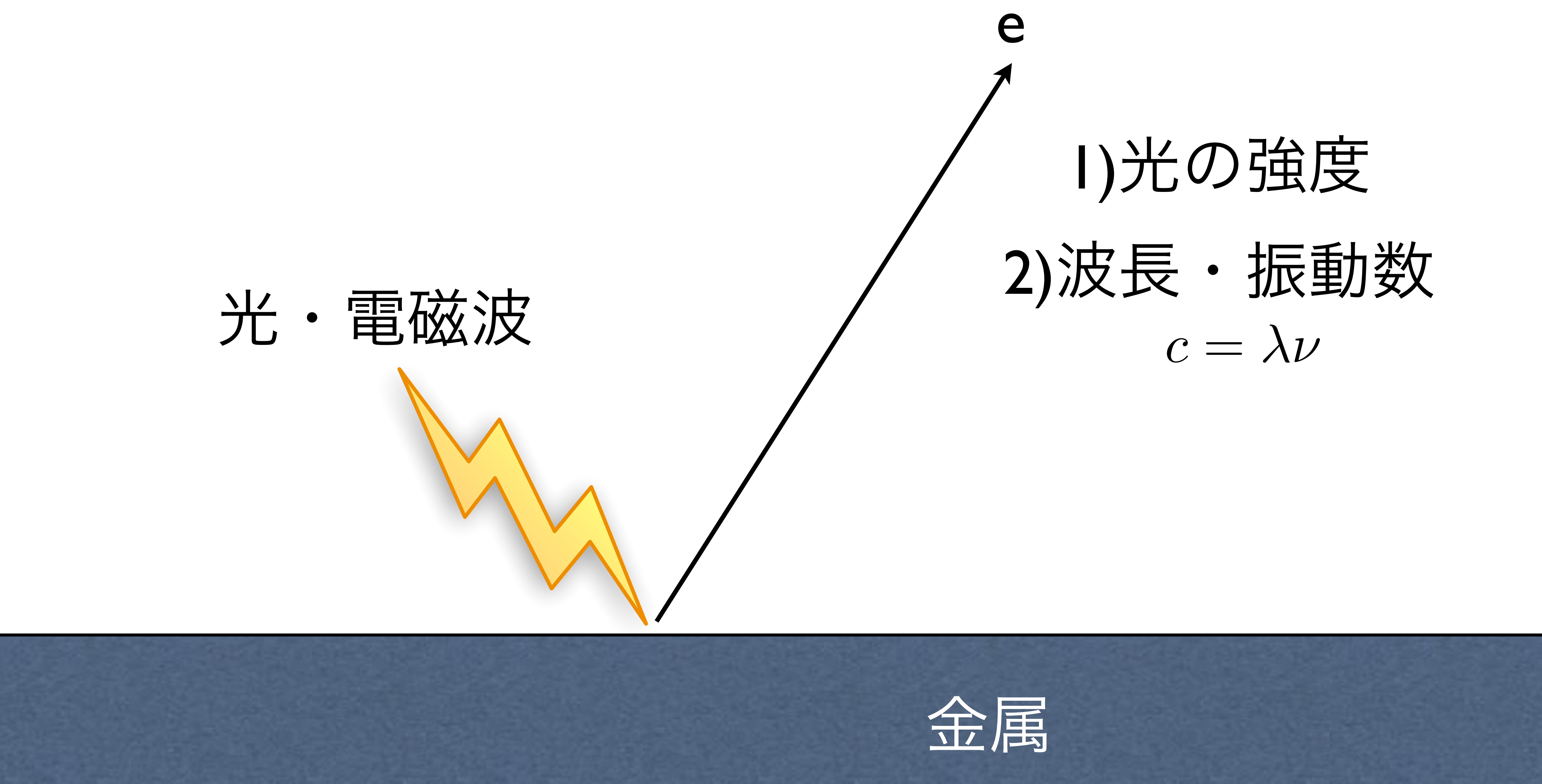
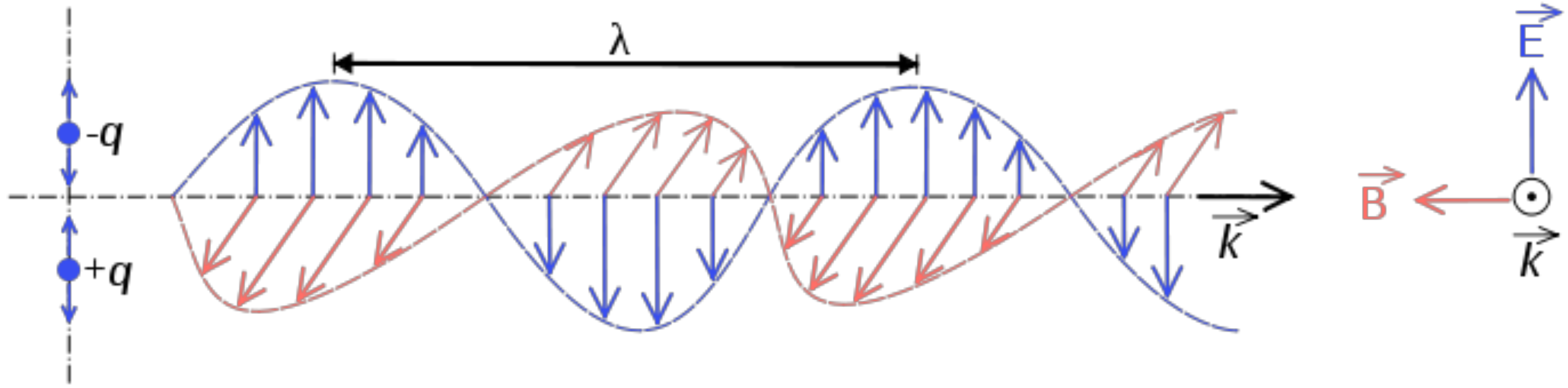
