

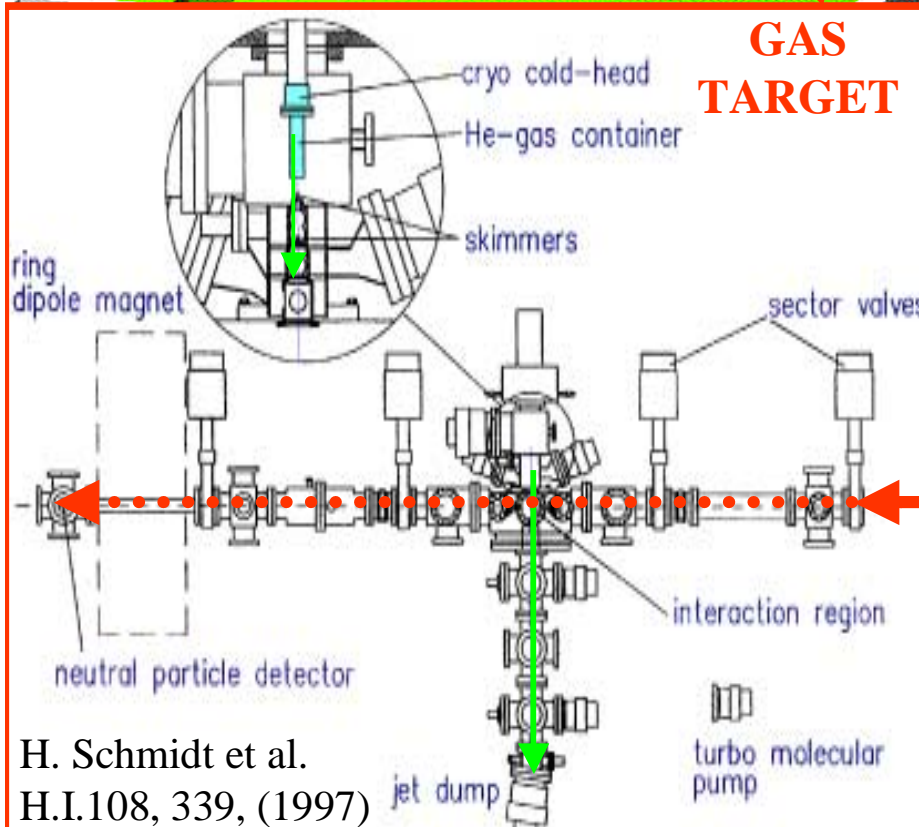
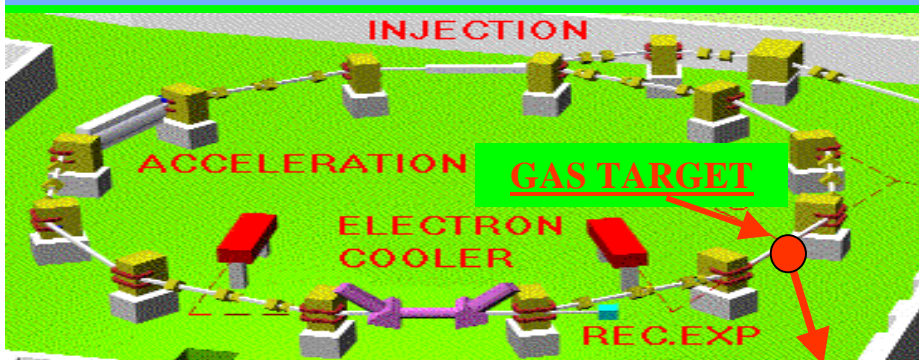


News from CRYRING/ Stockholm

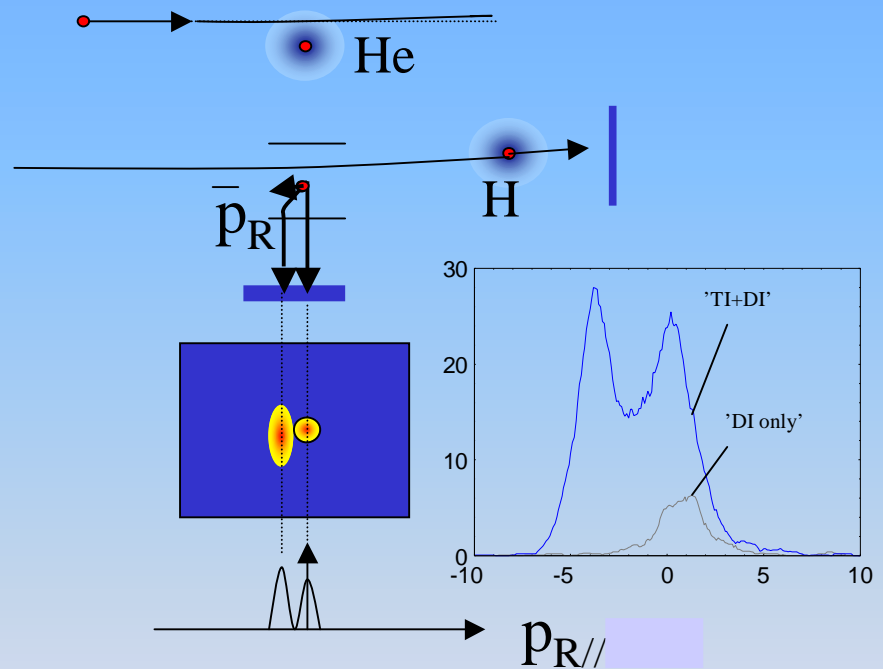
- ☀ Dynamics in many-body effects with internal jet-target
- ☀ Laser-probing of metastable states: Lifetimes
- ☀ QED tests for few-electron ions by recombination resonances
- ☀ Stored intense laser pulses

Fast atomic collisions in CRYRING

New experiments: Intense stored and cooled ion beam crosses with cooled gas target for high luminosity Recoil Ion Momentum Spectroscopy (RIMS!)



