

Activity report
Valer TOSA

ESF Short Visit Grant ESF Activity: 'Super-intense laser-matter interactions'.
Host Laboratory: Center for Ultrafast and Ultraintense Laser Science, Department of
Physics, Politecnico di Milano, Italy. **Host Scientist:** dr. Caterina Vozzi

The purpose of the visit was description through experimental data and modeling of the process of macroscopic generation of water window x-ray at long laser wavelengths. The activity and the obtained results can be summarized as follows:

A. Very high order harmonic generation

In the first part of the joined activity we discussed thoroughly the experimental parameters used in harmonic generation experiments. In particular the laser beam spatial properties is under uncertainty because we do not know accurately the output beam properties at the exit from the parametric amplifier, and, in consequence the focussing geometry need to be carefully considered. Another critical parameter connected to the focussing geometry is the gas jet position with respect to the focus. It was also discussed and this helped us establishing the input parameters for the 3D non-adiabatic model and setting their range of variation. This part of the work was largely done by V. Tosa, C. Vozzi and S. Stagira. The main results are:

- Calculation of the laser field spatial structure and comparison with dimensions measured in actual conditions of the experiment; **Result:** the beam dimension in the focussing region and the parameters needed for the full harmonic field calculation
- Full calculations of the harmonic field. Non-adiabatic model as well as phase matching calculations were done for this purpose Result: Understanding the origin of the high order harmonics amplification through analysis of the harmonic field and phase matching spatial structure. V. Tosa.
- the setting up of a first draft for publishing the results was performed by C. Vozzi, V. Tosa, and S. Stagira. ESF financial support will be acknowledged. Tentative title: Generation of very high order harmonics in quasi-neutral media
- The visitor also hold a seminar entitled "Modeling very high order harmonic generation" in which the results obtained were summarized. At the end of the seminar ESF financial support was acknowledged.

B. Agreement for future collaboration

The results obtained so far proved that the collaboration is fruitful and has to be continued. The preliminary data obtained so far stimulated the proposal of a new experiment in the framework of LaserLab Europe. Center for Ultrafast Science and Biomedical Optics (CUSBO) will provide the necessary infrastructure. The team will be extended by both parts in order to include younger researchers and to reach the excellence needed in a high quality research.

dr. Valer TOSA



dr. Caterina VOZZI

