

Detection of quantum beats in the fast photodissociation of small molecules

Patrick O'KEEFFE

M. Meyer (LURE)

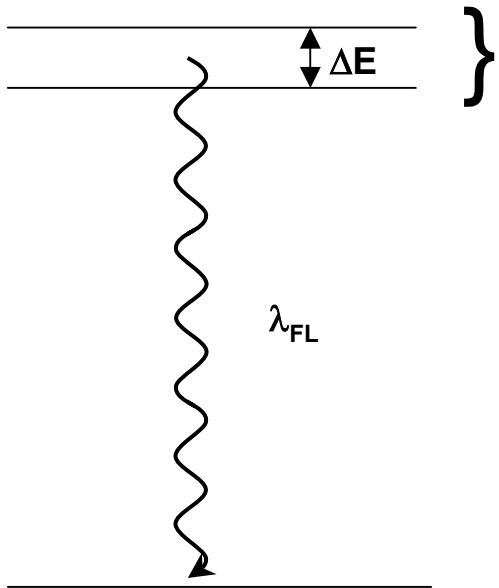
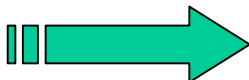
A. Grum-Grzhimailo (University of Moscow)

- I. Quantum beats
- II. Pump-probe detection of quantum beats
- III. Inner-shell excitation of HCl
- IV. Dissociative Photoionisation of H₂

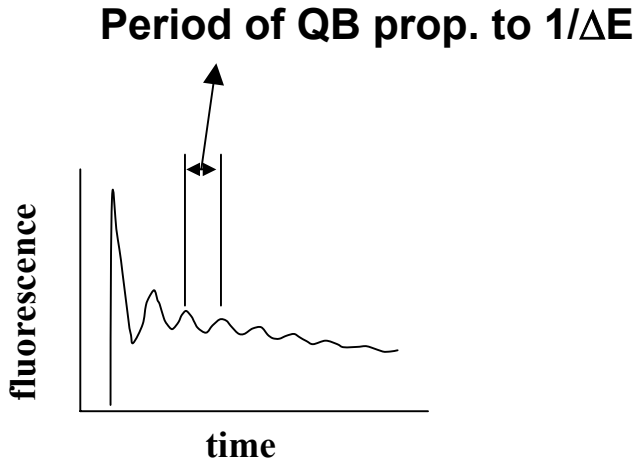
Fluorescence

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Coherent
Excitation (t=0)

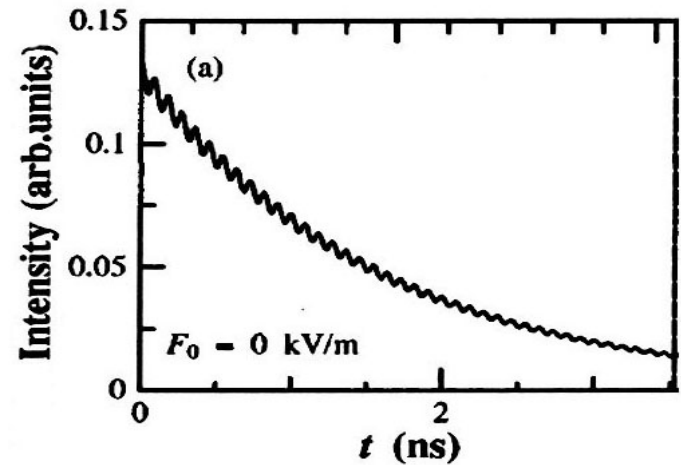
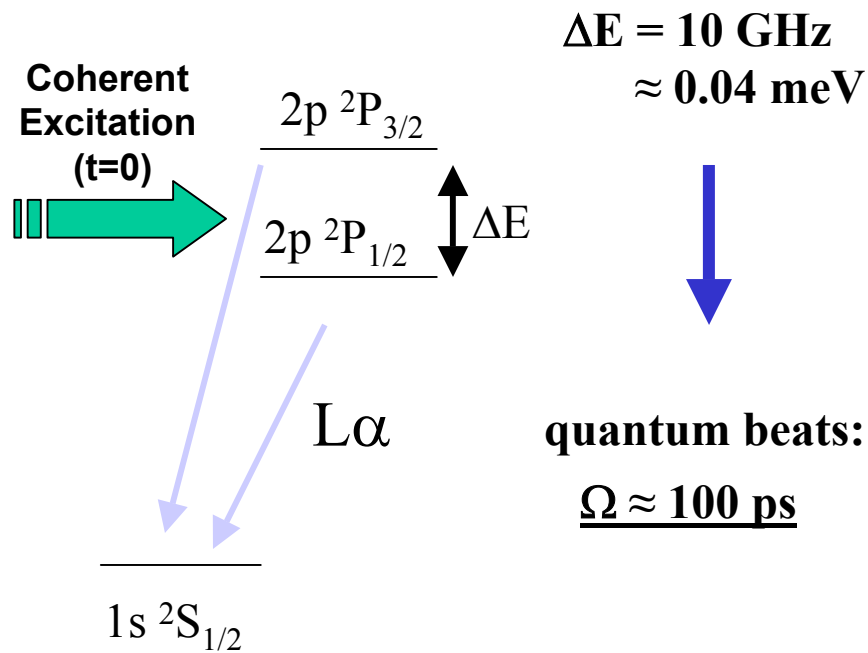


