Wednesday, 30 June 2021

15:30pm – 20:50pm CET (Hamburg, DE)

Attosecond to Few-Femtosecond Ultrafast Science at Future FELs (AsToFewFs@FutureFELs)

Session VII: "Dynamics and Control Down to Attosecond Timescales"

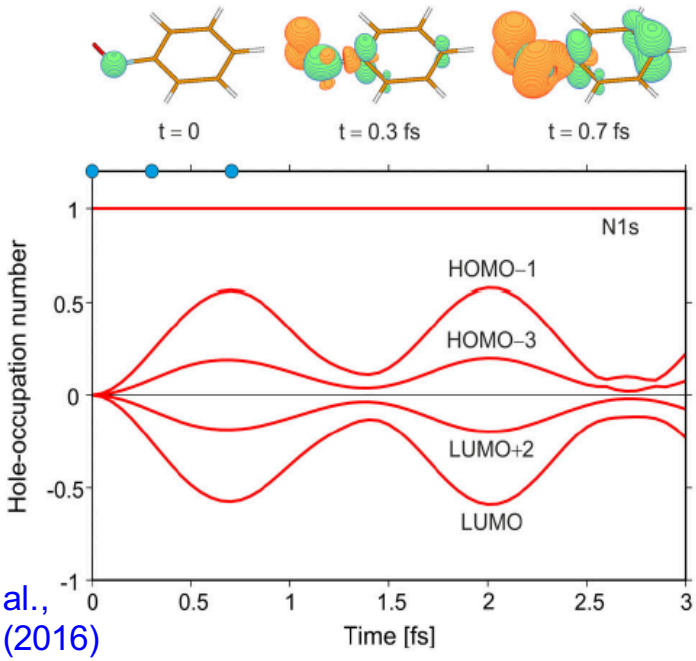
Chair: Michael Meyer

15:30 – 15:40	Introduction	M. Meyer (EuXFEL)
15:40 – 15:55	Photoionization Dynamics Measured at the Attosecond Time Scale	A. L'Huillier (Lund University)
15:55 – 16:10	The Power of Coincidences	R. Dörner (Univ. of Frankfurt)
16:10 – 16:25	New Opportunities for Attosecond Experiments Using FELs	G. Sansone (Univ. of Freiburg)
16:25 – 16:55	Discussion	
16:55 – 17:20	**Break**	

Electron dynamics

Sub-femtosecond core hole screening by **charge migration** in the valence

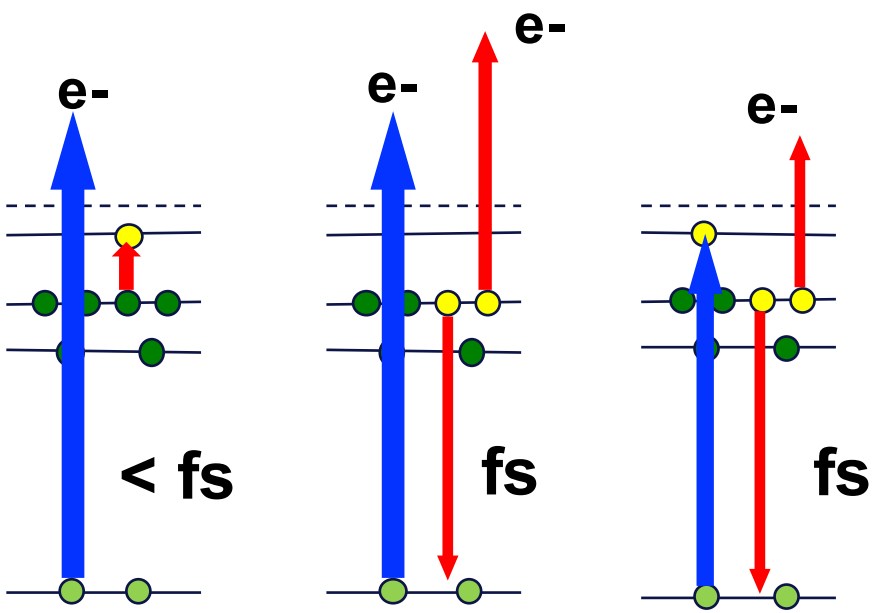
N 1s^{-1} in nitrobenzene



Kuleff et al., PRL 117 (2016)

