Collinear generation of few-cycle UV and XUV laser pulses for probing and controlling ultrafast electron dynamics at solid interfaces

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Synopsis: Here we discuss the implementation of the simultaneous collinear production of few-cycle UV and XUV laser pulses by high-harmonic generation of a few-cycle NIR laser pulse in two subsequent noble gas targets. Combining any of the few-cycle XUV, UV and NIR pulses will allow probing and controlling ultrafast electron dynamics in metal and semiconducting interfaces.

The generation of isolated attosecond XUV pulses by means of high-harmonic generation in noble gases with few-cycle NIR laser fields has been established in recent years[1]. Lately, the generation of few-cycle low-order harmonics has been demonstrated: sub-4 fs UV pulses were produced by third and fifth harmonic generation of few-cycle near-infrared (NIR) laser pulses in a noble gas target[2]. Here, we discuss the possibility to implement in an experimental setup the simultaneous generation of low-order harmonics and high-harmonic by two subsequent gas targets in a collinear geometry. Such achievement will enable attosecond pump-probe spectroscopy with any combination of XUV, UV, VIS and NIR few-cycle pulses. Future experiments employing this experimental configuration with such unique laser pulses include probing ultrafast intraband electron dynamics in semiconductors, time-resolving ultrafast electron transfer in organic/condensed matter interfaces, and controlling electronic motion in metal and semiconductor nanostructures with coherent optical fields (see Fig. 1).

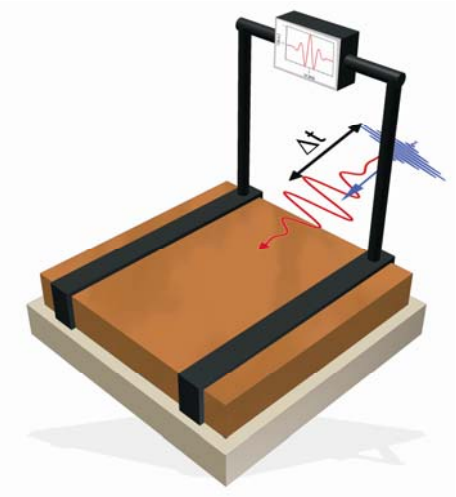

Fig. 1. Schematic of a nanostructured metal-semiconductor interface for the control of photoinduced currents with few-cycle UV and NIR laser pulses.

References

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