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Quantum Efficiency of Photoelectron Emission from Metal Surfaces with Laser Wavelengths from UV to NIR[1] YANG ZHOU, YI LUO, PENG ZHANG, ECE, Michigan State University — Laser-induced electron emission is important to free electron lasers, ultrafast electron microscopes, X-ray sources, and novel plasma sources. Here, we calculate the quantum efficiency (QE), defined as the number of emitted electrons per incident photon, for laser wavelengths from UV to NIR, using a recent quantum model based on the exact solution of time-dependent Schrdinger equation [1-3]. The dominant electron emission mechanism varies from multiphoton emission to strong field tunneling, depending on the laser intensity. For relatively low laser intensity I, QE ˜$I^{\mathrm{n}-1}$ for $n-$photon absorption processes. Increasing laser intensity can increase QE significantly beyond the $I^{\mathrm{n}-1}$ scaling, due to the non-equilibrium heating produced by the intense sub-picosecond laser pulse and the strong field tunneling. Adding a dc field shifts the dominant $n-$photon processes to smaller value of n, because of the combined effects of the narrowing and lowering of the potential barrier by the dc field [2,3]. [1] P. Zhang and Y. Y. Lau, Sci. Rep., 6, 19894 (2016). [2] Y. Luo, and P. Zhang, Phys. Rev. B, 98, 165442 (2018); Phys. Rev. Applied, 12, 044056 (2019). [3] Y. Zhou, and P. Zhang, J. Appl. Phys., 127, 164903 (2020).

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