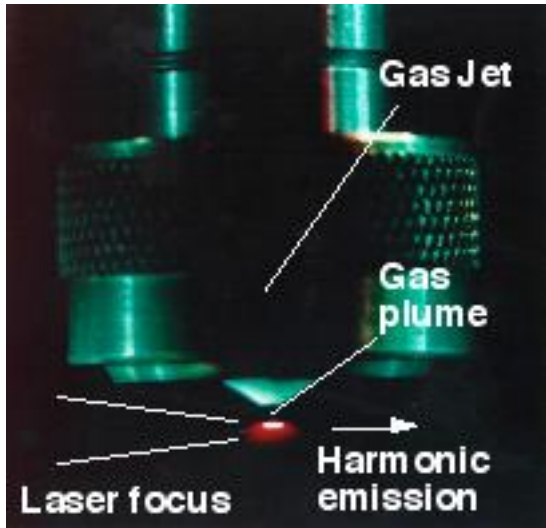
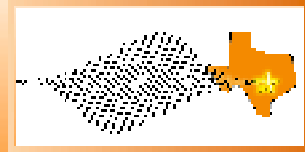
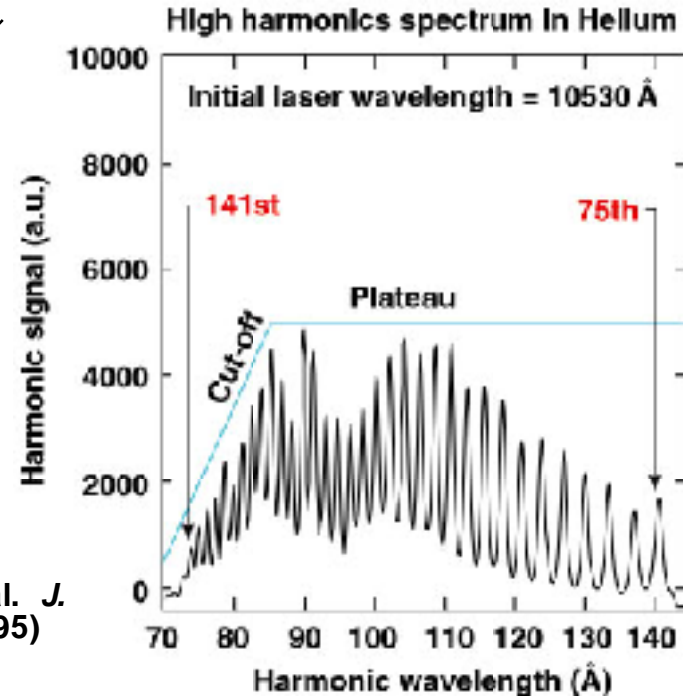


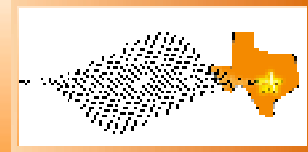
Atoms subjected to a strong laser field can emit high order harmonics of the laser frequency



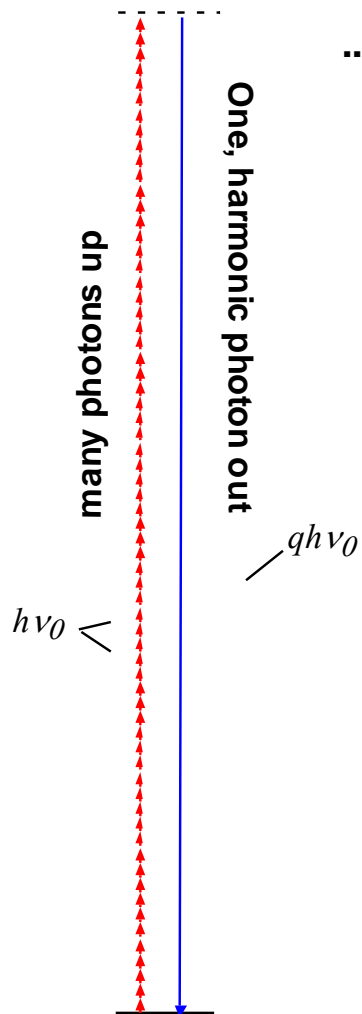
T. Ditmire, J. K. Crane et al. *J. Nonlinear Opt.* **4**, 647 (1995)



