Time-frequency representation of autoionization dynamics in helium

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Abstract. Autoionization, which results from the interference between direct photoionization and photoexcitation to a discrete state decaying to the continuum by configuration interaction, is a well known example of the important role of electron correlation in light-matter interaction. Information on this process can be obtained by studying the spectral, or equivalently, temporal complex amplitude of the ionized electron wavepacket. Using an energy-resolved interferometric technique, we measure the spectral amplitude and phase of autoionized wavepackets emitted via the $sp2^+$ and $sp3^+$ resonances in helium. These measurements allow us to reconstruct the corresponding temporal profiles by Fourier transform. In addition, applying various time-frequency representations, we observe the build up of the wavepackets in the continuum, monitor the instantaneous frequencies emitted at any time and disentangle the dynamics of the direct and resonant ionization channels.