Angular and dynamical aspects after multiphotonic absorption in the gas phase probed by X-Ray emission

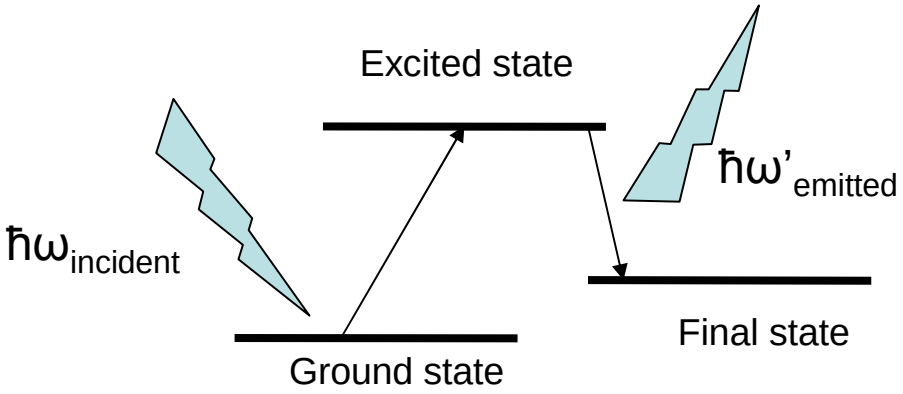
Renaud GUILLEMIN, Loïc JOURNEL, Thierry MARIN, Stéphane CARNIATO, Richard TAÏEB and Marc SIMON
Laboratoire de Chimie Physique-Matière et Rayonnement

Daniel ROLLES, Hamburg, Germany

Joachim ULLRICH, MPI, Heidelberg, Germany

Dennis W. LINDLE and Wayne C. STOLTE, ALS, USA

Resonant Inelastic X-Ray Scattering on gazes in the tender X-Ray region (1000eV-10 keV) using third generation Synchrotron Radiation



Kramers-Heisenberg

$$\sigma(\omega,\omega') \propto \sum_c \left| \frac{\langle f | \vec{\varepsilon}'.\hat{D} | c \rangle \langle c | \vec{\varepsilon}.\hat{D} | i \rangle}{\omega' - \omega_{cf} + i\Gamma_c} \right|^2$$

