PHOTODETACHMENT DYNAMCS
OF THE OXYGEN ANION O^- AT 266 nm

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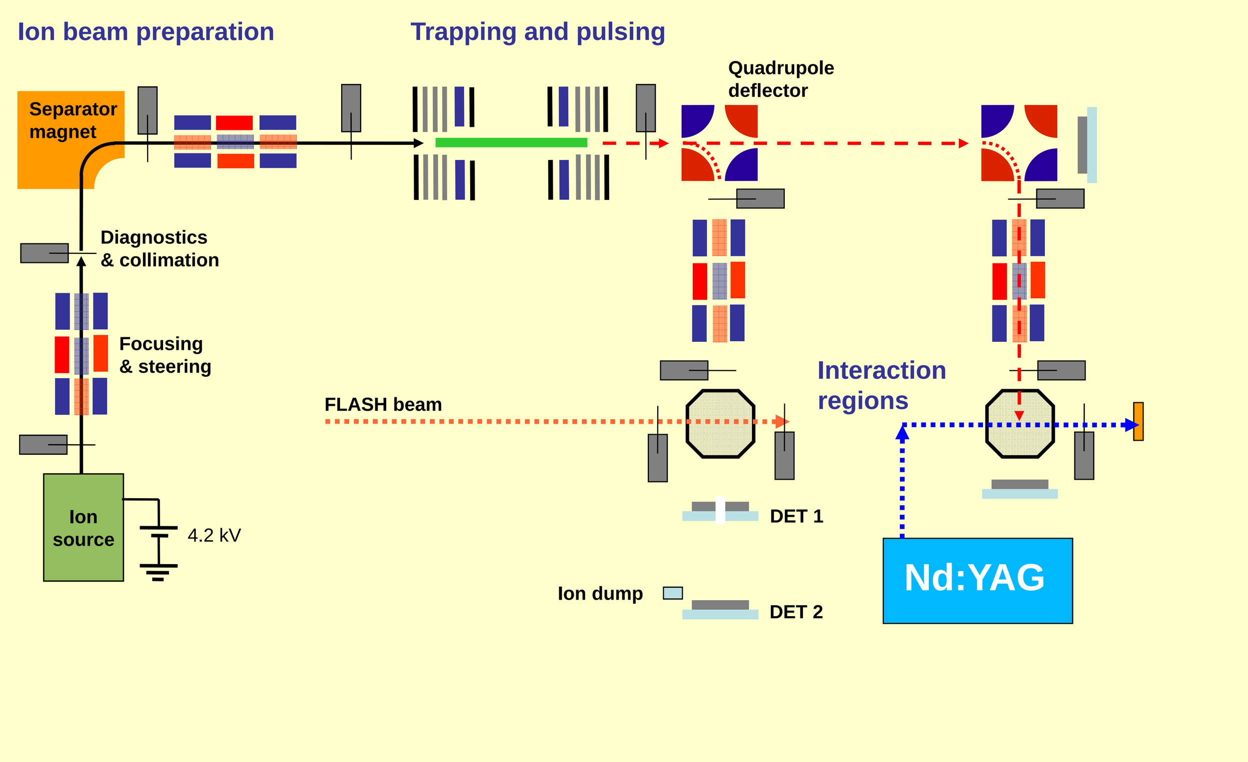
