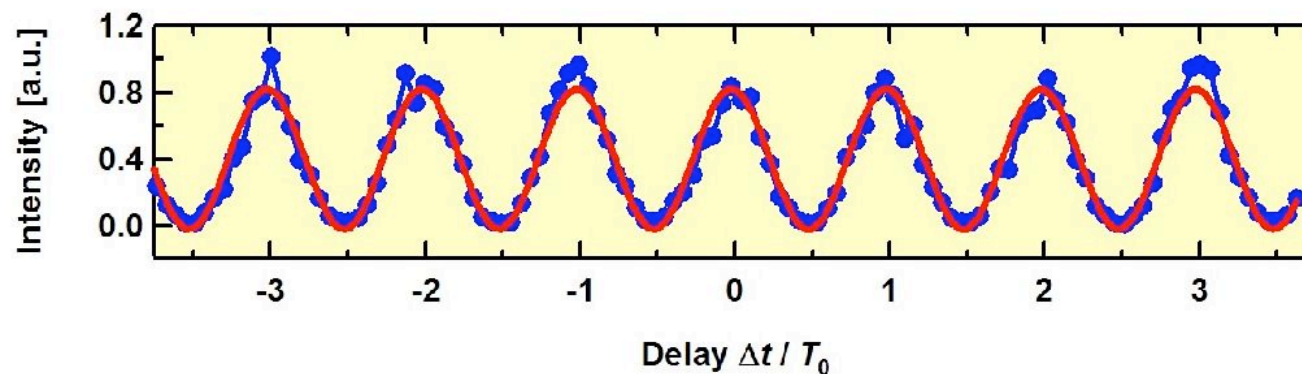
2光子2電子電離によるN2分子のクーロン爆発



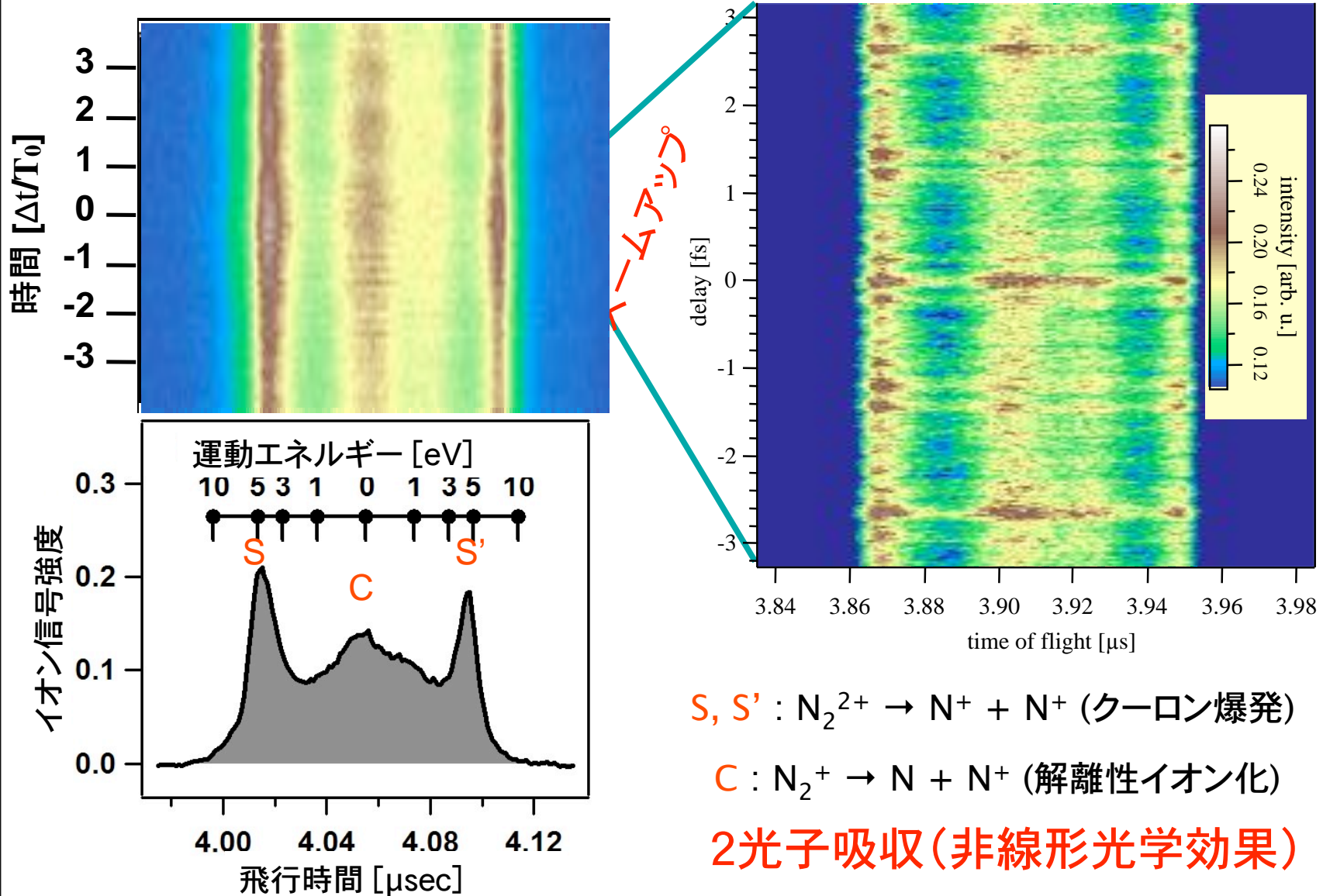
A train of attosecond pulses measured with N^+ ions from two-photon ionized N_2 Molecules



