First Results from the Clusterexperiment at the TTF-FEL

- Motivation
- Experimental Set-Up
- Multi-Photon Ionisation
- Coulomb Explosion of Clusters

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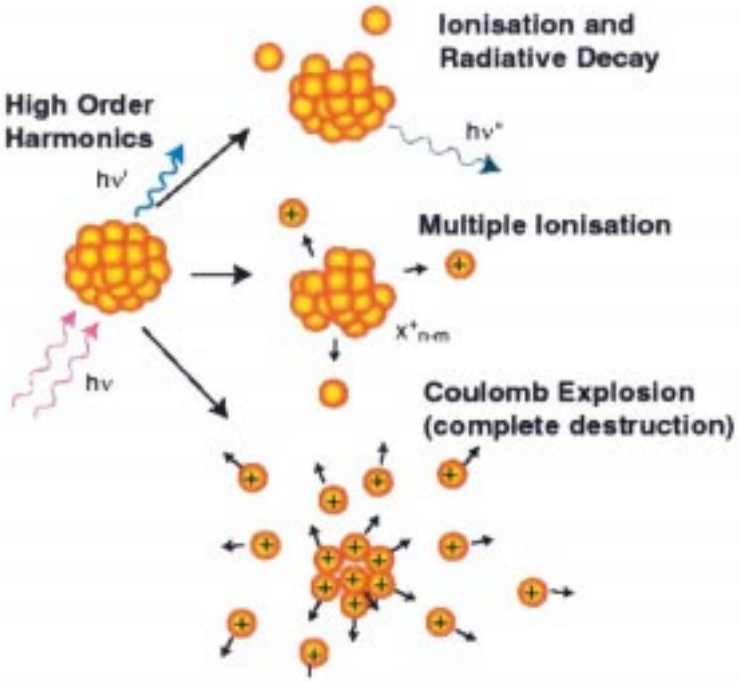
Idea of the experiment

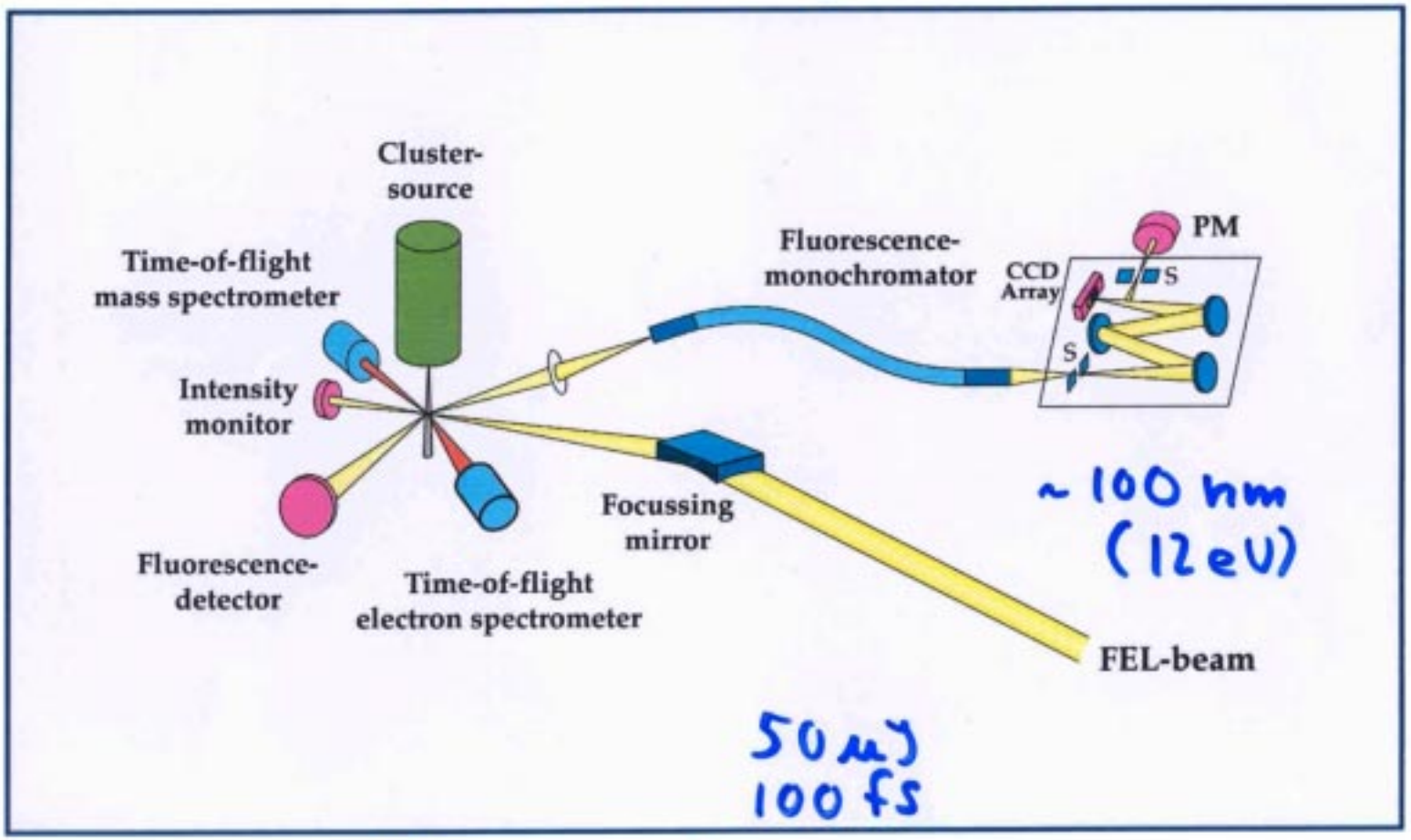
interaction of intense soft x-rays with matter



