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Complex time contours in tunnel ionization and low-energy structures[1] EMILIO PISANTY, MISHA IVANOV, Imperial College London —

In tunnel ionization, a strong low-frequency laser field removes an electron from an atom by setting up a slowly-varying potential energy barrier that the electron can tunnel through. During its subsequent oscillations in the laser field, the electron can revisit the neighbourhood of the remaining ion one or more times. Frequently, this is a soft recollision which affects the momentum distribution, although more substantial effects can happen. We use the Analytical R-Matrix theory to investigate the effect of these soft recollisions, focusing on low drift momenta, where the laser-induced trajectory has a turning point near the nucleus. Our framework provides a complex-valued trajectory perspective on the electron propagation, from first principles. We show that the presence of the Coulomb interaction, which is responsible for the soft recollisions, forbids certain common choices of contour within the complex time plane, and we describe an algorithm for safely circumventing the associated branch cuts. We find quantum analogues to the classical turning points near the ion, and we investigate their relation to the recently-discovered low-energy and very-low-energy structures in above-threshold ionization.

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