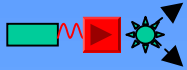
First experiment: $p + \text{He} \rightarrow \text{H} + \text{He}^{2+} + e^-$



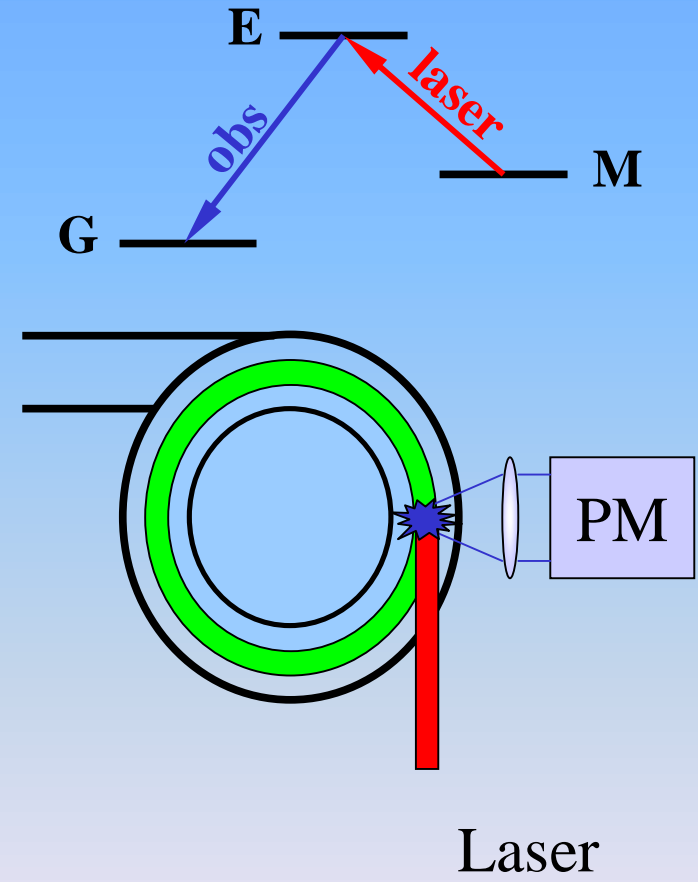
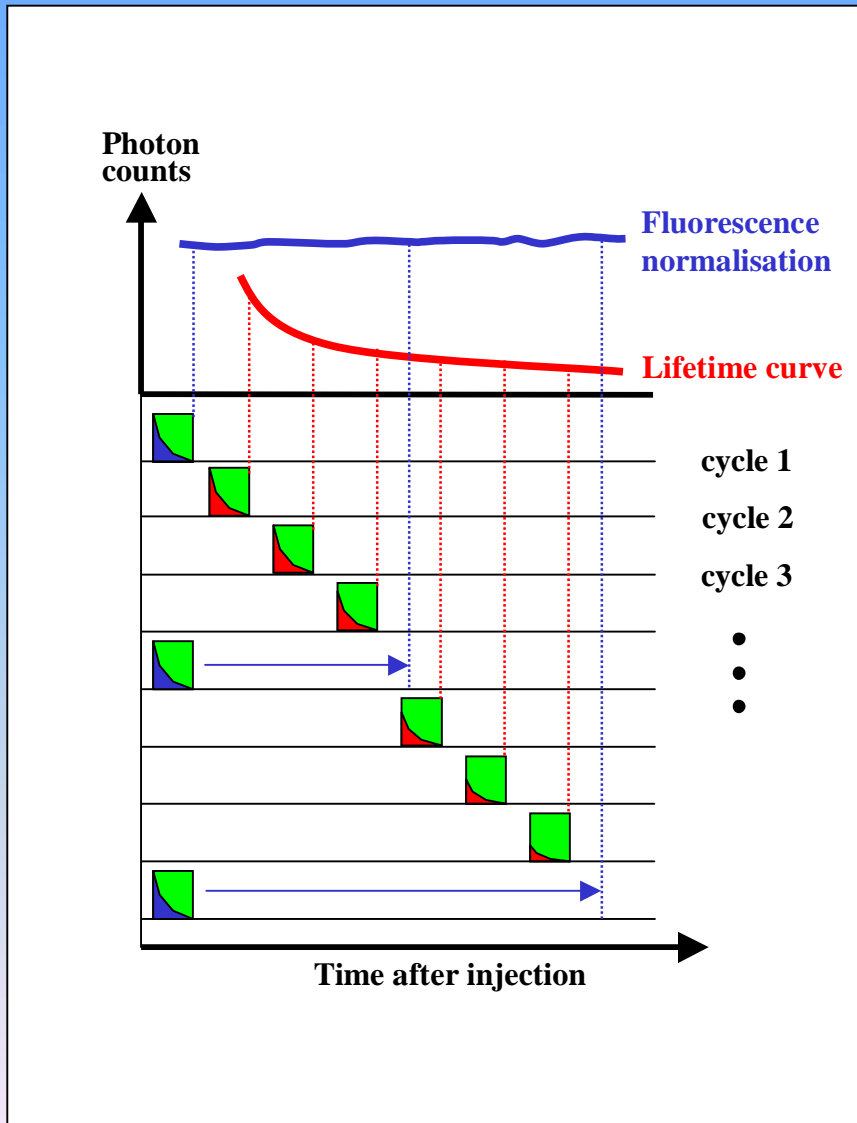
Investigate: The dynamics in electron rearrangement processes

Here: correlated and un-correlated transfer and ionization up to 7 MeV p

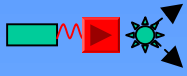
H. Schmidt et al.
H.I.108, 339, (1997)



Laser probing technique



Mannervik et al



Applying laser probing on complex atomic systems ...

