Report on the outcomes of a Short-Term Scientific Mission[1]

Action number: CA20129

Grantee name: Tzveta Apostolova

Details of the STSM

Title: Study of high harmonic generation in crystalline solids irradiated by intense ultrashort laser pulses

Start and end date: 25/02/2024 to 04/03/2024

Description of the work carried out during the STSM

In the course of the experiment, we investigated the generation of high harmonic radiation from the bulk of targets of zinc oxide which were irradiated by femtosecond pulses. We had three zinc oxide c-cut samples with 3 different thicknesses – 90 μm, 270 μm and 500 μm and one zinc oxide a-cut sample with a fixed thickness of 200 μm which will be additionally characterized (by XPS) for confirming the crystallographic orientation and the thickness. We investigated how the generated high harmonics depend on the driving pulse parameters and performed power (laser intensity) scans, polarization scans using broadband quarter-wave and half-wave plates and polarizers. We also investigated how the generated high harmonics depend on the carrier envelope phase (CEP) of the irradiating pulse and performed CEP scans. We used 2 pulse durations - 18 fs and 40 fs on the 90 μm ZnO targer of the MIR system at a wavelength of 3.2 μm, energy 150μJ, and repetition rate 100 kHz which is available at ELI Attosecond Light Pulse Source (ELI ALPS). The diagnostics available in the MIR lab we used was an AVANTES spectrometer, XUV spectromerer and a CCD camera.

Description of the STSM main achievements and planned follow-up activities

The goals of the experiment were achieved only partially due to the lack of the silicon samples – the procurement, delivery was delayed, and they did not arrive at the facility during the experiment. In addition the XUV spectrometer was not functioning correctly and the higher harmonics (harmonic order >15) were not adequately observed. One

[1] This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

of the zinc oxide samples was broken which did not allow complete investigation of that sample. We reached an agreement with the colleagues from the MIR Lab and the administration of the facility that a continuation of the experiment will be needed via the submission of a new proposal from the Principal Investigator. This will ensure the development of a stable collaboration with the MIR group as well as the HHG group at the ELI ALPS Institute.

The results obtained from the experiment will be properly analysed and we expect they will be published in the near future (2-4 months) before the end of the COST action CA20129.