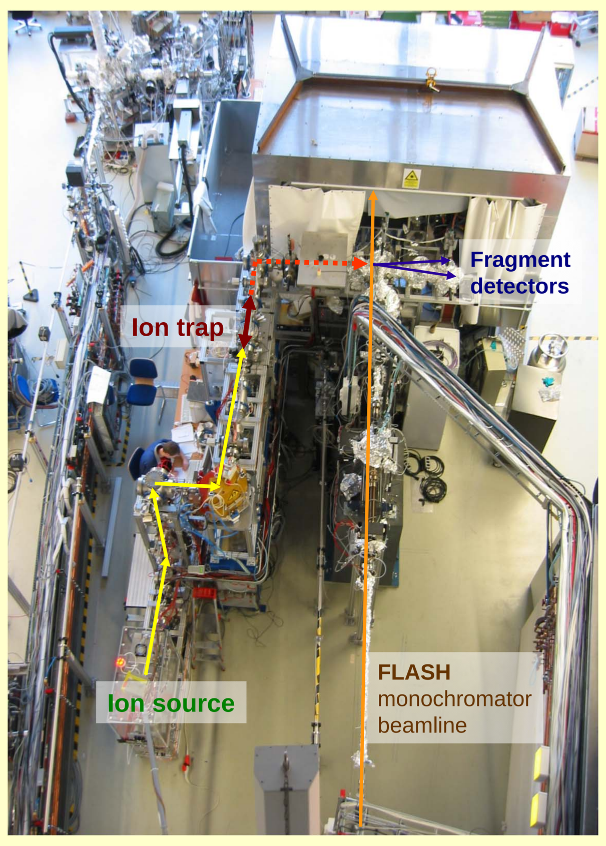
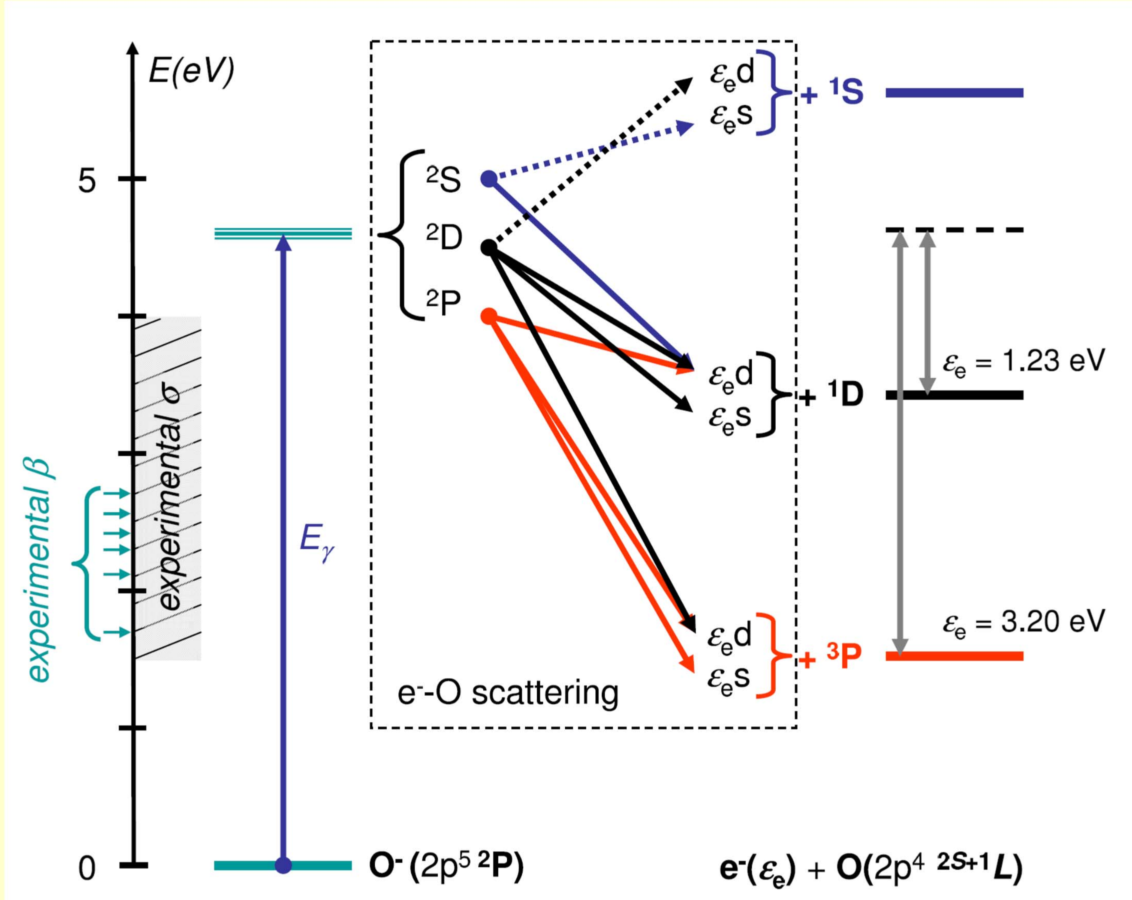
The TIFF experiment [3,4] – Trapped Ion Fragmentation at FLASH [1,2]