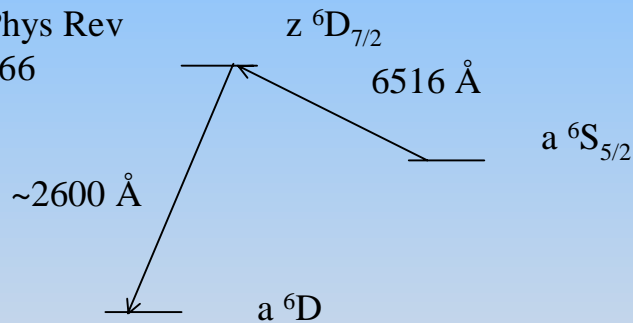
Utilizing:

- high sensitivity
- high selectivity
- long observation time

Mannervik et al, Phys Rev Lett **76**(1996)3675

62 truly metastable levels in Fe II
- 4 have been investigated

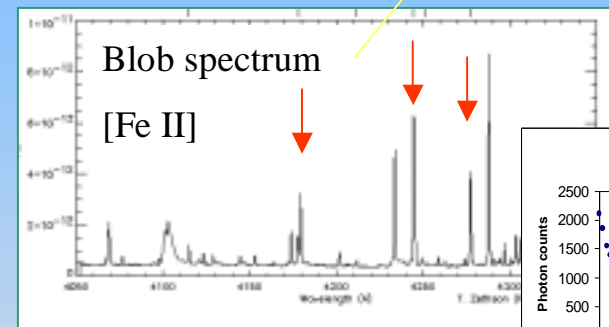
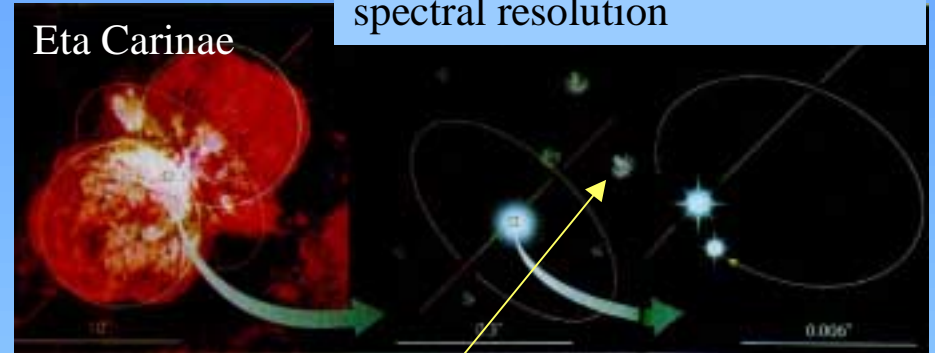
Rostohar et al, Phys Rev Lett **86**(2001)1466



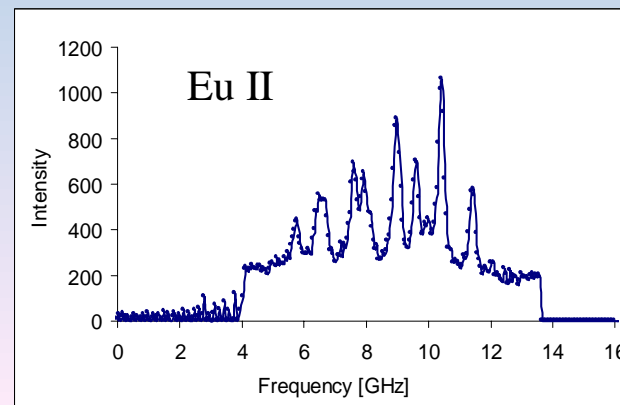
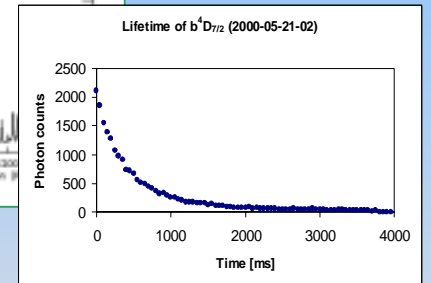
Rare earth elements - unexplored until now

Rostohar et al, Physica Scripta (to be published)