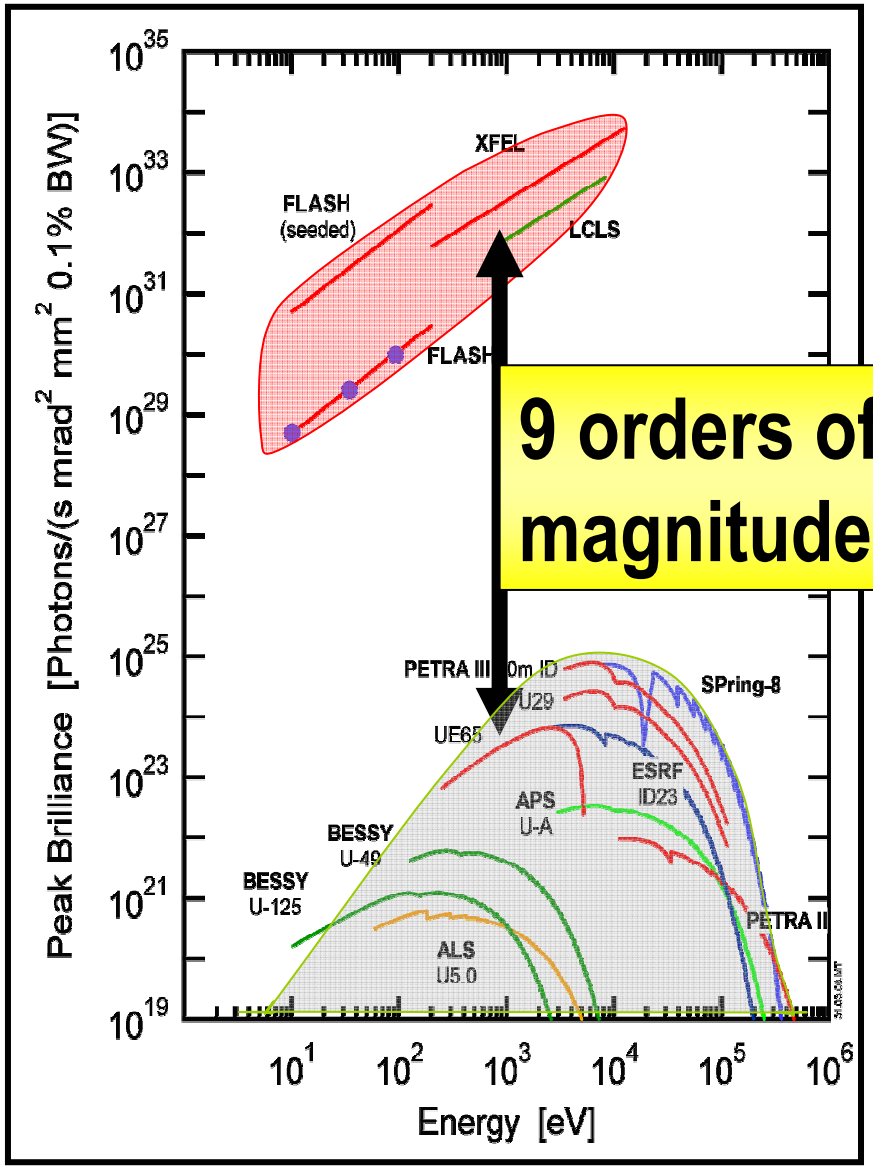
Resonant Raman regime, J.-Cl. Dousse (Fribourg, Switzerland); Phys. Rev. Lett. (2006)

RIXS on HCl: Ideal for ultrafast nuclear motion, M. Simon et al., Phys. Rev. A (2006)

Dispers./nondispers. at threshold, M. Zitnik (Ljubljana, Slovenia), Phys. Rev. A (2007)

Polarisation measurements, D. Lindle (ALS, USA), Rev. Sci. Instrum. (2007)

Linear dichroism in RIXS, R. Guillemin et al., Phys. Rev. Lett. (2008)