Molecular electron dynamics decoupled from nuclear motion

Time-resolved evolution of **correlated electron excitations**



Photoionization
Shake-up

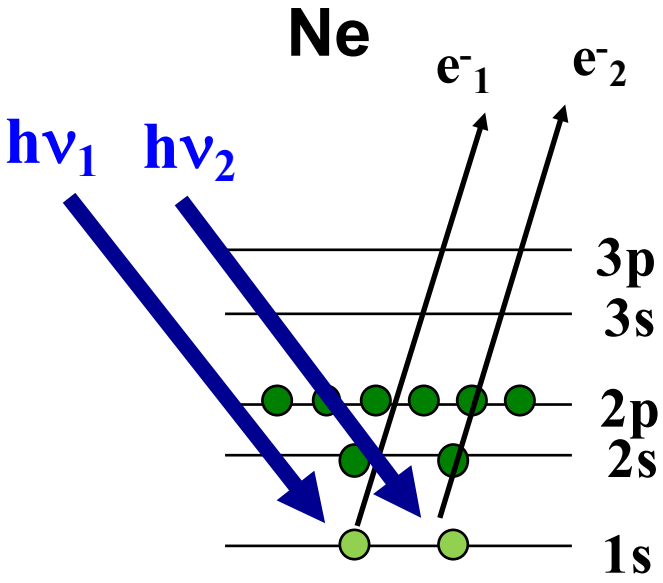
Auger decay
Auger cascades

Resonances
Fano-profiles

Dynamics of photoionization and in resonant processes

Dynamics upon photoionization with sub-fs pulses

Beating the core hole clock



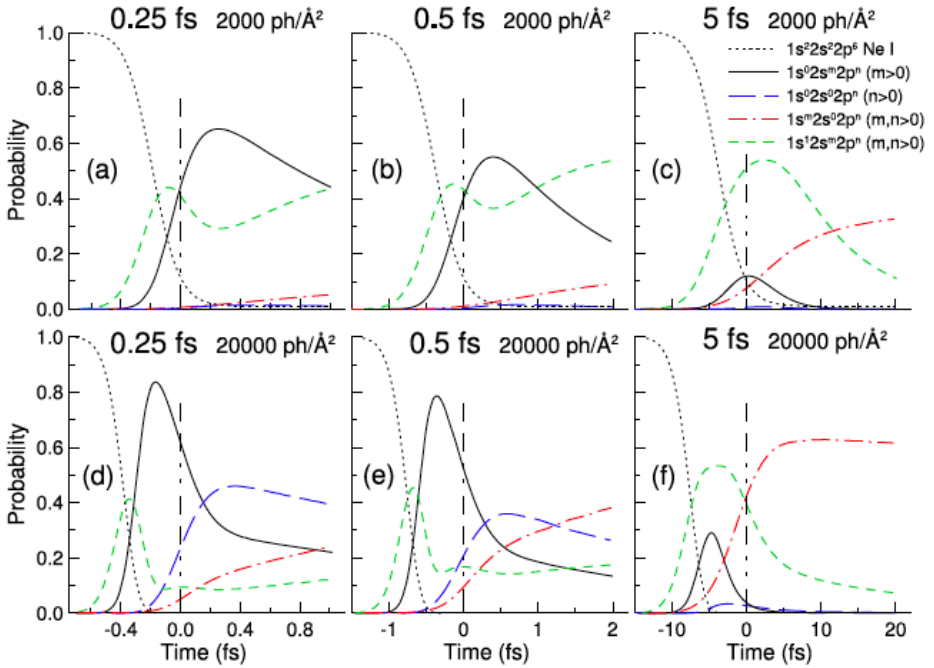
Auger lifetime (SCH)

Γ(1s) = 2.4 fs

Enhancing direct multi-photon processes

Serkez et al., J. Opt. **20** (2018)