Hubble gives spatial and spectral resolution



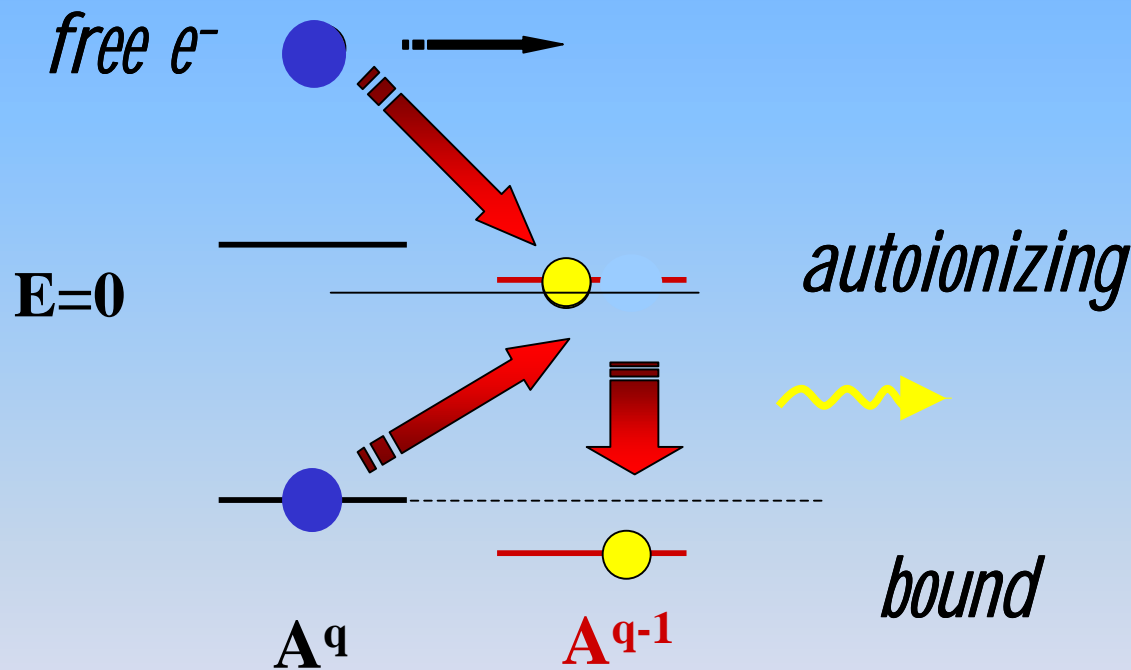
Forbidden lines



QED

effects on resonances

in *Dielectronic Recombination*



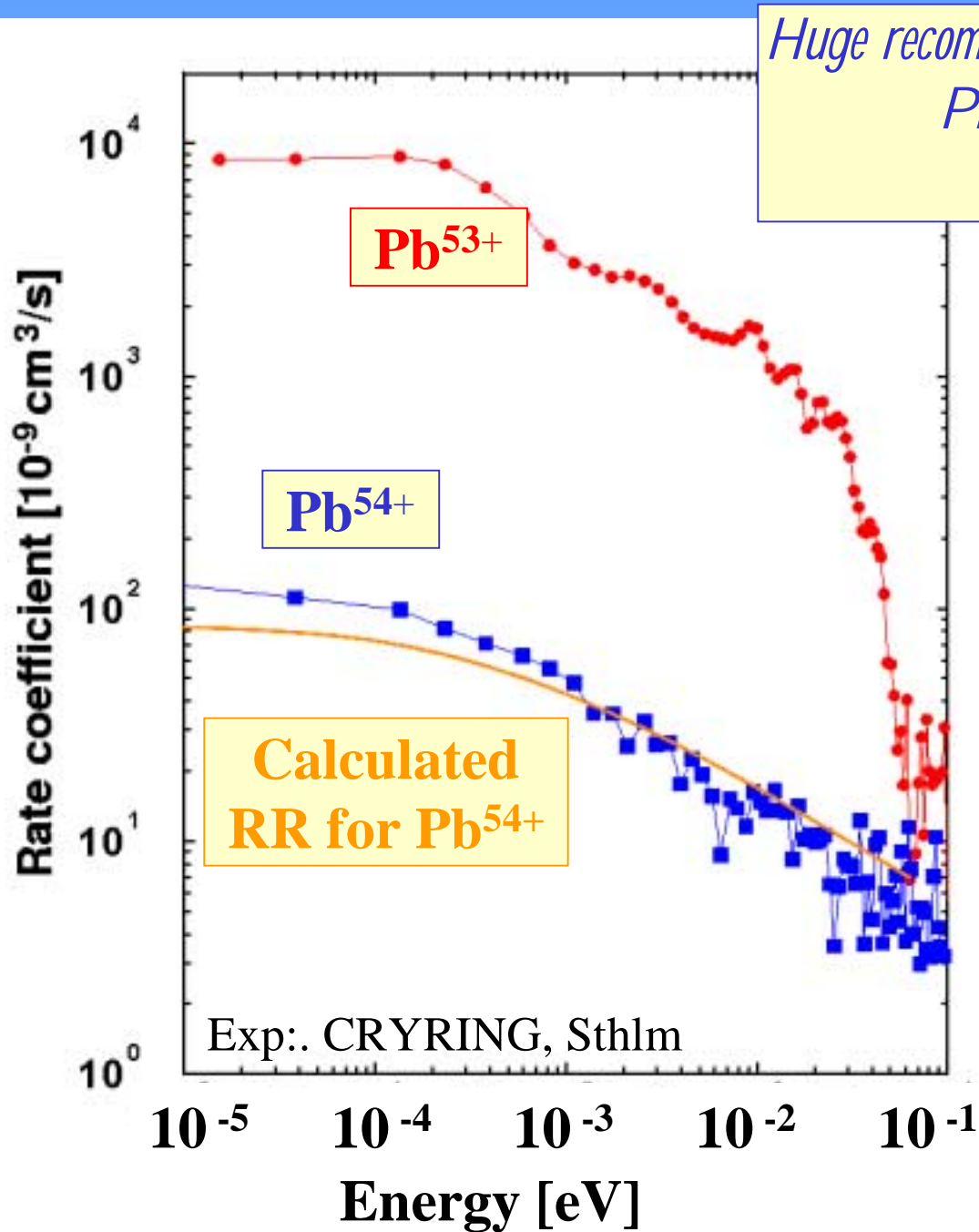
principle:
 $E_r = \Delta E - E_{nl}$

*high-Z
ions*

*large QED effects many e^-
system*

