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Femtosecond electron switching with plasmonic antennae and nano-fabricated gratings.[1] MARIA BECKER, WAYNE CHENG-WEI HUANG, ROGER BACH, HERMAN BATELAAN, Department of Physics and Astronomy, University of Nebraska-Lincoln — We have shown that the optical response of a plasmonic antenna is faster than 20 fs [1]. We report on this measurement and our proposal to use such a device for femtosecond electron switching. Plasmonic antennae and nano-scale gratings may exhibit near-field enhancement. This phenomenon can increase the intensity of an input electric field by up to a factor of one thousand in the near field of the structure. Cross-correlation measurements of femtosecond laser pulses reflected from an antenna indicate that the duration of the enhanced near-fields is of the same order as the incident excitation pulses. Thus, we propose that enhanced near-fields of a plasmonic antenna may be used to influence the motion of free electrons at the femtosecond time scale. Our estimates indicate that the antenna can cause deflection angles of approximately 0.1 radian upon applying a 10 nJ, 10 fs laser pulse. In a separate experiment we have observed electron beam deflection induced by a laser beam when the electrons pass closely over the surface of a nano-grating. This effect is currently under investigation.

[1] Maria Becker, Wayne Cheng-Wei Huang, Herman Batelaan, Elisabeth J. Smythe, and Federico Capasso, *Ann. Phys.* published online (2012).

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