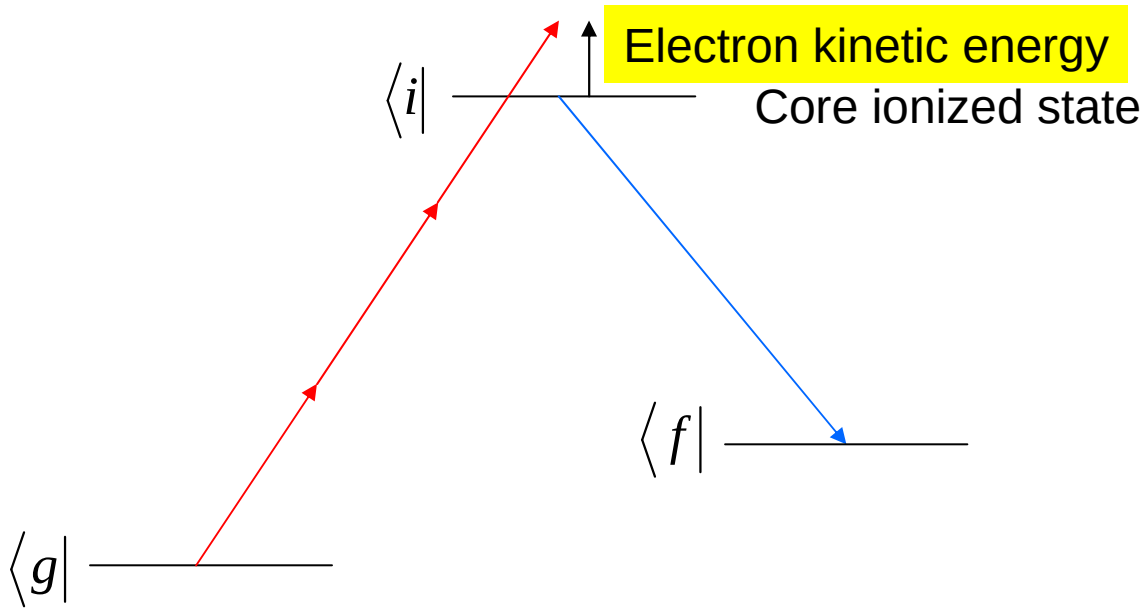


FEL

synchrotrons

Huge Intensities → Non-Linear Processes

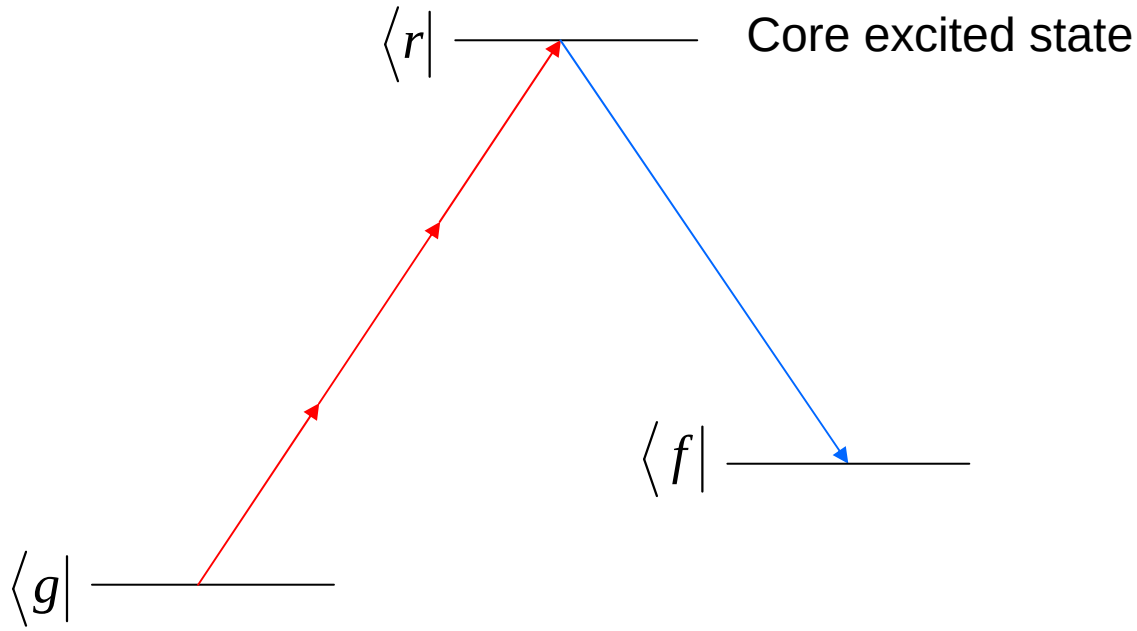
X-Ray Fluorescence after Multi-Photon Core Ionization



Dependence with incident photon energy
Energy and angular distribution of the emitted photon

Project at LCLS with Daniel Rolles and Joachim Ullrichon on rare gases

MultiPhoton Resonant Inelastic X-Ray Scattering on atoms and molecules



Dependence with incident photon energy
Energy and angular distribution of the emitted photon

Symmetry probe
Nuclear dynamics?