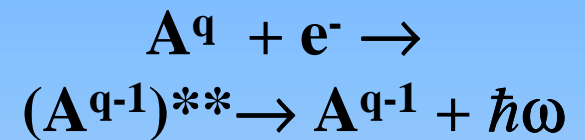


M. Fogle, P. Glans, S. Madzunkov, R. Schuch, M. Tarek
theory: E. Lindroth, M. Tokman



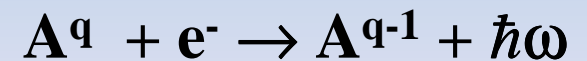
*Huge recombination rate for
Pb⁵³⁺ !*

DR - resonant

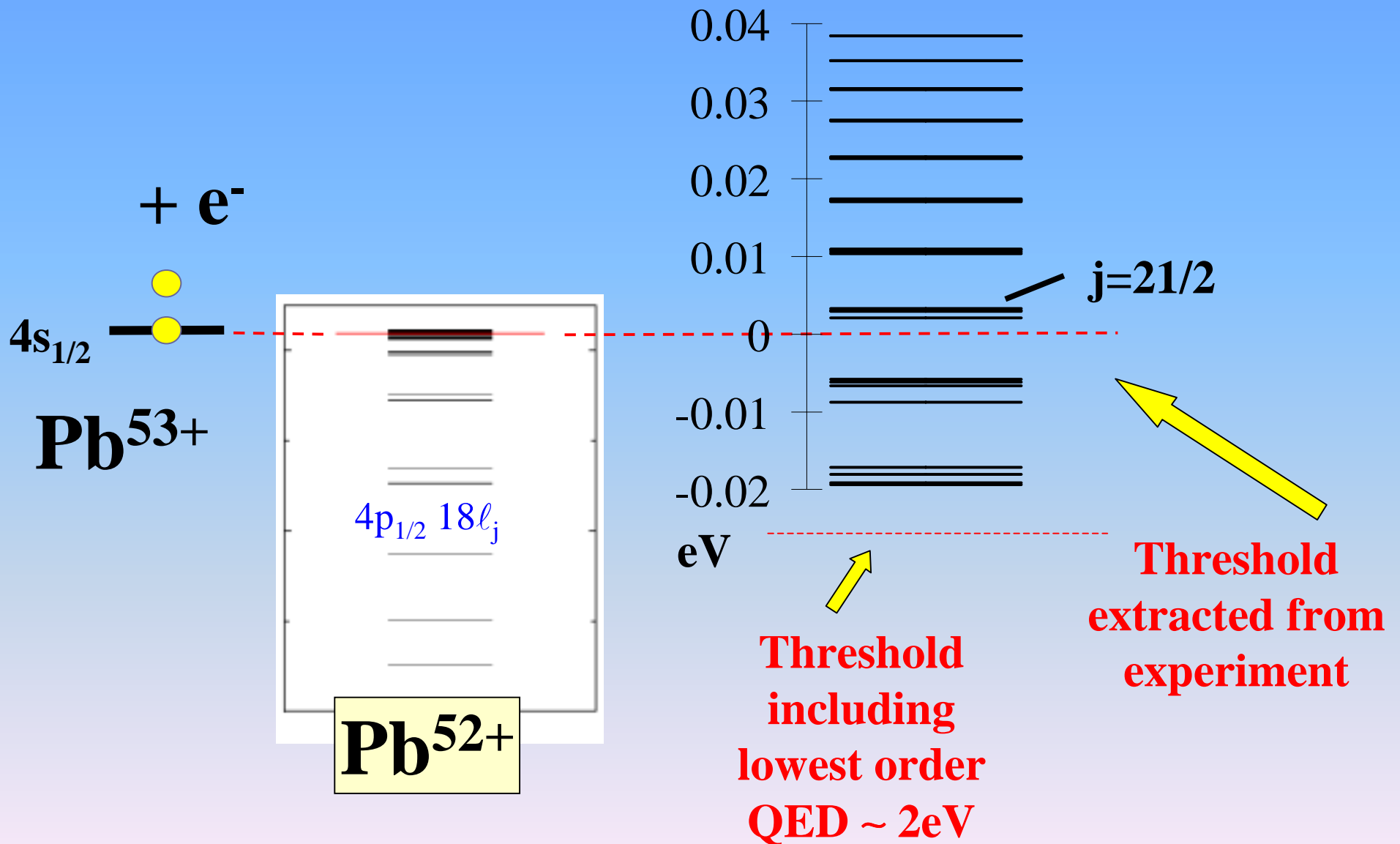
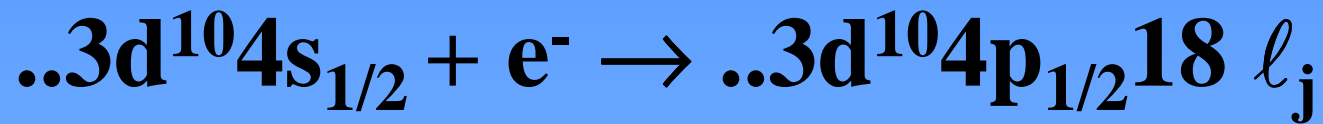