Very high order harmonic generation can not be described by "classic" perturbation theory

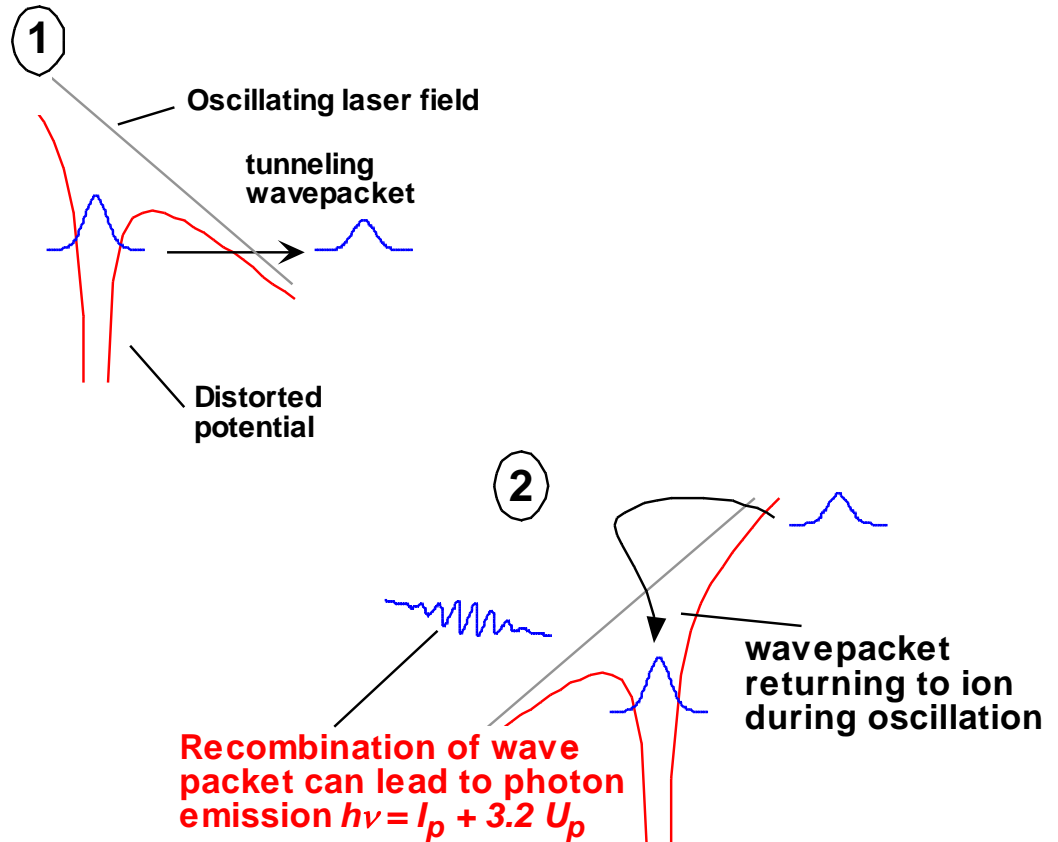


Perturbative picture...

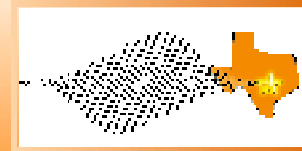


... inadequate

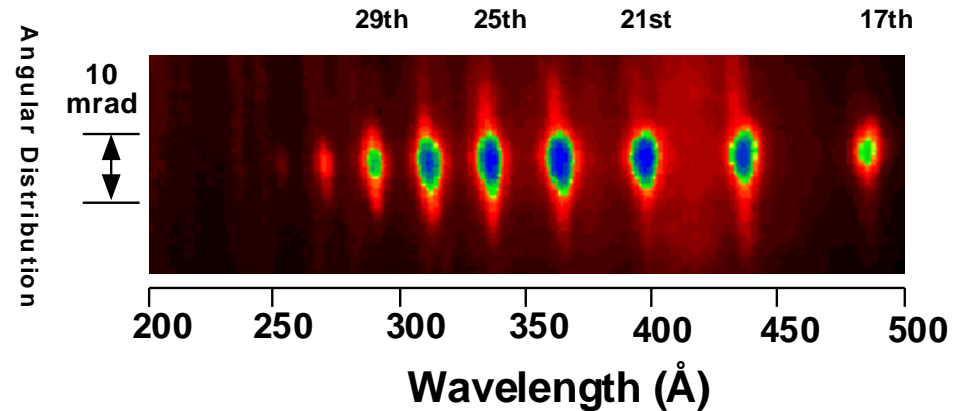
"Strong field" picture of harmonic generation