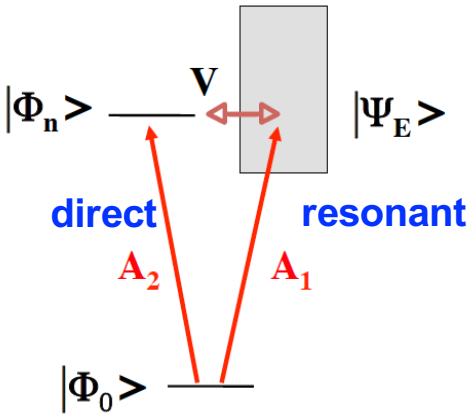
hν = 1 keV, 0.5 fs, 300μJ, 2x10⁴ ph/A²

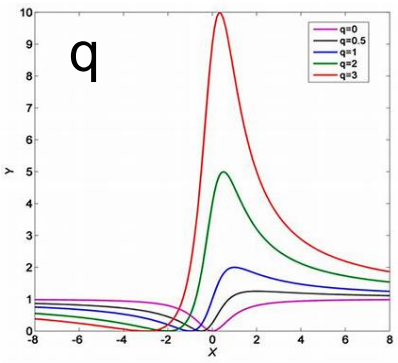


Theory: A. Grum Grzhimailo, E. Gryzlova (Moscow State Univ.)

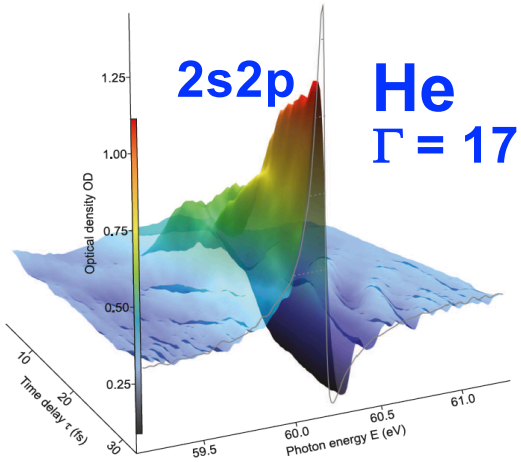
Dynamics upon resonant excitations

"Fano" resonances





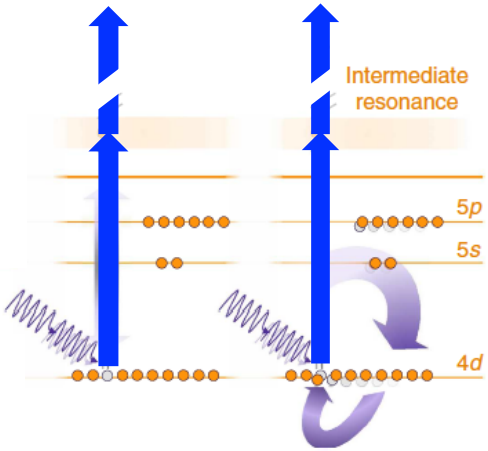
Time-resolved resonance profile



Kaldun et al., Science **354**, 738 (2016)

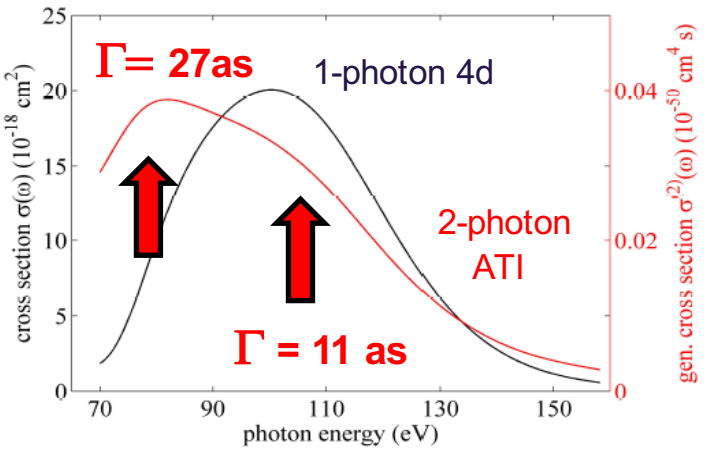
"Giant" resonances

Xe



Mazza et al., Nat.Comm. **6**, 6799 (2015)

Chen et al., PRA **91**, 032503 (2015)