which multi-photon processes are observed

- **cross sections (surface, bulk)**
- **which ions are prepared (charge state, electronically excited states)**
- **life time of intermediate states**
- **high-order harmonic generation**

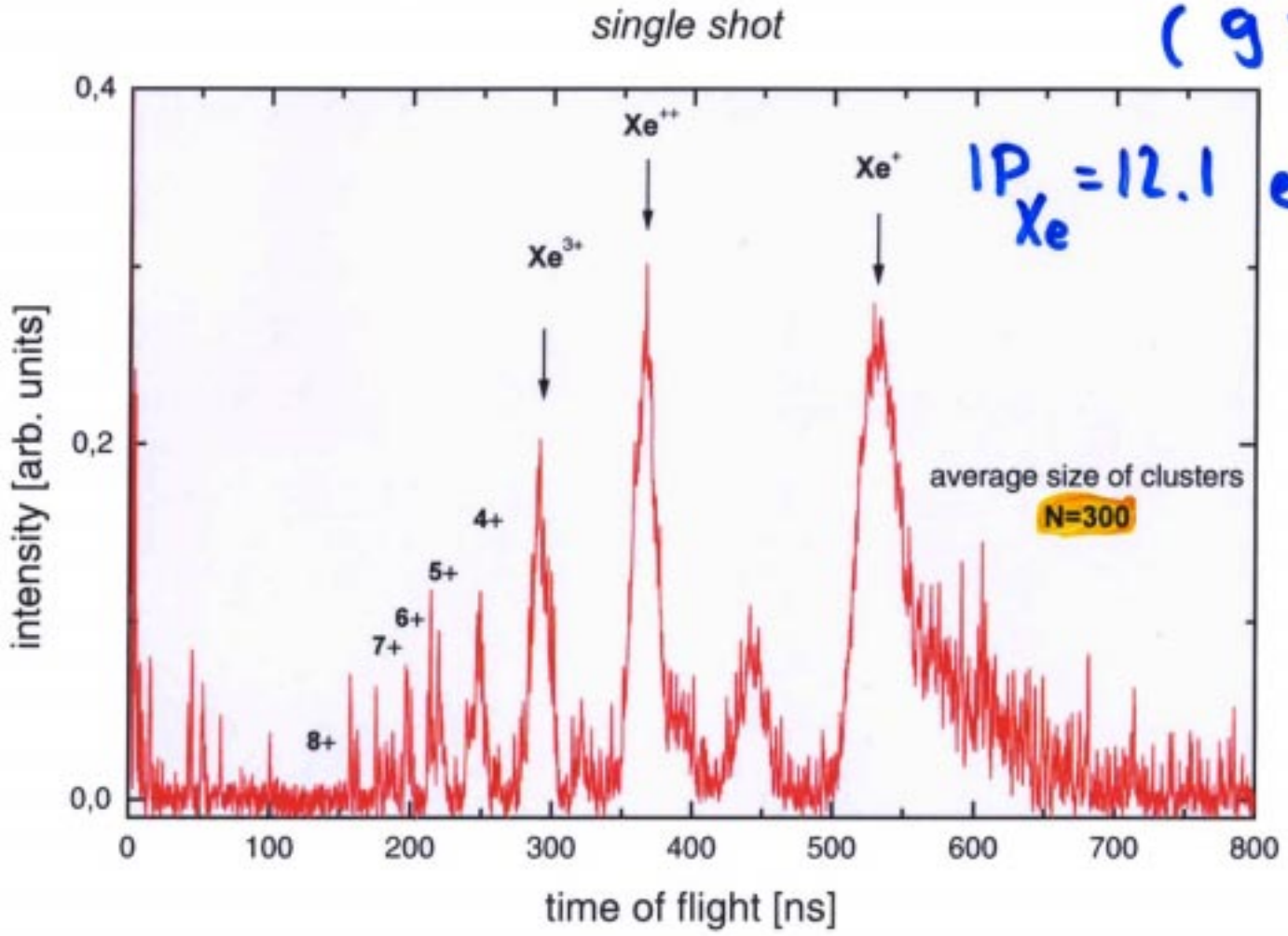