Magnetic bottle photoelectron spectrometer

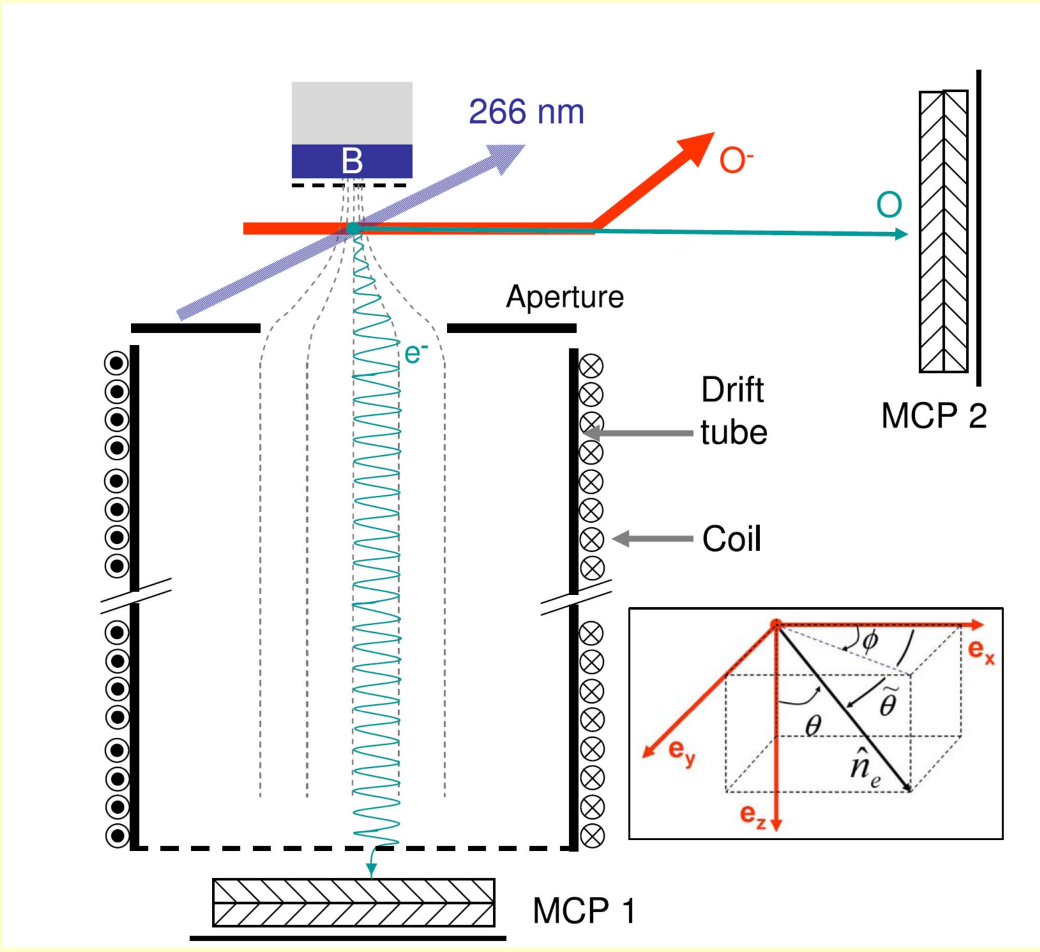


O^- photodetachment dynamics



- Recent calculations on O^- detachment, see Ref. [1,2]
- Measurements of photodetachment cross section, see Ref. [3,4]
- Measurements of anisotropy (β) parameters, see Ref. [5]

Magnetic bottle spectrometer and fast ion beams [6]



