

ULTRAFAST X-RAYS 2004
April 28-May 1, La Jolla

WORKSHOP SUMMARY

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- Few years I was in a DOE committee, chaired by S. Leone, to review FEL. The committee was positive on FEL but recommended to give also strong support to other X-rays sources like plasma lasers, harmonic generation The reason was that there is no ideal X-ray source: each has advantages and drawbacks.
- The number of photons/pulse is not the only important parameter. Due to the fact that in many cases one has to do diffraction and spectroscopy experiments, the tunability is fundamental.
- **YOU NEED FLEXIBILITY**

- Since the Napa Valley conference 2 years ago there have been many exciting developments and most of them have been presented at this workshop.
- I will underline now some of them.

NEW DEVELOPMENTS

1-fs Electron Diffraction (Zewail, Miller, Cao): one of the highlights of this workshop: tremendous progress in a short time, exciting results.

2-Attosecond Spectroscopy (Kienberger): provides time-domain access to inner-shell atomic or molecular electron dynamics.

Proposal to obtain attosecond pulses with FEL (Zholents) with synchronization

1-Plasma Lasers:

- 10 Hz_ 10^3 Hz, 10^8 ph/s in 200 μ m. Very good signal/noise ratio (Bargheer)
- 2 $\cdot 10^3$ Hz(Rose-Petruck)-XAFS-Pump-probe exp.
- Sokolowski-Tinten
- attempt to have a white spectrum in the soft and hard X-Rays (Rousse)

Although the number of ph/p is low, fs pl.lasers have shown the importance of fs diffraction.

2-High Harmonic Generation in the Soft X-Rays(Kapteyn)

Limited until recently at 100 eV but extended at 300 eV by using hollow waveguides and generating harmonics from ions

Proposal to do time-resolved 4 waves mixing (FWM) in the soft X-Rays to do nonlinear spectroscopy (Nelson)
: exciting but challenging

3-FEL: Important parameters

- emittance of the e gun (1.6 mm-mrad reached recently)
- shortening of the pulse (Galayda : 230_2 fs, Zholents)
- Synchronization: fundamental for pump-probe experiments (Jones, Corlett, Reis): various schemes to be tested.

4-Synchrotron Radiation

- limitation to 50 ps

- few 10^9 ph/p in 2% BW and 10^3 Hz rep.rate

- powerfull tool because allows diffraction and spectroscopy experiments (important to understand the origin of a phase transition:VO₂ Cavalleri)

- Diffraction(Wulff, Collet, Moffatt, Sasaki, Lee)

:many applications in chem.and sol.state physics, less in biology.

- Absorption (Cavalleri,Young, Bressler, Chen)

One should not forget that there are applications for which the ps timescale is appropriate:magnetism (Scholl) and shock waves(Wark)

5-New Proposals for X Rays SOURCES

Due to the shape and the structure of the SASE pulse (see Wang paper) people try to avoid to use it, especially in the soft X-Rays:

- LUX (Corlett)
- Arc-en-ciel (Couperie)
- ERL-Cornell (Shen)
- CEBAF (Williams)

6-AREAS where efforts are necessary

- THEORY
(Santra)
very few people working in the field
- DETECTORS