# Strong-field electron spectra of rare gas atoms in the rescattering region: channel closing and a simulation of the experiment

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**Synopsis** We report experimental photoelectron spectra of Ne, Ar, Kr, and Xe in intense laser fields. These results are simulated using the low-frequency approximation for high-order above-threshold ionization. Resonant-like structures, observed both in the experiment and simulation, are analyzed.

In recent years femtosecond infrared lasers with peak intensity in the TW to PW cm$^{-2}$ range have become widely available. When such intense laser pulses are irradiated on atoms, interesting nonlinear phenomena such as high-order above-threshold-ionization (HATI) occur. It had been shown that HATI is due to the elastic scattering of the returning electrons into the backward directions by the target ion. Theoretical considerations for longer pulses have shown that resonantlike enhancements should appear for higher energy electrons. They have been interpreted in terms of channel closings and it has been shown that these enhancements result from constructive interference of a large number of long orbits of the returning electron [1].

The resonantlike enhancement has been observed [2], but a detailed comparison between the theory and experiment is still missing. We report here experimental HATI spectra of rare gas atoms (Ne, Ar, Kr, and Xe) recorded at 800 nm, with pulse width of 100 fs and laser power densities in the region $0.5 - 3.2 \times 10^{14}$ W/cm$^2$. These results are simulated using recently introduced low-frequency approximation for HATI [3], modified to include the laser dressing of the bound state. An example of this simulation is shown in Fig. 1. The spectra for energies below $4U_p$ in simulation are denoted by dashed line since in this region the spectrum is dominated by the direct electrons while our simulation includes only the rescattered electrons.

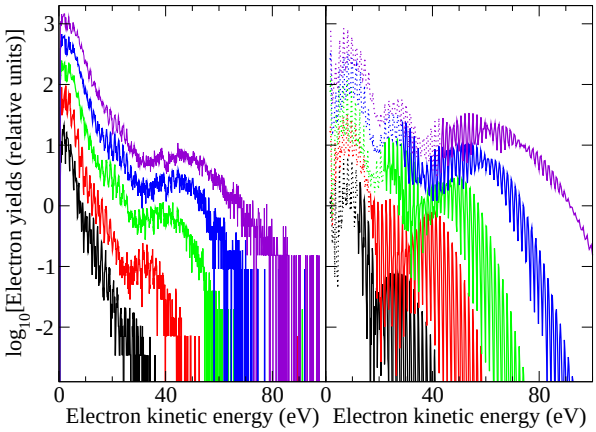


**Fig. 1**. Electron energy spectra in direction of the polarization axis of linearly polarized 800 nm laser pulse at several laser intensities $I \times 10^{14}$ W/cm$^2$, where: $I = 0.5$ (bottom, black curve), 0.7 (red), 0.9 (green), 1.2 (blue), and 1.8 (top, violet). Left panel: experiment. Right panel: simulation.

## References

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