Physikalisches Kolloquium

Universität Konstanz

Prof. Dr. Thomas Pfeifer
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Di 23.05.17
15:15 Uhr
14:45 Uhr, Kaffee/Tee
R 513

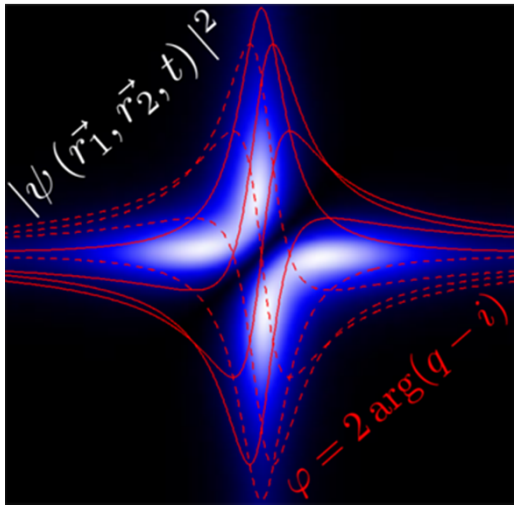

Figure: A correlated wavefunction of 2 electrons inscribed into a Fano family of curves, which can be parametrized by the Fano-q parameter or a dipole-phase φ related by a simple mathematical transformation.

Listening to the ultrafast chat of two excited electrons—and asking them some quick physics questions

Electrons interact via the long-range Coulomb force, repel each other and feel attracted by a nucleus that traps them inside an atom. When both electrons are in excited states, they keep communicating repulsively, where they may agree that one of them drops back down to the ground state, giving its energy to the other one to escape the atomic binding potential (autoionization).
In this talk, I will show how this very fast communication and the corresponding fundamental dynamical processes are recorded (measured) and translated into understanding using time-domain physics pictures. The key methods in our experimental research are the combination of ultrafast laser/light fields (including High-Harmonic Generation and Free-Electron Lasers) and multi-dimensional detection techniques accessing time scales of 1 femtosecond (10-15 s) and shorter. Moreover, by asking some quick questions encoded and carried at visible frequencies (time- and intensity-tunable laser pulses), and listening to the electrons' optical response (spectroscopy) we learned to interpret a fundamental quantum interference process—the Fano resonance—in the time domain, with currently emerging science and technology applications ranging from x-ray lasing-without-inversion to frequency combs locked to nuclear resonances for precision spectroscopy in the hard-x-ray region.