} Superposition of
excited states



Fluorescence, e.g. H^*

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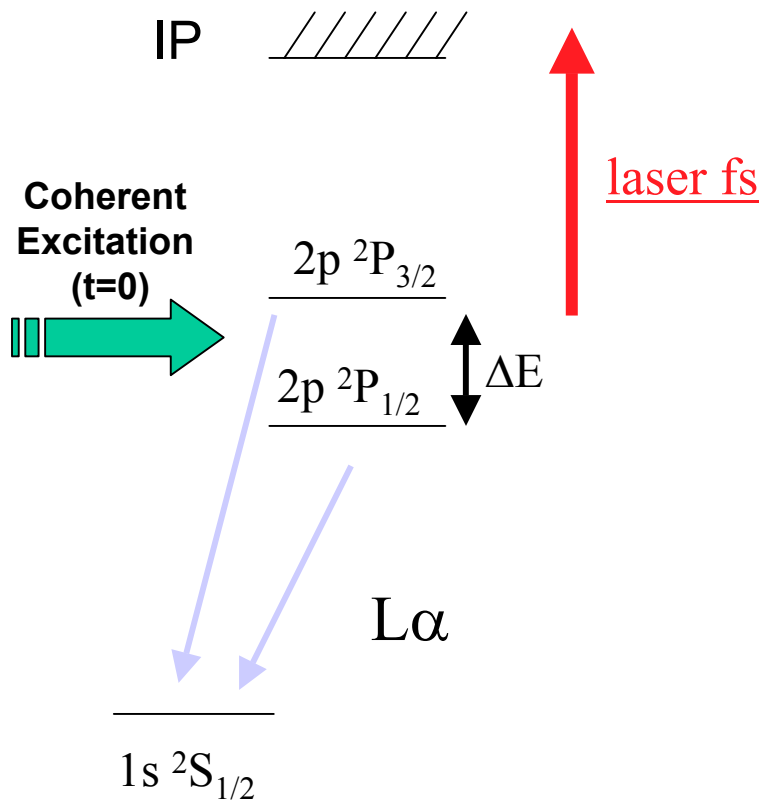


Y. Kimura et al., Phys.Rev.A56, 4612 ('97),
calculation, beamfoil-experiment

~ Limit of temporal resolution for fluorescence detection

Photoionisation, e.g. H^*

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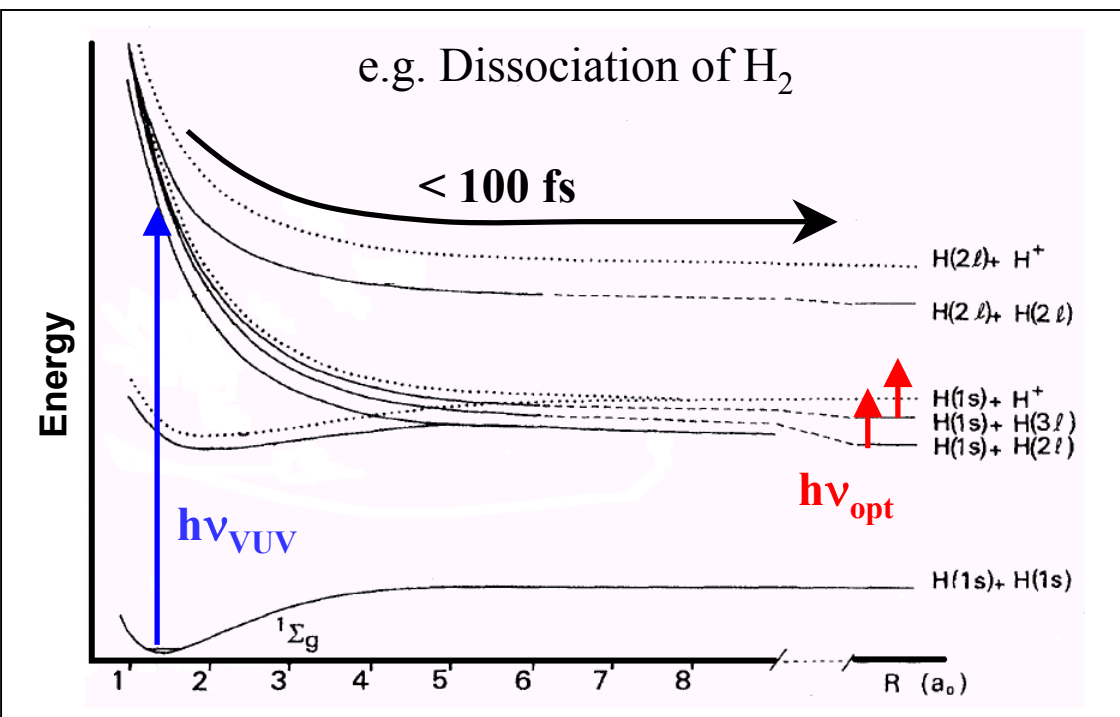
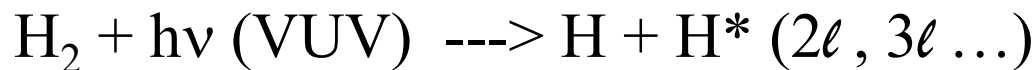