FEL Cluster-Experiment

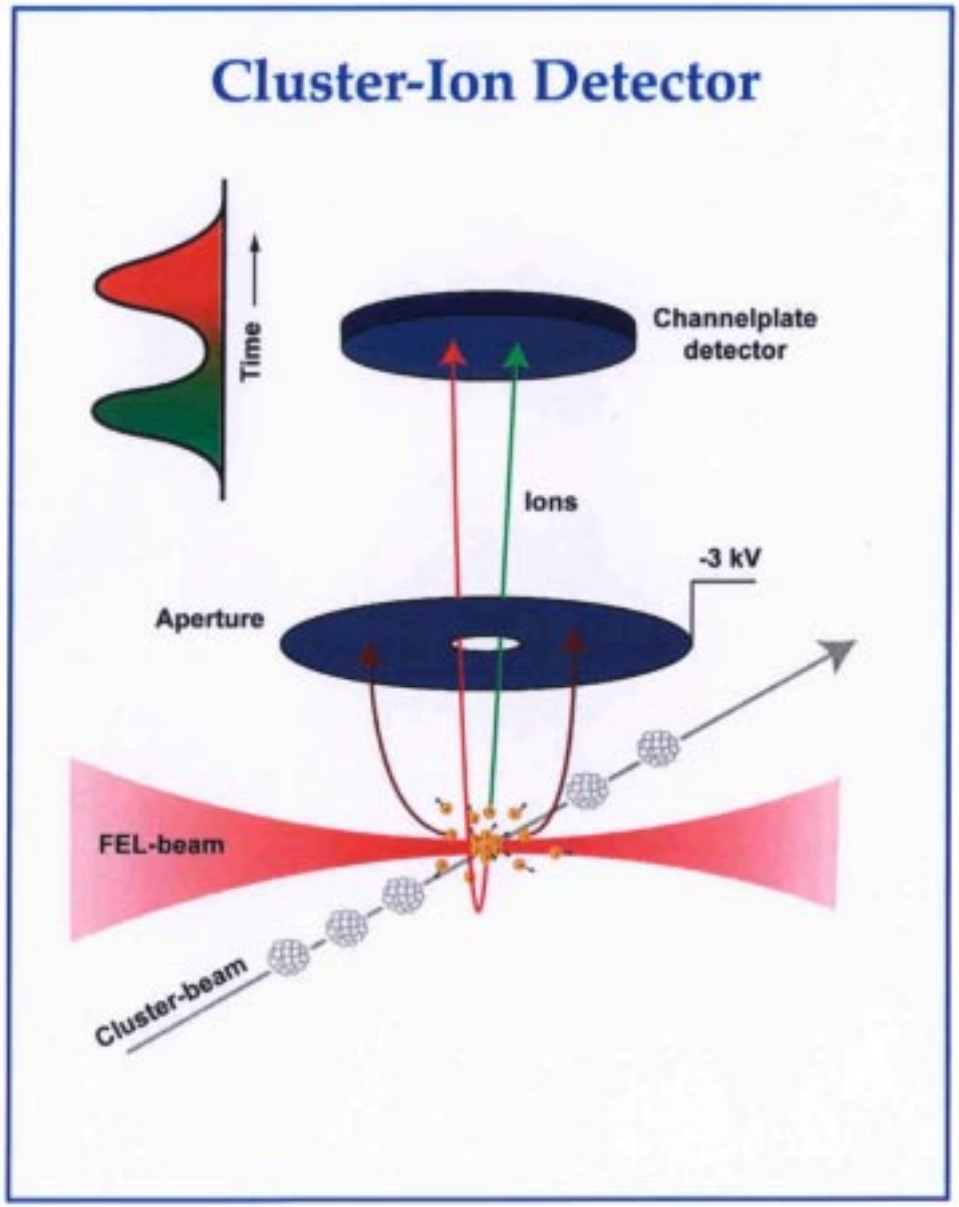


10^{14} W/cm^2

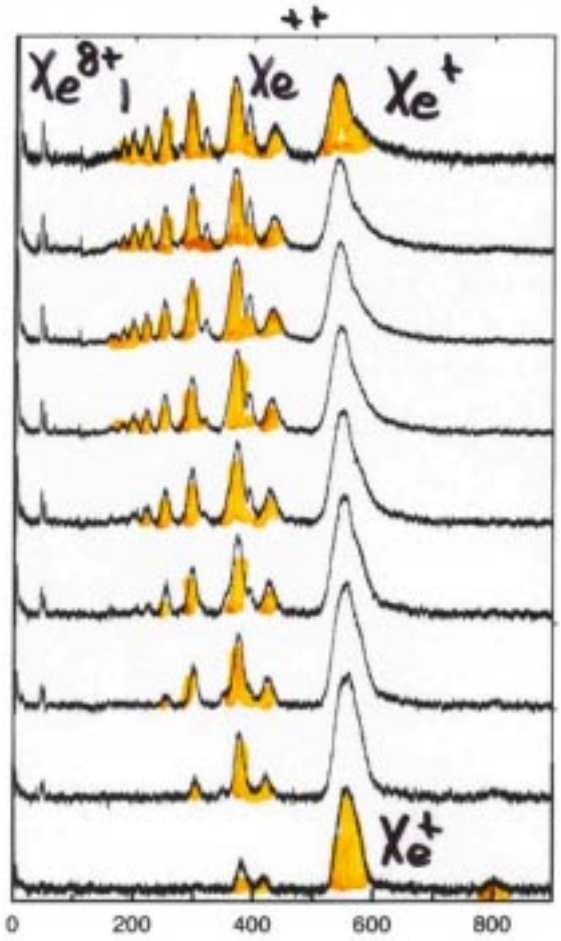
Xenon clusters

E = 12.7 eV
(97 nm)




Cluster-Ion Detector
Time
Channelplate
detector
Ions
-3 kV
Aperture
FEL-beam
Cluster-beam