The XUV light generated by high harmonic generation maintains the coherence properties of the laser



Spatial distribution of harmonics produced in Ar with a 100 fs, 820 nm laser

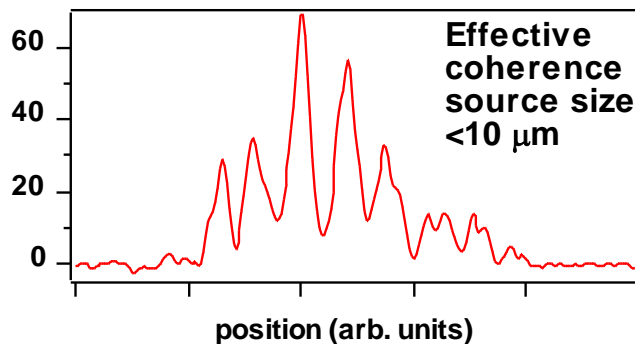
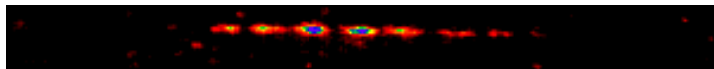


T. D. Donnelly, et al. *Phys. Rev. Lett.* **76**, 2472 (1996).

Low divergence, near diffraction limited beam quality



Young's Interference Pattern from a 479 Å Harmonic in He

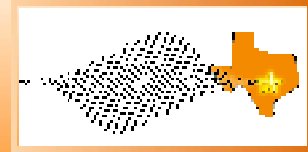


High degree of spatial coherence



T. Ditmire, et al. *Phys. Rev. Lett.* **77**, 4756 (1996).

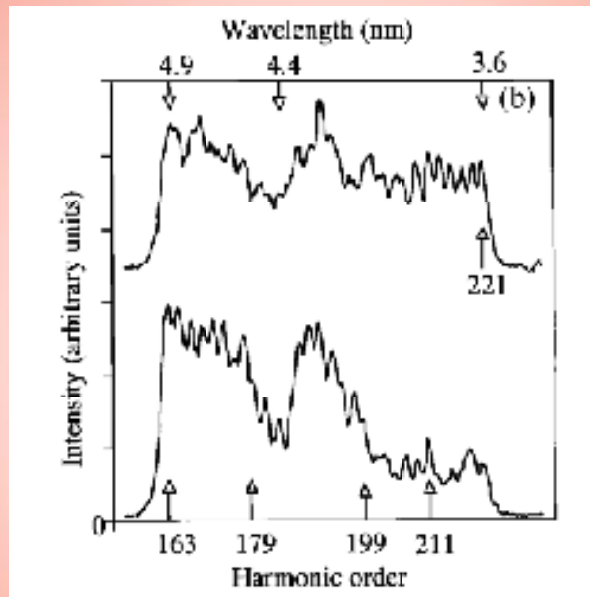
High harmonics have now been produced at wavelengths in the water window (45 - 23 Å)



Using very short, 5 - 25 fs, laser pulses, very high harmonic orders can be produced.

→ These harmonics represent a promising avenue for coherent x-ray production in the water window for biological probing

Harmonic conversion of 800 nm, 25 fs pulses in helium



Data from: U. of Michigan
Z. Chang, et al. *Phys. Rev. Lett.* **79**, 2967 (1997)

Also: Vienna Technical University,
C. Spielmann, et al. *Science* **278**, 661 (1997)

The Water Window lies between the C and O absorption edges

