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Time-resolved photoemission by attosecond streaking: extraction of time information STEFAN NAGELE, RENATE PAZOUREK, KATHARINA DOBLHOFF-DIER, CHRISTOPH LEMELL, JOACHIM BURGDÖRFER, Institute for Theoretical Physics, Vienna University of Technology, Austria, EU, KAROLY TŐKÉSI, Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI), Debrecen, Hungary, EU, JOHANNES FEIST, ITAMP, Harvard-Smithsonian Center for Astrophysics, Cambridge, USA — Attosecond streaking is one of the most fundamental processes in attosecond science allowing for a mapping of temporal information to the energy domain. We study attosecond streaking setups for measuring the release time of electrons in atomic photoemission [cf. M. Schultze et al, Science 328, 1658 (2010)]. We show that on the single-particle level, the extracted time delays (phase shifts) contain timing (or spectral phase) information associated with the Eisenbud-Wigner-Smith time delay matrix of quantum scattering. However, this is only accessible if distortion effects by the streaking infrared field on the emission process are properly accounted for. We show that the "time shifts" due to the interaction between the outgoing electron and the combined Coulomb and IR laser field can be described classically. By contrast, we also find a strong initial state dependence of the apparent time delay, which is of quantum mechanical origin.

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