Dependence on the power density



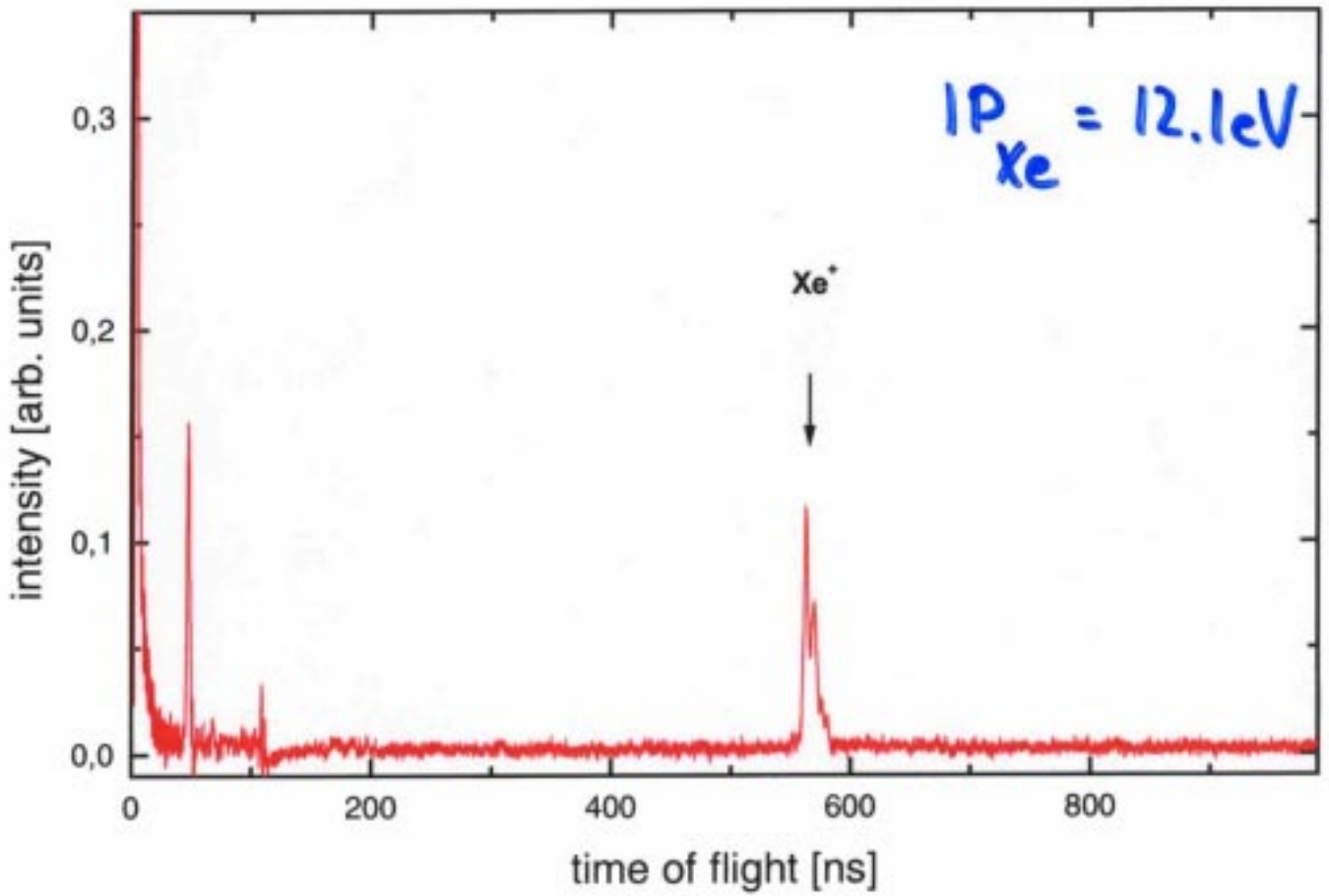
Xenon clusters, 50 atoms

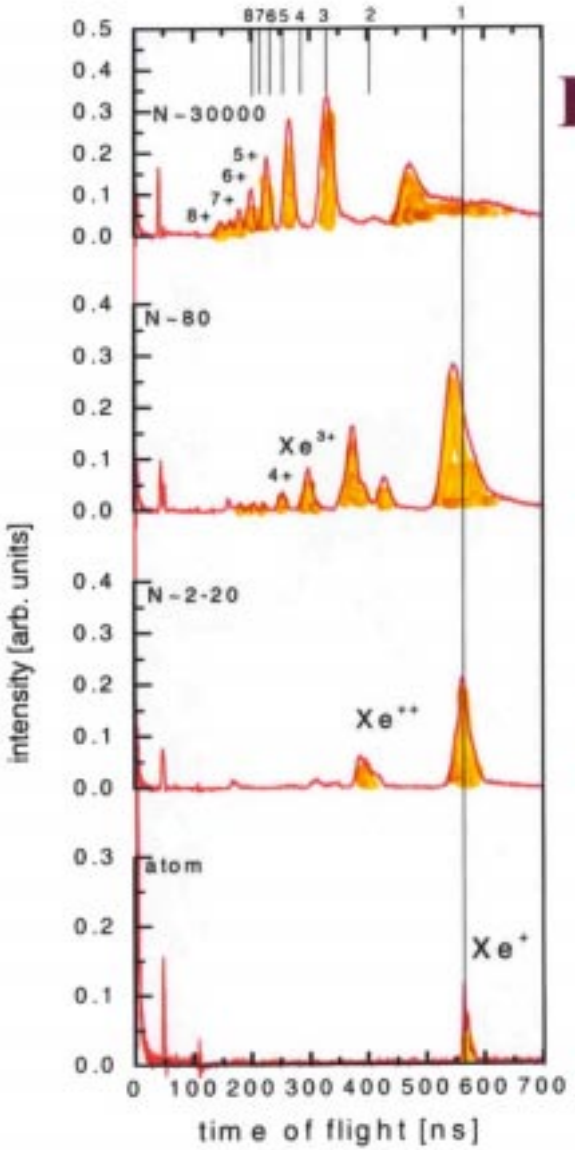
10^{13} Watt/cm^2

$5*10^{11}$ Watt/cm^2

$E = 12,7\,eV$

atomic beam