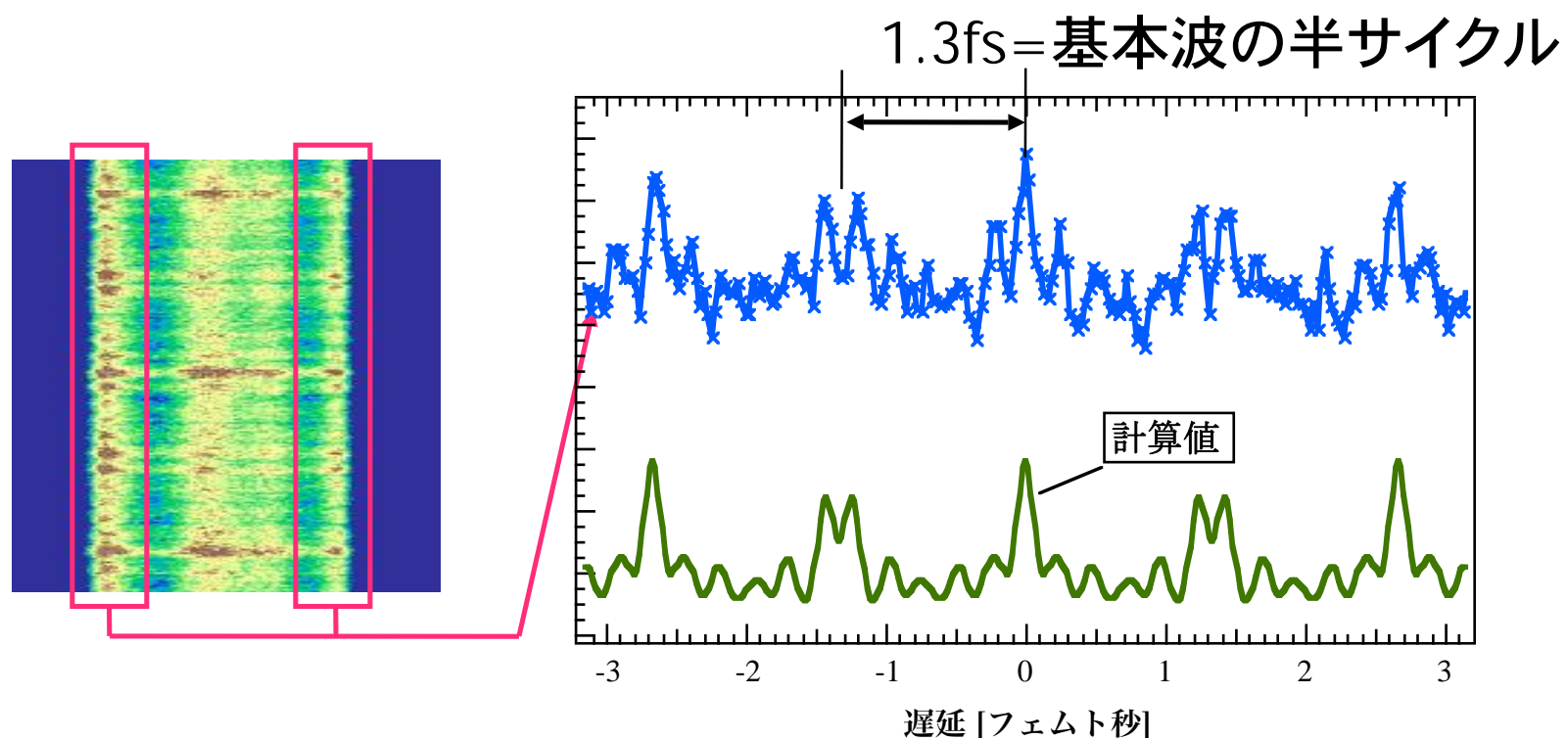
five harmonics
from 11th to 19th



170アト秒から30アト秒へ(時間分解)