Pb⁵³⁺: ($\dots 3d^{10}$) 4s

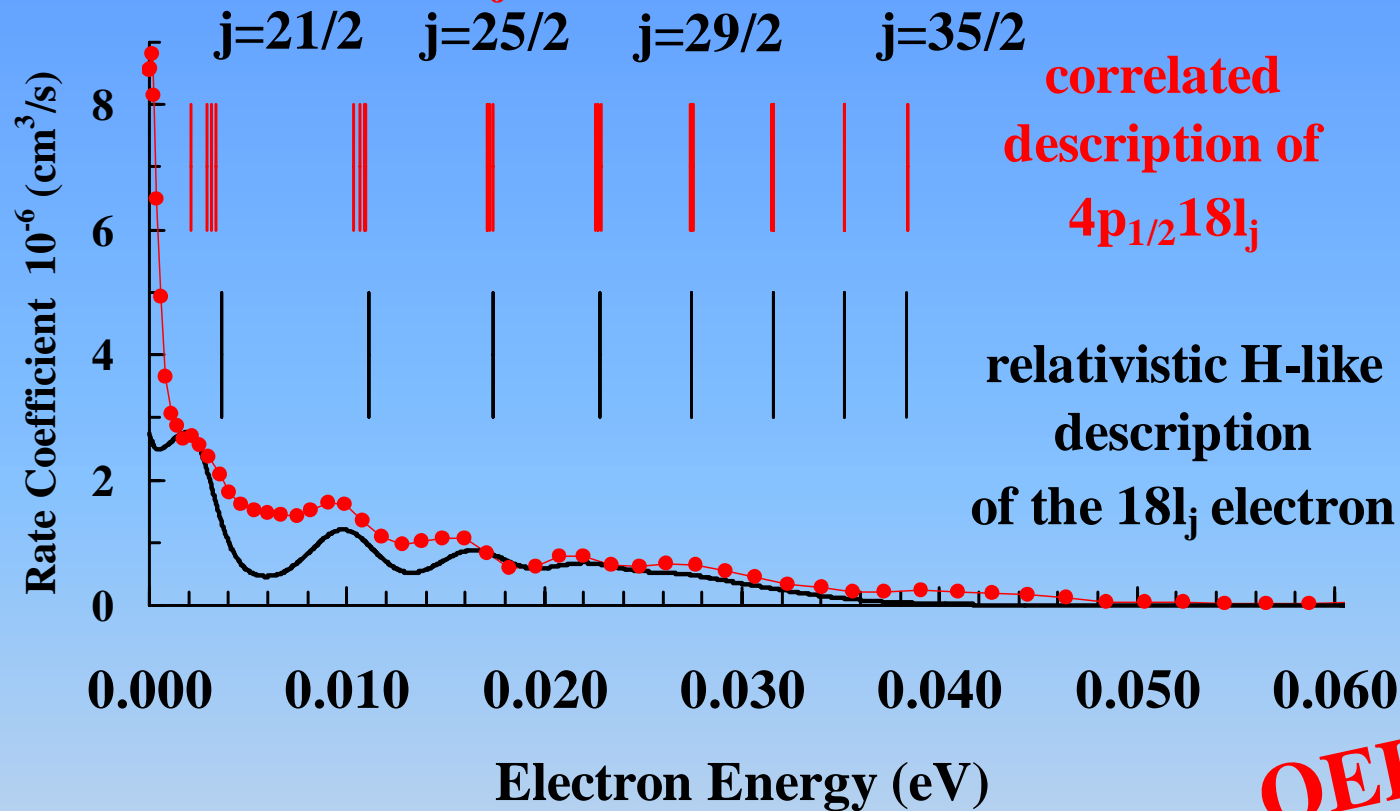
RR - non resonant



Pb⁵⁴⁺: ($\dots 3d^{10}$)



$$\epsilon = \text{Pb}^{52+} (4p_{1/2} 18l_j) - \text{Pb}^{53+} (4s_{1/2}) = \text{Pb}^{53+} (4p_{1/2} - 4s_{1/2}) + \Delta E(18l_j)$$



QED in Pb^{53+}

determined:

$\Delta (4p_{1/2} - 4s)$:

118.010 ± 0.001 eV (QED ~ 2 eV)



Incl. screening of self energy and vac.pol.

