

## **From Rabi oscillations to collective excitations**

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I will discuss some topics that I think provide interesting opportunities for highly coherent and intense XUV and x-ray sources. First, I will discuss the potential impact of soft-x-ray-driven Rabi oscillations involving inner-shell resonances. I will show that a suitable observable is the shape of Auger-electron spectral lines. Only when using coherent beams are characteristic multi-peak structures expected, which so far have eluded experimental confirmation. Second, I will discuss the preparation of nonstationary states of valence electrons through optical ionization. The associated dynamics can currently only be observed in very special cases accessible to table-top XUV sources based on high-harmonic generation. A powerful technique that allows one to probe the valence electron dynamics is transient absorption spectroscopy, which should be implemented with Fourier-limited, broadband free-electron laser sources. Finally, I will discuss opportunities for discovering new quantum states in matter using nonlinear XUV spectroscopy.