Photoelectron properties

$$\varepsilon_e = h\nu - EA_O - E_{X={}^3P/{}^1D}$$

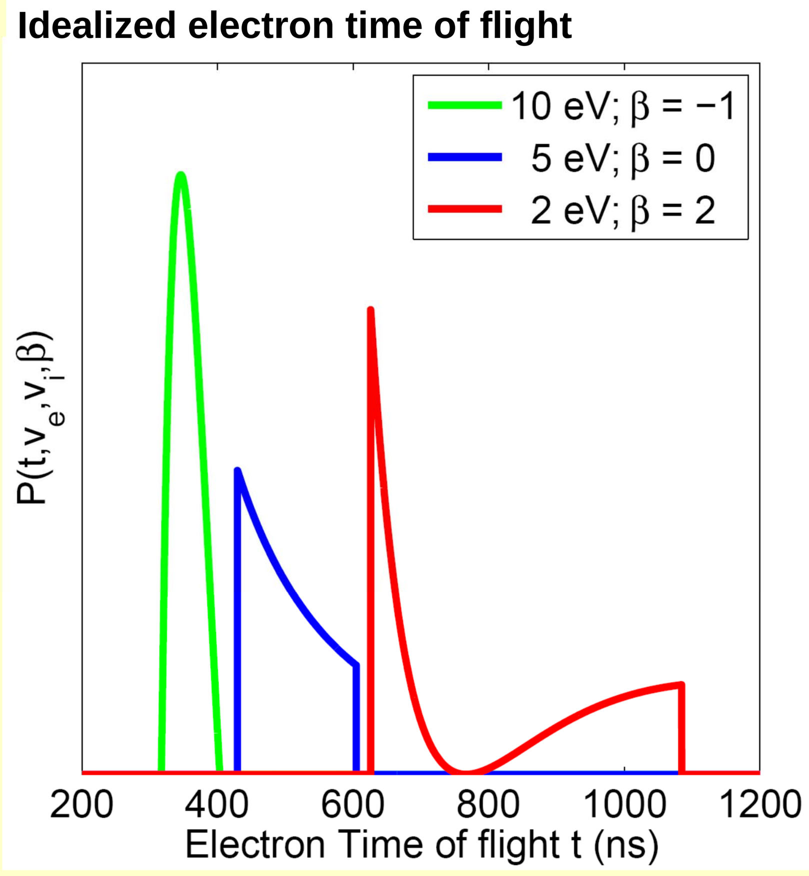
$$P(\tilde{\theta},\beta)dt = \frac{1}{2}\cdot\left[1-\frac{\beta}{2}+\frac{3\beta^2}{4}\cdot\cos^2\tilde{\theta}\right]\cdot d(\cos\tilde{\theta})$$