2.01

+ core QED etc

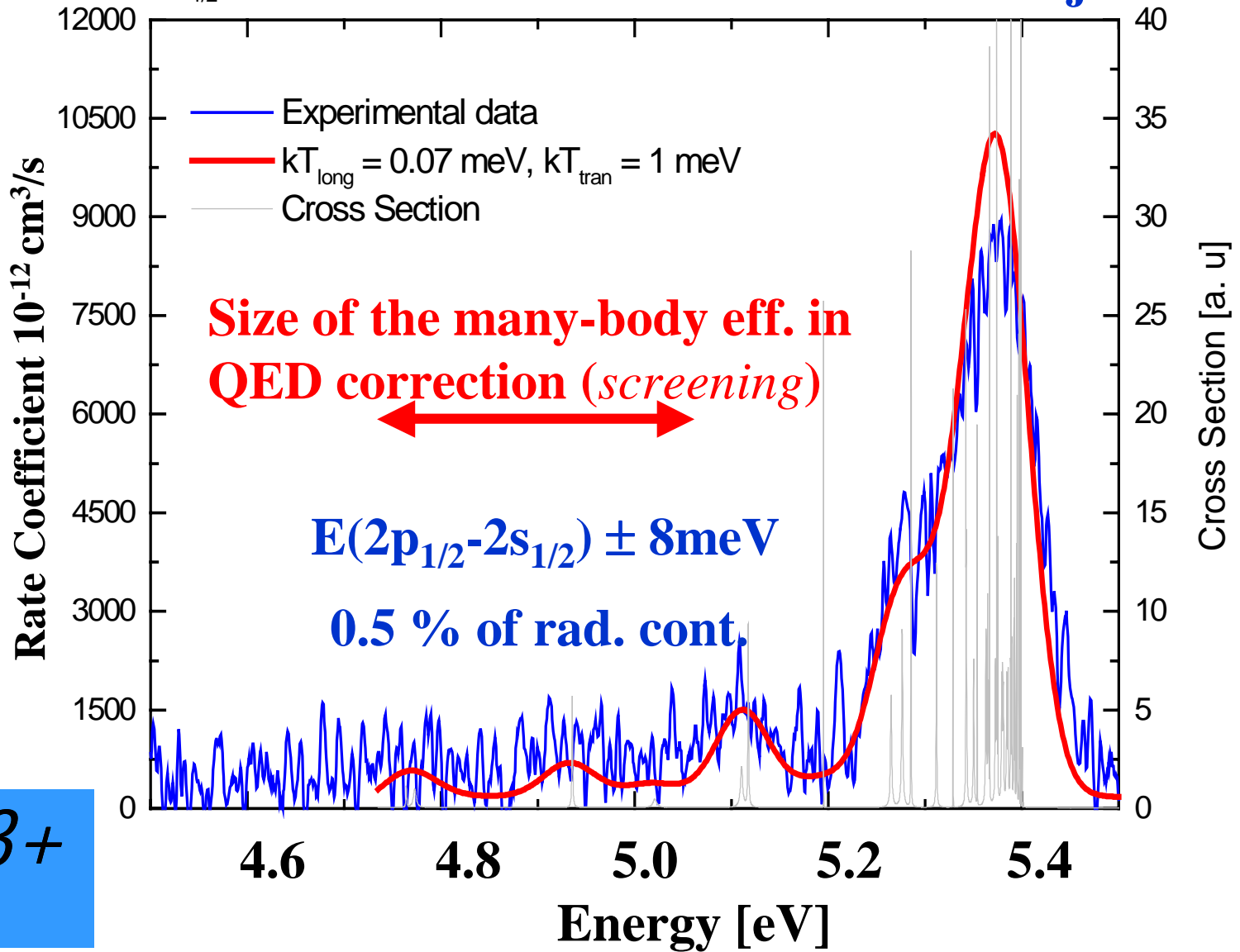
2.05 (1)

(Blundell -93)