Observation of structures unresolved in linear spectroscopy

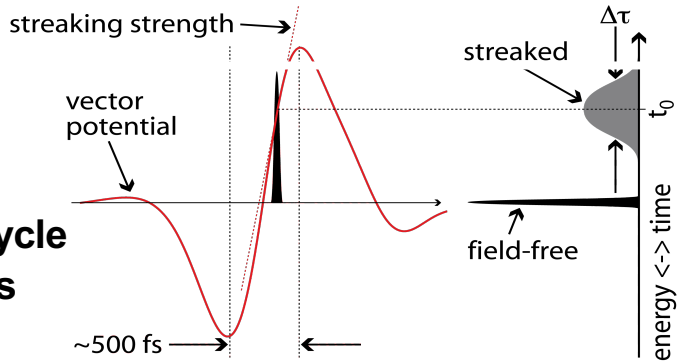
Controlling (measuring) the pulse duration

Γ (XUV) << T (IR)

THz streaking

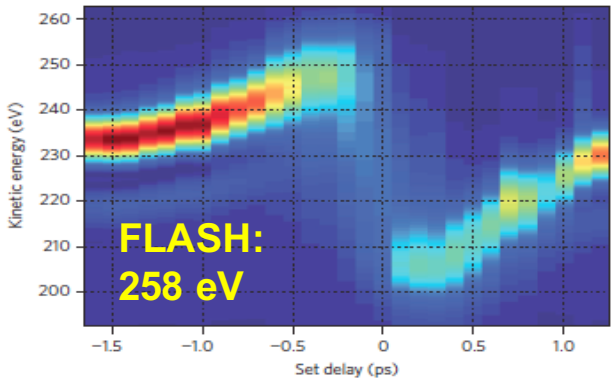
Linearly polarized field → kinetic energy

Single cycle pulses



Δt , Γ

4 μJ, 2 ps, 0.6 THz

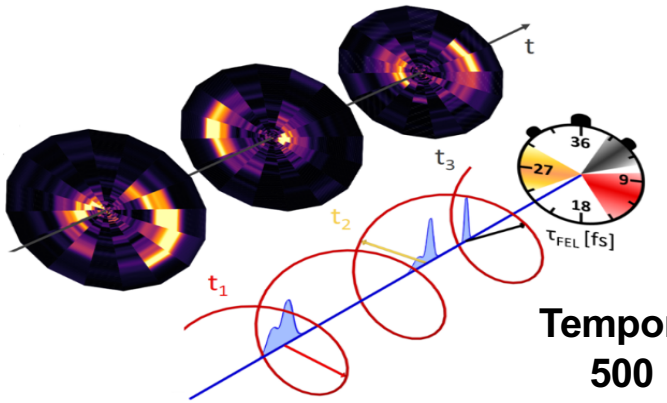


Grguras et al.
Nat.Phot. **6** (2012)

Helml et al.
Nat.Phot. **8** (2014)

Angular streaking

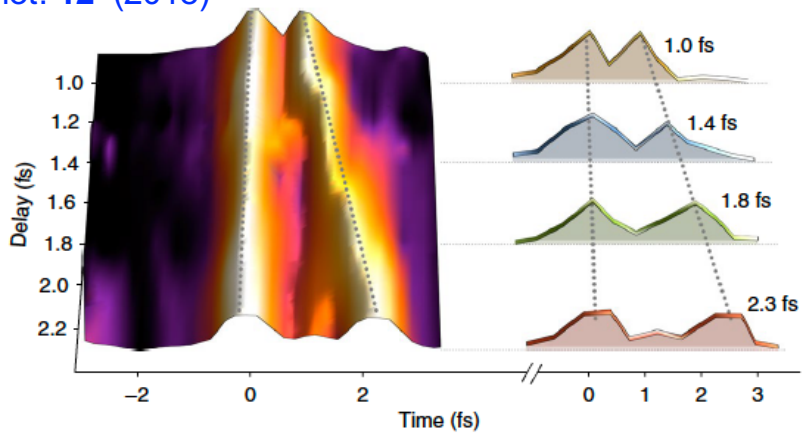
Circularly polarized field → angular distribution



λ = 10.6 μm (35 fs)

Temporal Resolution 500 as (→ 50as)

