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The Strong Field Approximation has become the workhorse theory of photoionization, and related phenomena, through its simplicity and transparent physical insight, and it is generally desirable to extend this transparency to situations where the Coulomb field of the parent ion is not negligible.

Intuitively, one expects the main effect of the ionic Coulomb field on the photoelectron is to modify the usual SFA amplitude as

$$\langle \mathbf{p}|\psi(\infty)\rangle = -i\int_{-\infty}^{\infty} e^{-iW_C} \times e^{iI_p t} e^{\frac{i}{2}\int_{\infty}^{t}(\mathbf{p}+\mathbf{A}(\tau))^2 \mathrm{d}\tau} \langle \mathbf{p}+\mathbf{A}(t)|V_L(t)|g\rangle \mathrm{d}t$$

through the inclusion of a phase $e^{iW_C}$ which describes the Coulomb action. Recent results [1] implement this intuition rigorously, giving a quantum-orbit picture based on a laser-driven trajectory $\mathbf{r}_{\mathrm{cl}}(t) = \int_{t_s}^{t} \mathbf{p} + \mathbf{A}(\tau)\mathrm{d}\tau$ whose initial conditions – with a real-valued trajectory at the *entrance* of the classically-forbidden region – are provided by the formalism instead of being imposed externally. This means, in turn, that the quantum-orbit trajectory is in general complex-valued at real times.

We explore the consequences of this complex-valued position with regards to the calculation of the Coulomb action $W_C = \int_{t_s}^{\infty} U(\mathbf{r}_{\mathrm{cl}}(\tau))\mathrm{d}\tau$, and show that in general the complex-valued trajectory can pass through branch cuts of the Coulomb potential $U(\mathbf{r}) = -1/\sqrt{\mathbf{r}^2}$. We present a reliable method, based on rich geometrical structures, for consistently choosing appropriate contours in the time domain, including situations where the Coulomb branch cuts cross the real time axis and preclude the usual real-time contour: here one must trade a slightly imaginary time to obtain a suitably real trajectory.

Our analysis naturally predicts the known low-energy structures and reveals an exactly analogous series of peaks at much lower energies, which are consistent with the recently-observed near-zero energy structures [3], thus providing a kinematical explanation for them.

**References**

[1] L. Torlina et al. *Phys. Rev. A* **86**, 043408 (2012)
[2] E. Pisanty and M. Ivanov. arXiv:1507.00011 (2015).
[3] J. Dura et al. *Sci. Rep.* **3**, 2675 (2013).