Quantum beat detected in the electron signal

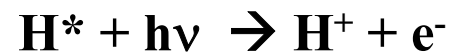
Quantum beats in photoionisation demonstrated for coherently excited states of Na:

Jong Lee *et al.*
J. Chem. Phys. **115** 739 (2001)

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Exp.:



$$\text{IP}(2p / 3p) = 3.4 / 1.5 \text{ eV}$$

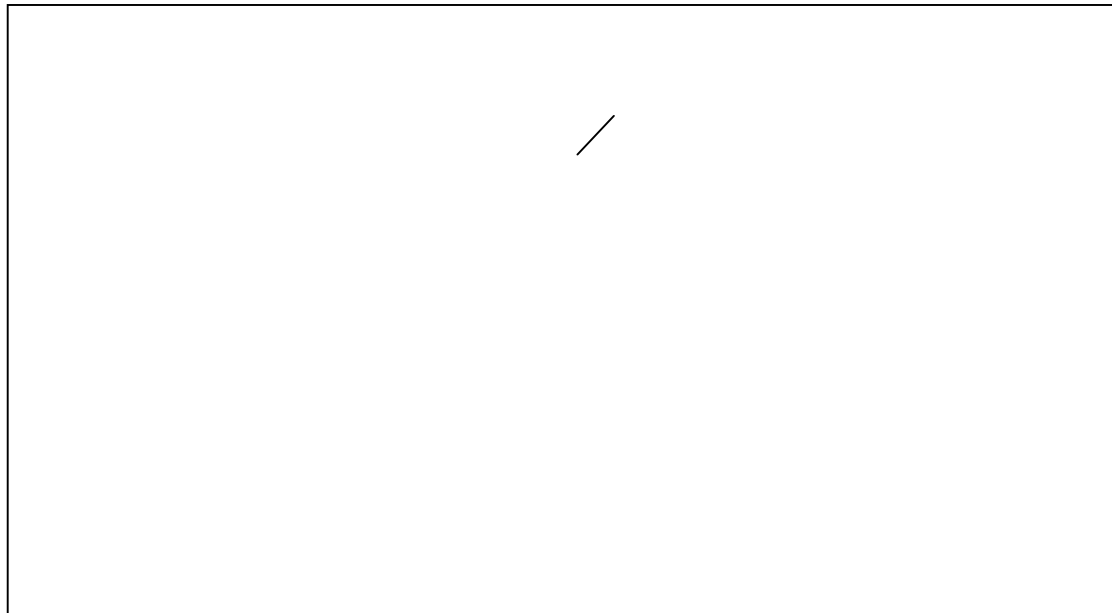
$$\lambda(\text{las}) < 365 / 825 \text{ nm}$$

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Inner shell excitation of HCl



Estimate from Super-Aco: 1 H*(n=3) produced per 5 x 10⁵ photons



M. Meyer, S. Aloïse,
A.N. Grum-Grzhimailo,
Phys. Rev. Lett.
88, 223001 (2002)

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Interference between indistinguishable dissociation pathways

