Time-resolved Spectroscopy of Nanoscale Dynamics in Condensed Matter Physics

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We will show how inelastic photon scattering spectroscopy will benefit from the advent of the new generation of ultra bright light sources. Our idea is to extend the standard transient grating spectroscopy technique [1] towards higher energies in such a way that nanoscale dynamics may be investigated. This would allow us to better understand the physics of disordered systems since it will make accessible the mesoscopic kinematic region that today cannot be explored by the use of visible laser or synchrotron based instruments.

The current construction of the free electron laser FERMI@ELETTRA by Sincrotrone Trieste, is expected to make available VUV photon pulses with unique characteristics [2] and therefore calls for the development of the proposed technique in Trieste.

The possibility to create and probe sub-picosecond transient gratings with spatial periods in the nanometer range will be extremely useful also in other fields of research, since it will provide the unique capability to measure correlations, electronic excitation lifetimes, heat transport, intramolecular dynamics and non-linear material responses [2,3].

References

[1] - H. J. Eichler, P. Gunter, D. W. Pohl, Laser-Induced Dynamic Gratings (Springer-Verlag, Berlin, 1986)
[2] - http://www.elettra.trieste.it/FERMI
[3] - R. I. Tobey et al., APL 89, 091108 (2006)