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On the Strong-Field Approximation Describing Atoms and Molecules in Intense Laser Fields ALEJANDRO SAENZ, YULIAN VANNE, Humboldt University Berlin, 10117 Berlin (Germany) — A very popular theory to describe atomic (and recently also molecular) behavior in intense laser fields is the strong-field approximation (SFA), also known as Keldysh-Faisal-Reiss theory. It can be seen as the first-order term of an in principle exact time-dependent S -matrix theory. We have recently investigated some aspects of this theory in more detail. This includes the correctness of a recently proposed “exact” Keldysh theory based on the residue theorem instead of the saddle-point method. Furthermore, we have derived an analytical expression of the velocity-gauge SFA in the long-wavelength limit including the full Coulomb interaction. This revealed a break-down of the theory, but also allowed for a derivation of a new Coulomb correction factor and of a simplified quasi-static SFA (QSFA) that is of special interest for experimental studies in which the wavelength is scanned over large ranges. Finally, we will comment on a recently proposed SFA formulation in a “gauge-invariant gauge.”

Alejandro Saenz
Humboldt University Berlin, 10117 Berlin (Germany)

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