VOLUME 54, NUMBER 5

PHYSICAL REVIEW LETTERS

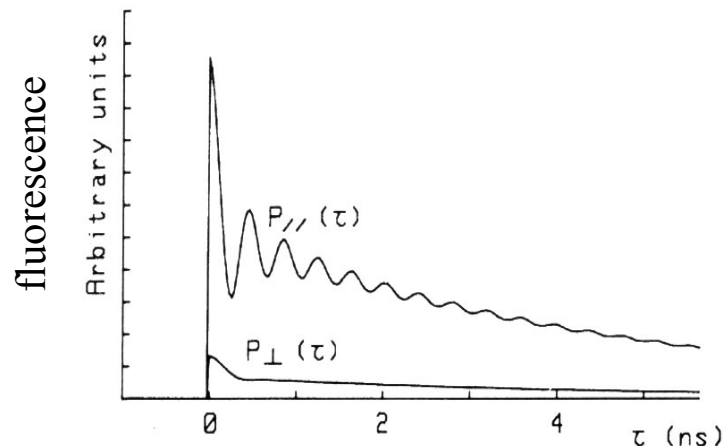
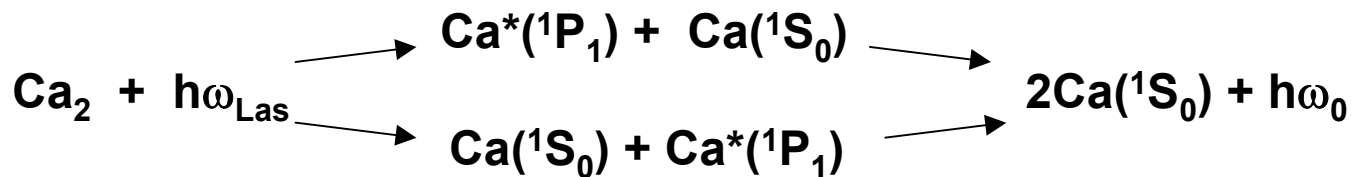
4 FEBRUARY 1985

Quantum Interference Effect for Two Atoms Radiating a Single Photon

Philippe Grangier and Alain Aspect
Institut d'Optique, Université Paris-Sud, F-91406 Orsay Cédex, France

and

Jacques Vigue
Laboratoire de Spectroscopie Hertzienne de l'Ecole Normale Supérieure, F-75231 Paris Cédex 05, France
 (Received 5 November 1984)



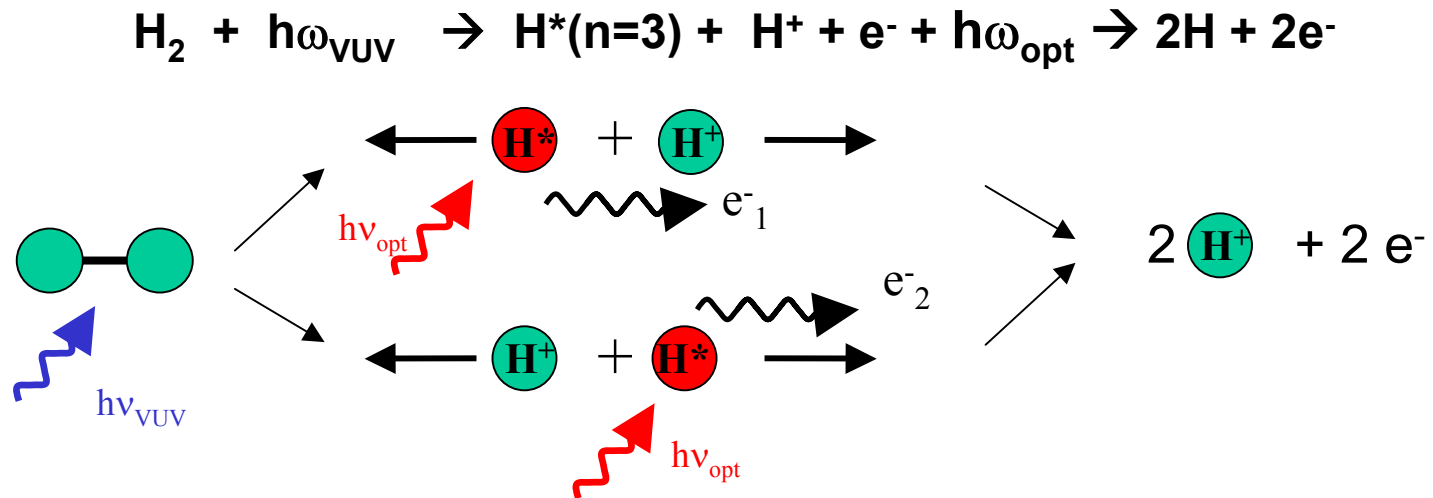
$$\underline{\Omega = 2 \omega_0 (\underline{v} / c)}$$

$$2 v = 1100 \text{ m/s}$$

$$2\pi / \Omega = 385 \text{ ps}$$

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Interference between indistinguishable dissociation pathways



Experiment: $\text{H}^*(3\ell) + h\nu (\text{laser}) \rightarrow \text{H}^+ + e^-$

$\text{IP}(3\ell) = 1.5 \text{ eV}$, $\lambda(\text{las}) \approx 800 \text{ nm} \rightarrow E_{\text{kin}}(e^-) = 0.1 \text{ eV}$

$E_{\text{kin}}(\text{H}^*) = 0.3 \text{ eV}$

$2\pi / \Omega = 2 \text{ ps}$