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Nanoplasmonic light field synthesis for isolated attosecond pulse generation JOHANNES FEIST, ITAMP, Harvard-Smithsonian Center for Astrophysics, M.T. HOMER REID, Research Laboratory of Electronics, MIT, MATTHIAS F. KLING, J. R. Macdonald Laboratory, Kansas State University —
Nanometer-scale metallic structures can lead to a strong concentration of optical fields due to plasmon resonances. This can be used to generate very strong electric fields even with moderate driving laser intensities, enabling high-harmonic generation (HHG) at much lower intensities than usually required. The reduced need for amplifying stages in the driving laser then allows for high repetition rates in the MHz range. However, the sources demonstrated up to now do not produce ultrashort (attosecond) pulses, in part because the temporal response of a plasmon resonance stretches and distorts the incoming laser pulse. We here describe a general approach for generating isolated attosecond pulses using nanoplasmonically enhanced fields. We show that for practically useful structures, pulse shaping of the incoming pulse can compensate for the distortion and temporally confine the plasmon-enhanced field response. Coherent control techniques for pulse shaping, which are applicable at the low required input intensities, can then be used to generate isolated attosecond pulses even if the response of the plasmonic structure is not known a priori.

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