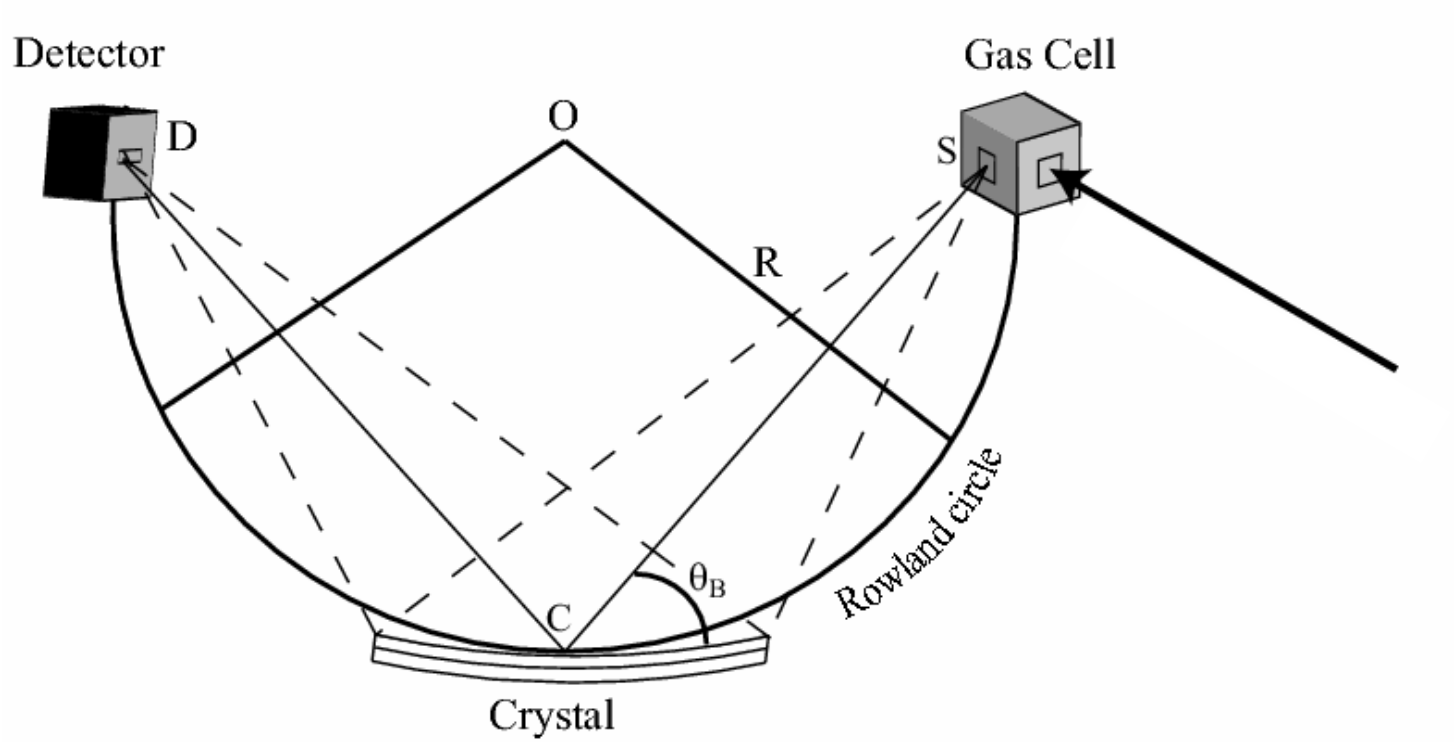
pn-CCD detector developped at Max Planck Institute

Active area	60 cm^2 (7.8 cm x 7.4 cm) 1024x1024 pixels
Pixel size	75 x 75 μm^2
Frame read-out rate	up to 125 Hz
Single-photon energy resolution	50 eV @ 800 eV 80 eV @ 2000eV
Quantum efficiency	> 90 % above 400 eV
Operating range	0.1 – 24 keV

Very large solid angle
Angular distribution
Energy distribution measurement on each pixel

Ideal for the first mesurements

Bent crystal diffractometer



Smaller solid angle
Polarization measurements
Angular distribution
High resolution (200 meV at 2 keV)