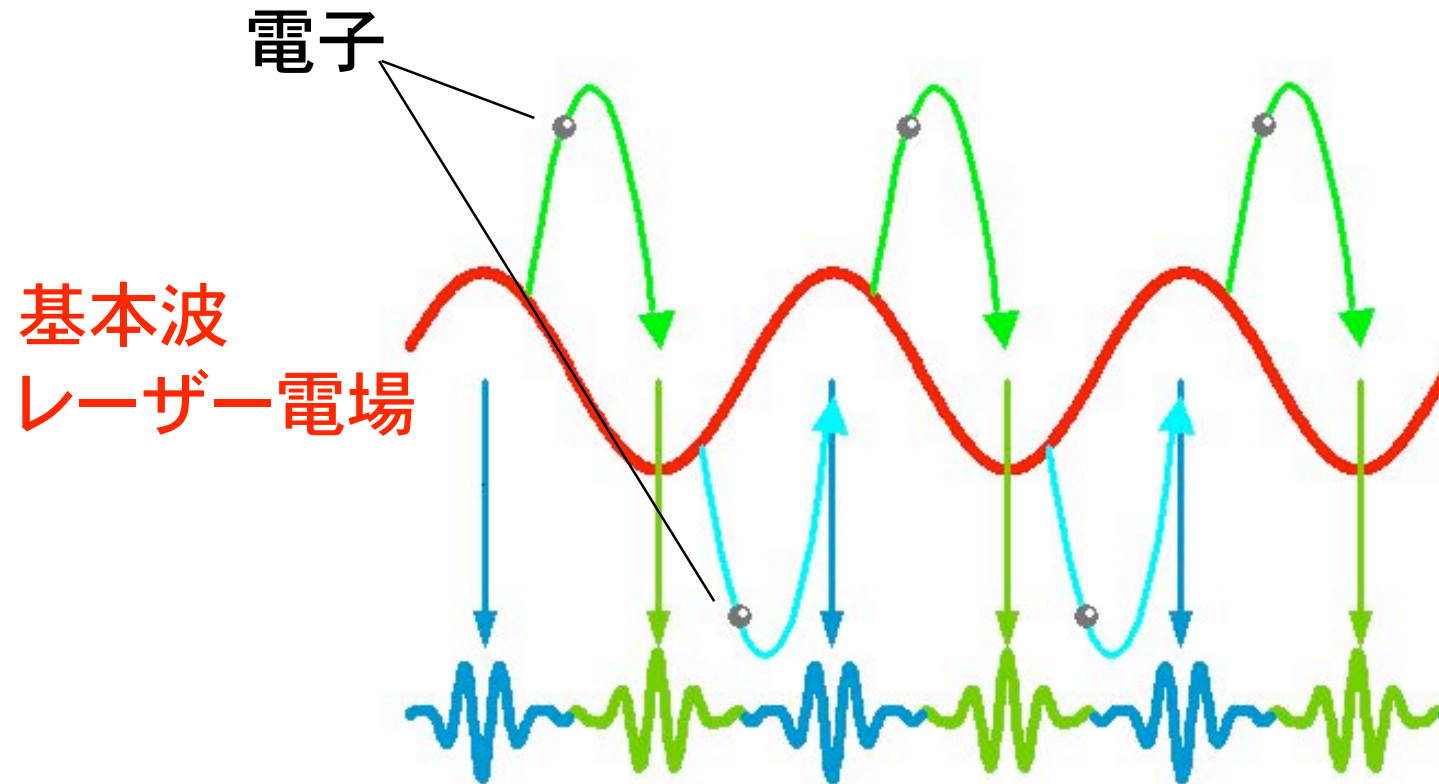


アト秒パルスの内部構造の解明



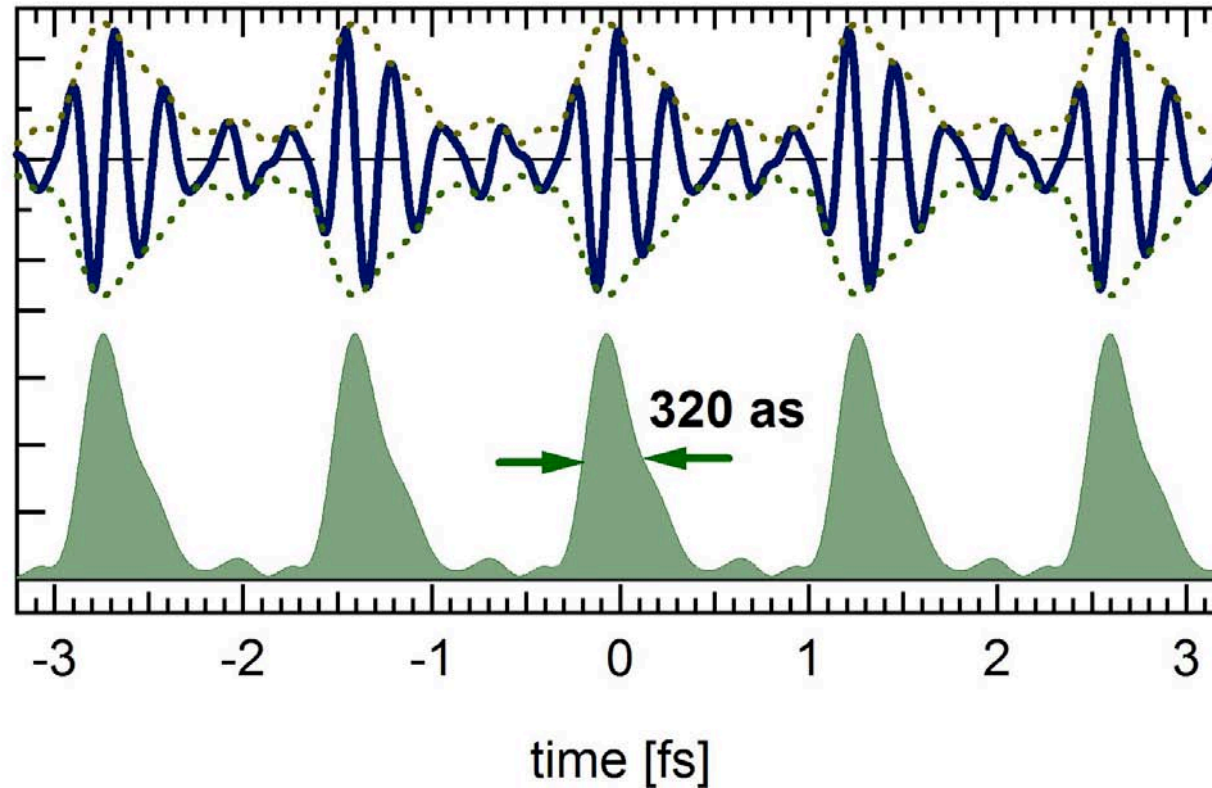
我々は一体、何を計測したのだからか？

高次高調波の発生機構とアト秒パルス列



高次高調波(アト秒パルス列)の光電場

アト秒パルス列の電場構造の直接観測



320アト秒: 11次高調波の1.3サイクル

群速度分散 = $\sim 1.3 \times 10^{-32} \text{ s}^2$

Nabekawa et al., PRL 96, 083901 (2006)



エクストリームフォトンクス

—光科学のフロンティアを目指して—

- 新しい光を創る
- 新しい光で見る
- 新しい光で造る