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Experimental setup of HHG-ARPES and first test measurement on Au (111)

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Angular resolved photoemission spectroscopy (ARPES) is known to be a probe a powerful method to characterize the electronic band structure dispersion of crystalline solids. With the recent availability of laboratory scaled laser drive High Harmonic Generation sources (HHG) in the extreme ultraviolet, ARPES experiments can be performed with (sub-) femtosecond pulse and thus prove the way to measure ultrafast temporal electron dynamics in solids.
Thus, my thesis projects consists of three sub-projects.

1. Calibration of the ultrafast laser pulse. In our laboratory, a few-cycle driver laser amplifier is used to produce the ultrashort laser pulse (˜4fs). The laser pulse needs to be calibrated by the special measurement systems including the CEP phase meter[1] regarding the pulse divergence to the carrier enveloped phase and FROG system (Frequency resolved optical gating)[2].
2. ARPES measurement by HHG. HHG is produced by non-linear process of the interaction between laser and gas target (Neon). The electron band structure of Au (111) is measured by the HHG-ARPES.
3. Using NIR-XUV system to analyze the photoemission electron under the ultrafast laser. In detail, NIR ultrafast laser pulse will perform as a probe and interact with the photoemission electron resulting in a change of the moment of the emission photos[3]. Finally, we can measure the electron dynamics on the Au surface on attosecond scale.

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[2] Sweetser J N, Fittinghoff D N, Trebino R. Transient-grating frequency-resolved optical gating[J]. Optics letters, 1997, 22(8): 519-521.
[3] Cavalieri A L, Müller N, Uphues T, et al. Attosecond spectroscopy in condensed matter[J]. Nature, 2007, 449(7165): 1029-1032.

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