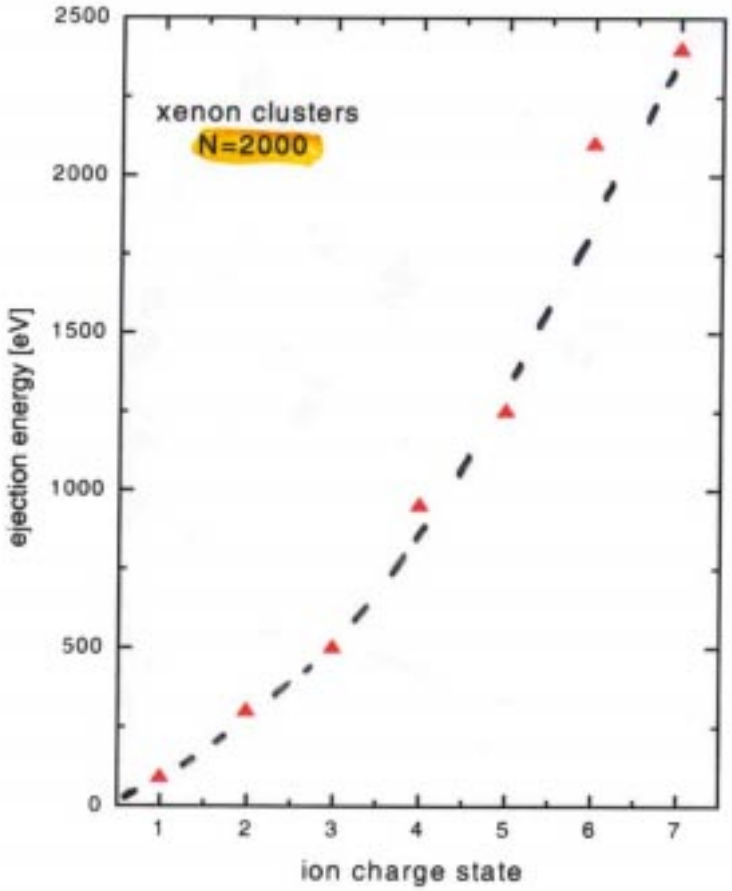




Dependence on the cluster size

- Single photon absorption in Xe atoms
- emission of highly charge ions from clusters (up to eight times charges)
- ions have high kinetic energy