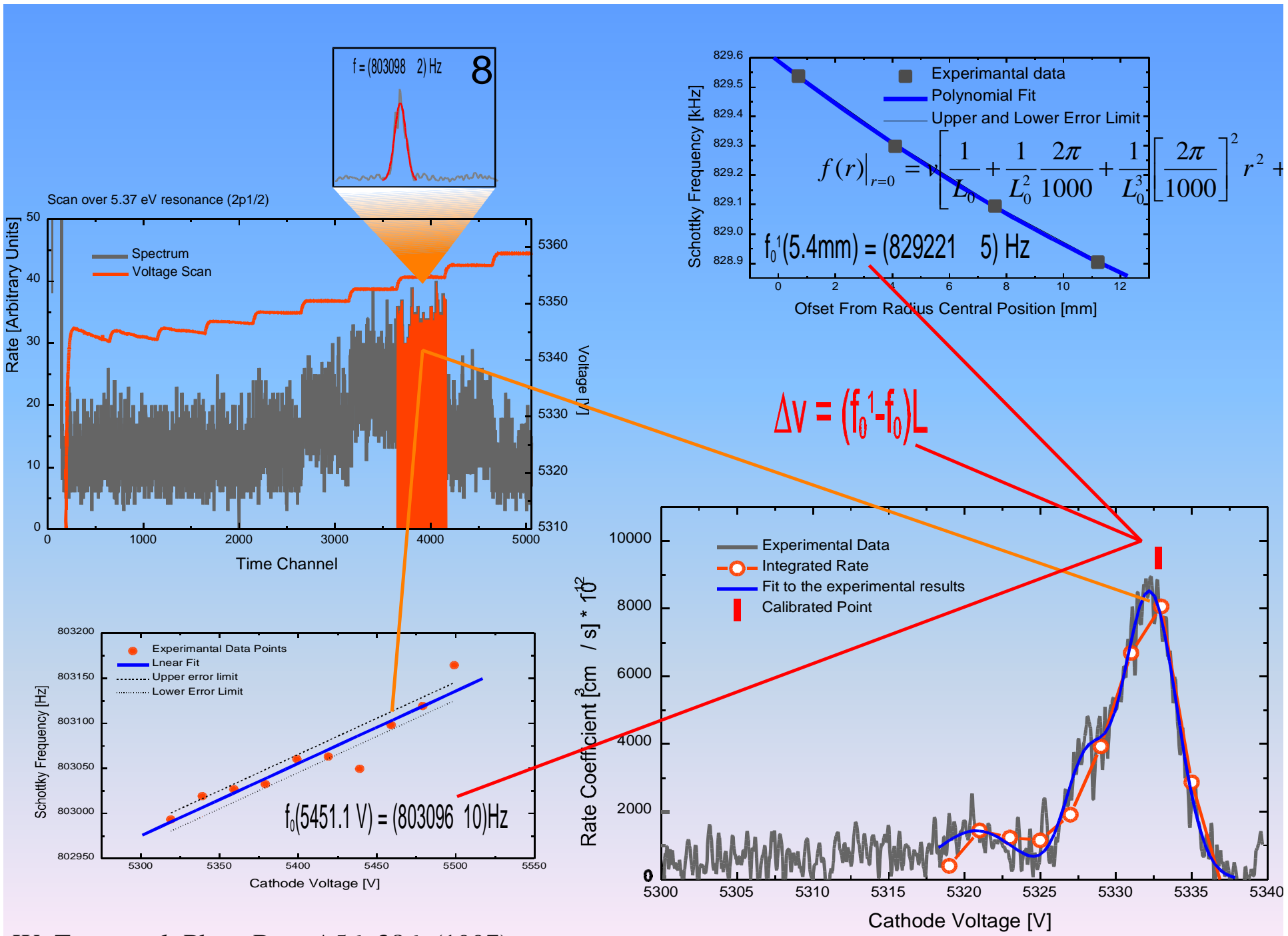
Experiment

2.004 (1)

Lindroth et al. PRL 86, 5027, 2001

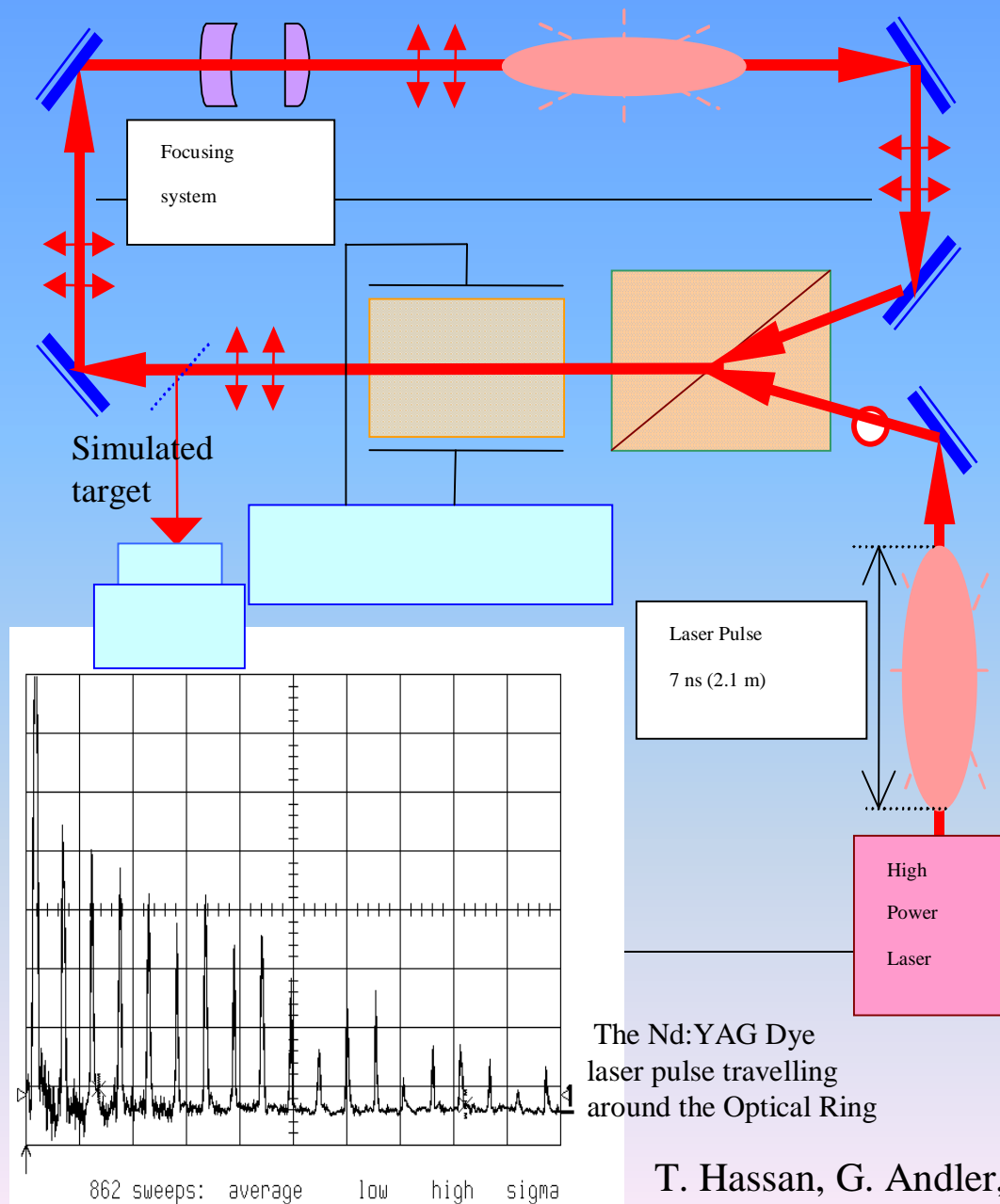


*Kr*³³⁺



W. Zong et al. Phys. Rev. A56, 386, (1997)

Optical Ring for High-Intensity Laser Pulses



The Nd:YAG Dye laser pulse travelling around the Optical Ring

T. Hassan, G. Andler, and R. Schuch to be subm.