Publ. Astron. Obs. Belgrade No. 84 (2008), 144 *Topical Lecture*

SIMULATION OF STREAKING EXPERIMENTS AT SURFACES

C. LEMELL[1], B. SOLLEDER[1], K. TŐKÉSI[2], and J. BURGDÖRFER[1]

[1] *Inst. for Theoretical Physics, Vienna Univ. of Technology, Vienna, Austria*
E–mail: lemell@concord.itp.tuwien.ac.at

[2] *ATOMKI, H–4001 Debrecen, P.O.Box 51, Hungary*

Abstract. Recently, first streaking experiments at a tungsten surface (Cavalieri et al. 2007; "streaking": Kienberger et al. 2004) were performed. An XUV laser pulse was directed on a tungsten surface together with a collinear ultrashort near infrared probe pulse. Surprisingly large run-time differences of 110 ± 70 as for different regions of the electron spectrum were observed.

In our simulation of this experiment we model first electron excitation by the XUV laser pulse. We determine the energy distribution and emission depths of excited electrons from material and laser-pulse properties. These electrons are then propagated in the target material by a classical transport simulation. Along their trajectory, electrons undergo elastic and inelastic collisions with the target material (Solleder et al. 2007). Furthermore, trajectories are deflected due to the probe laser field penetrating into the metal. Electrons escaping the target are subject to the laser field in vacuum and may eventually reach the detector mounted perpendicular to the surface.

A lower bound for the run-time difference within the target material for electrons from the conduction band and 4f electrons of about 20 as can be derived. Inelastic scattering events increase the observed run-time difference. Depending of the dispersion relation used in our model values of up to 85 as were found.

References

Cavalieri, A. L., Müller, N., Uphues, Th., Yakovlev, V. S., Baltuska, A., Horvath, B., Schmidt, B., Blümel, L., Holzwarth, R., Hendel, S., Drescher, M., Kleineberg, U., Echenique, P. M., Kienberger, R., Krausz, F., Heinzmann, U.: 2007, *Nature*, **449**, 1029.

Kienberger, R., Goulielmakis, E., Uiberacker, M., Baltuska, A., Yakovlev, V., Bammer, F., Scrinzi, A.,Westerwalbesloh, Th., Kleineberg, U., Heinzmann, U., Drescher, M., Krausz, F.: 2004, *Nature*, **427**, 817.

Solleder, B., Lemell, C., Tökesi, K., Hatcher, N., Burgdörfer, J.: 2007, *Phys. Rev. B*, **76**, 075115.