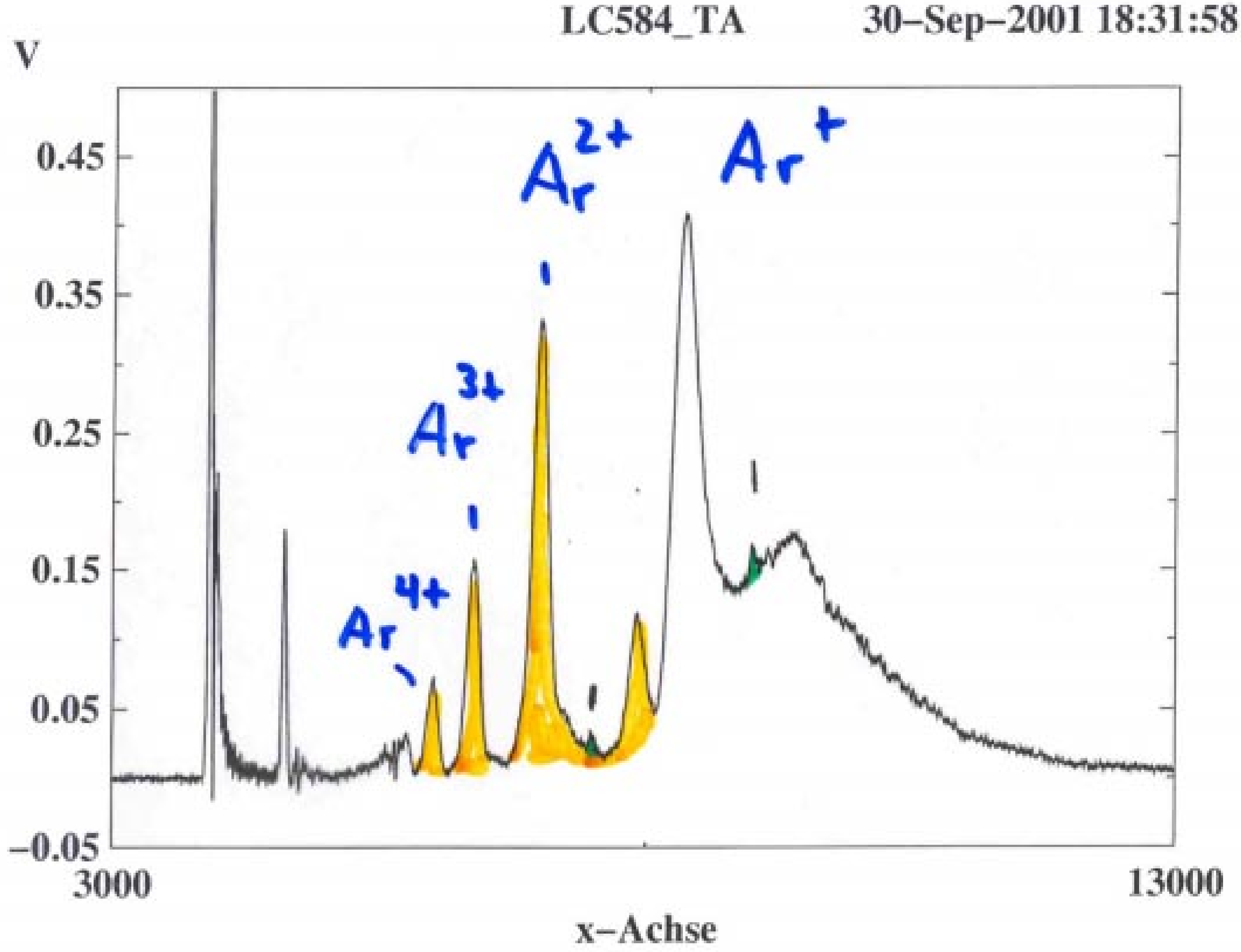
Kinetic energy of the ejected ions



- Quadratic dependence on charge
- Coulomb explosion

Argoncluster

97 nm

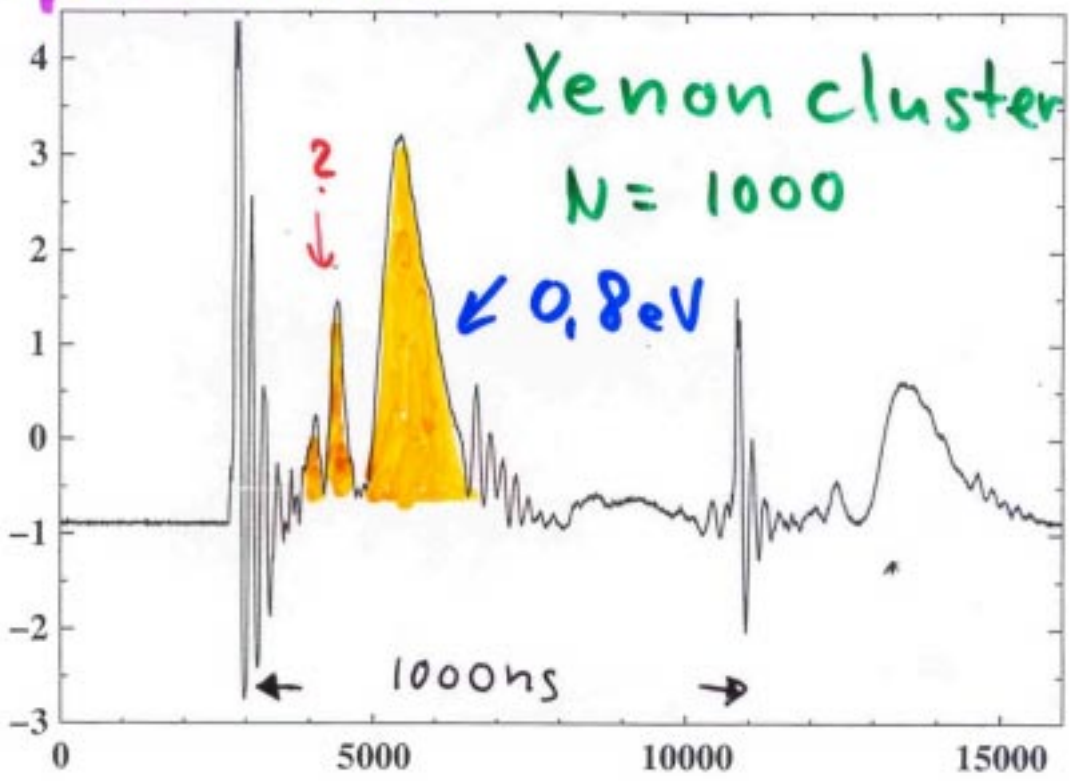