$$\vec{v}_e^{LAB} = v_i\cdot\vec{e}_x + v_e\cdot\hat{n}_e$$

$$v_e = \sqrt{2\varepsilon_e/m_e}$$

$$v_i = \sqrt{2E_i/m_i}$$

Idealized electron time of flight



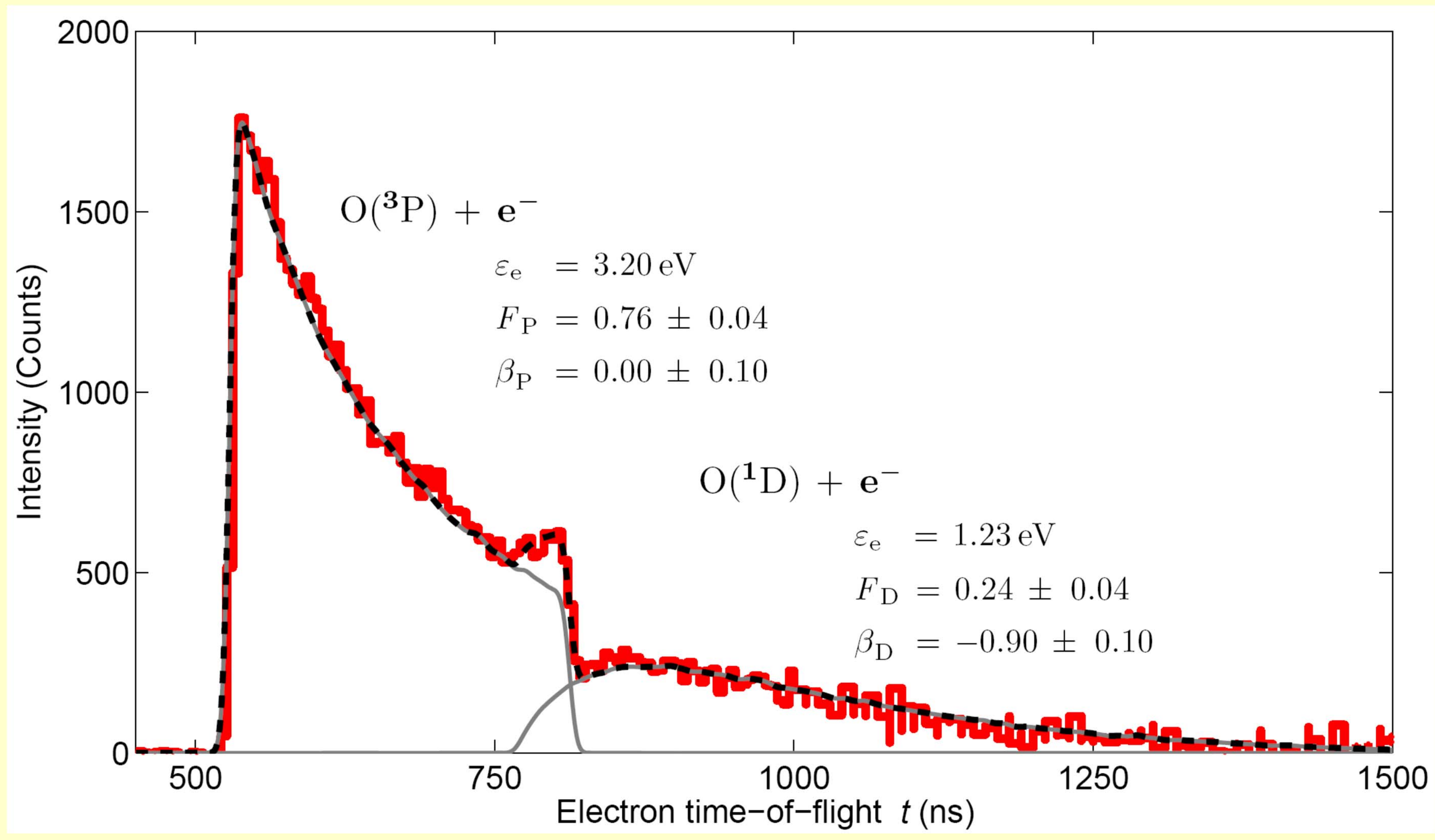
$$P(t,v_e,v_i,\beta)dt = \frac{1}{2}\left[1-\frac{\beta}{2}+\frac{3\beta}{8}\left(\frac{v_e}{v_i}\right)^2\cdot\left(1+\left(\frac{v_{ion}}{v_e}\right)^2-\left(\frac{L}{Tv_e}\right)^2\right)^2\right]\cdot\left(\frac{v_e}{v_i}\right)\cdot\left(\frac{L}{tv_e}\right)^3\cdot\frac{v_e dt}{L}$$

Effect of Doppler shift: width

$$w = \frac{2L\cdot\min(v_i,v_e)}{\left|v_e^2-v_i^2\right|}$$

Distributions for comparisons to the experiment are obtained by a Monte Carlo model

Experimental results [6]



O^- + 266 nm → (24 %) $O(^1D) + e^-$, β = -0.9

O^- + 266 nm → (76 %) $O(^3P) + e^-$, β = 0

References

[1] O. Zatsarinny and K. Bartschat, Phys. Rev. **73**, 022714 (2206)

[2] J.-H Wu *et al.*, Chin. Phys. **12**, 1390 (2003)

[3] L. M. Branscomb *et al.*, J. Chem. Phys. **43**, 2906 (1965)

[4] P. Hlavenka *et al.*, J. Chem. Phys. **130**, 061105 (2009) and its references

[5] S. J. Cavanagh *et al.*, Phys. Rev. A **76**, 052708 (2007) and its references

[6] C. Domelse *et al.*, Phys. Rev A **82**, 033402 (2010)