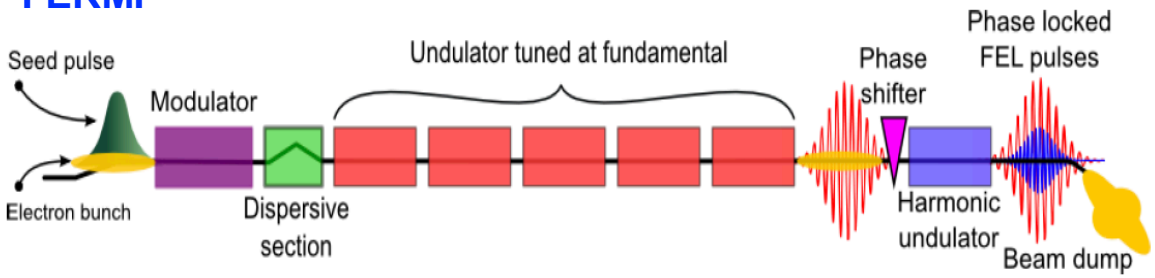
Hartmann et al.
Nat Phot. **12** (2018)



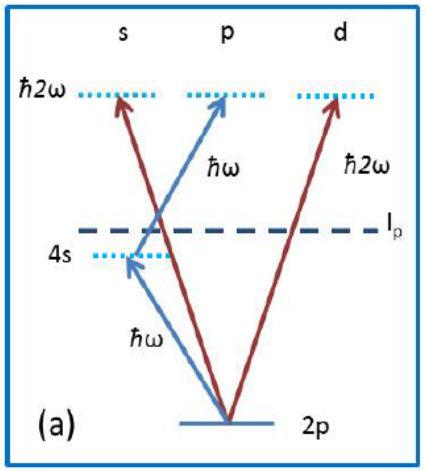
Coherent Control of photoionization

XUV + XUV (ω + 2ω)

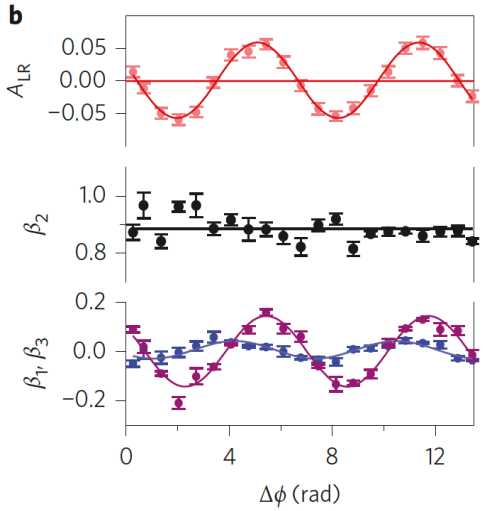
FERMI



Two interfering pathways



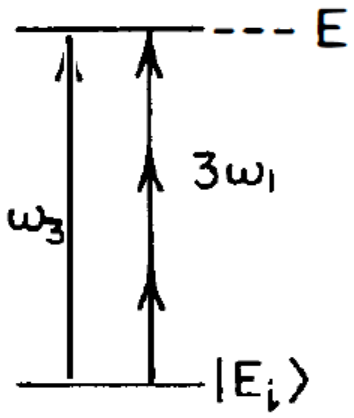
Prince et al.,
Nat.Comm. **10** (2016)



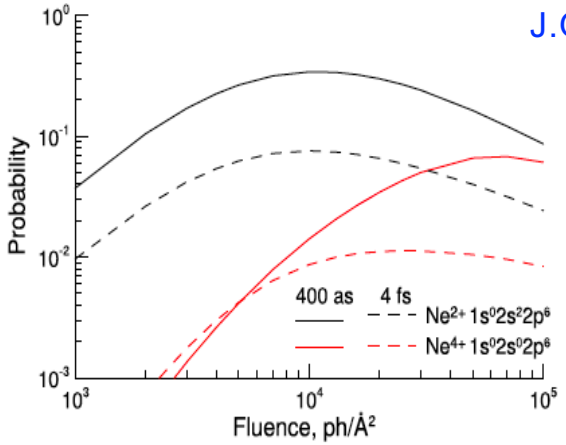
Temporal Resolution
3 as !

XUV + XUV (ω + 3ω)

Brumer, Shapiro
Annu.Rev.Phys.Chem. **43** (1992)



Serkez et al.,
J.Opt. **20**, (2018)



1.5 keV

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