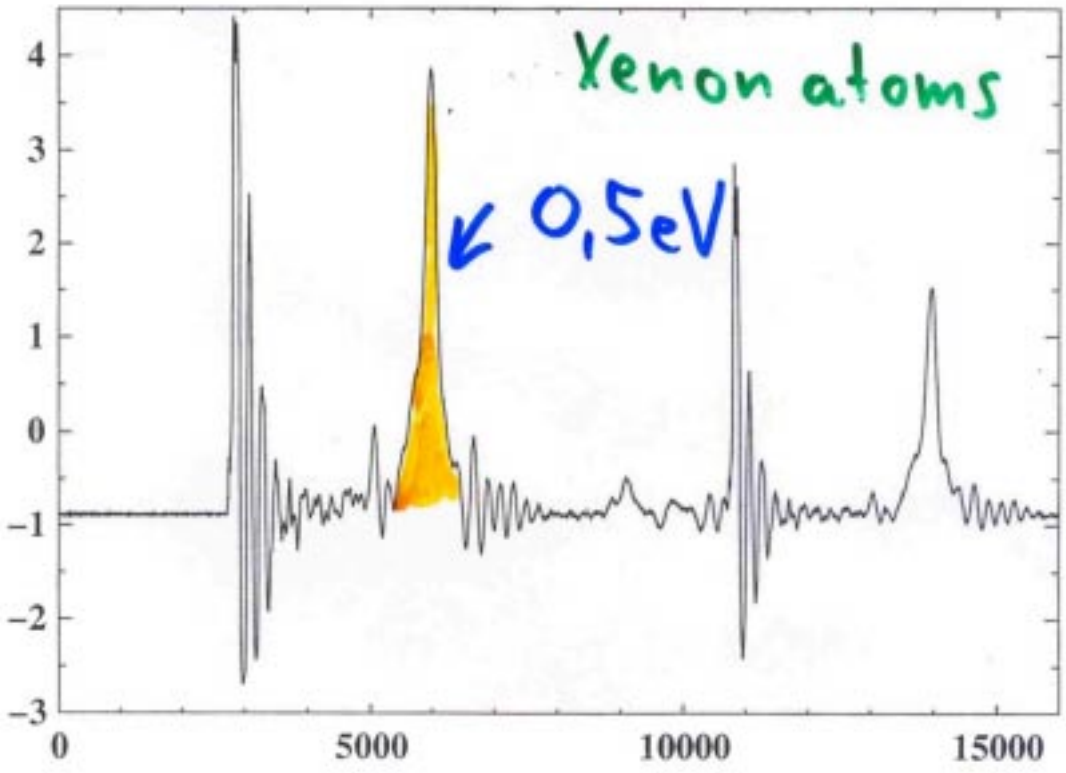
Ar 30s09

20bar

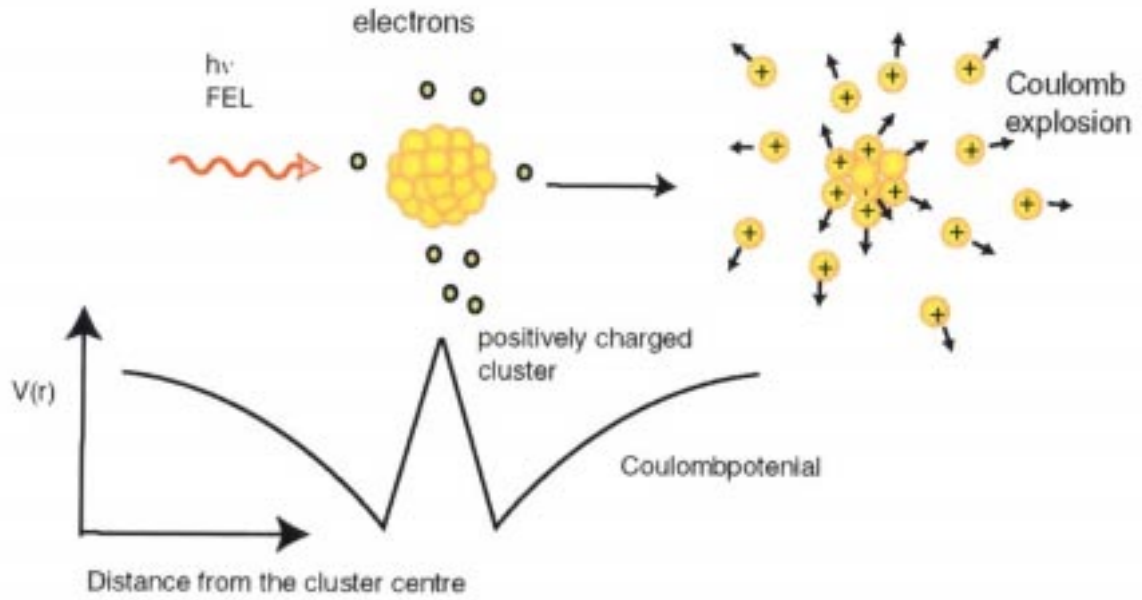
vergrößert

Time of flight photoelectron spectra





Do we understand the results?



Nanoplasma formation: multi photon absorption

hot ions, cold electrons

Outlook

- **High quality electron spectra**
- **Pumpe-probe experiments?**
- **Experiments in Phase II**: multiphoton processes
  mass selected clusters