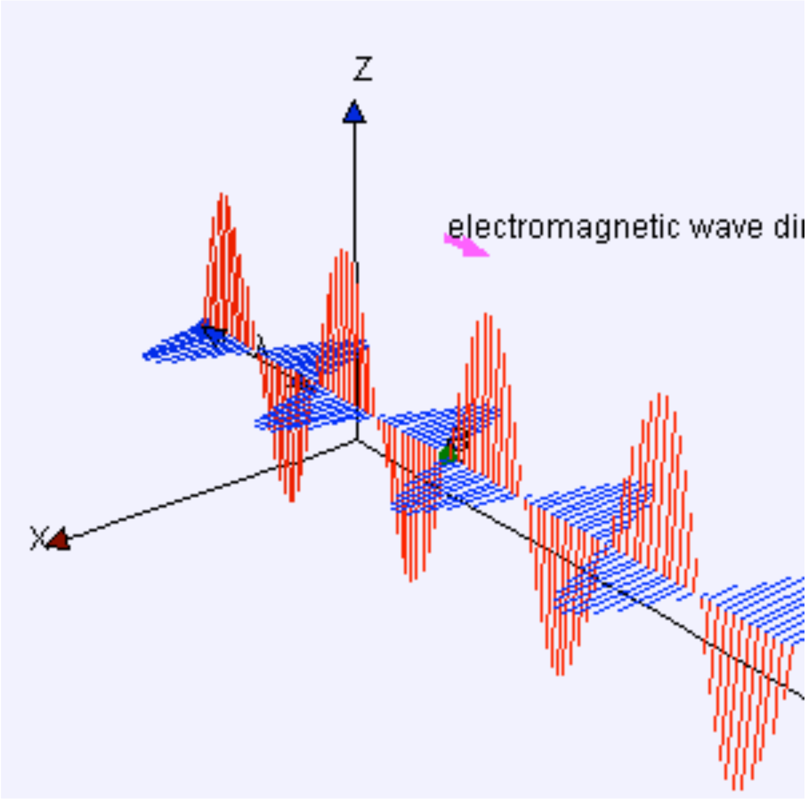
光電効果





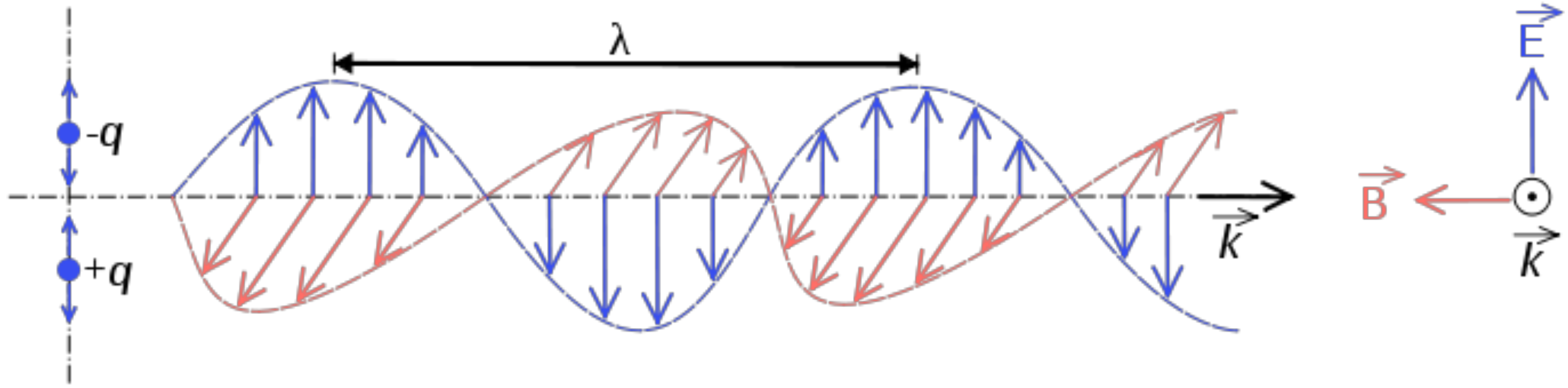
電磁波のエネルギー（古典）



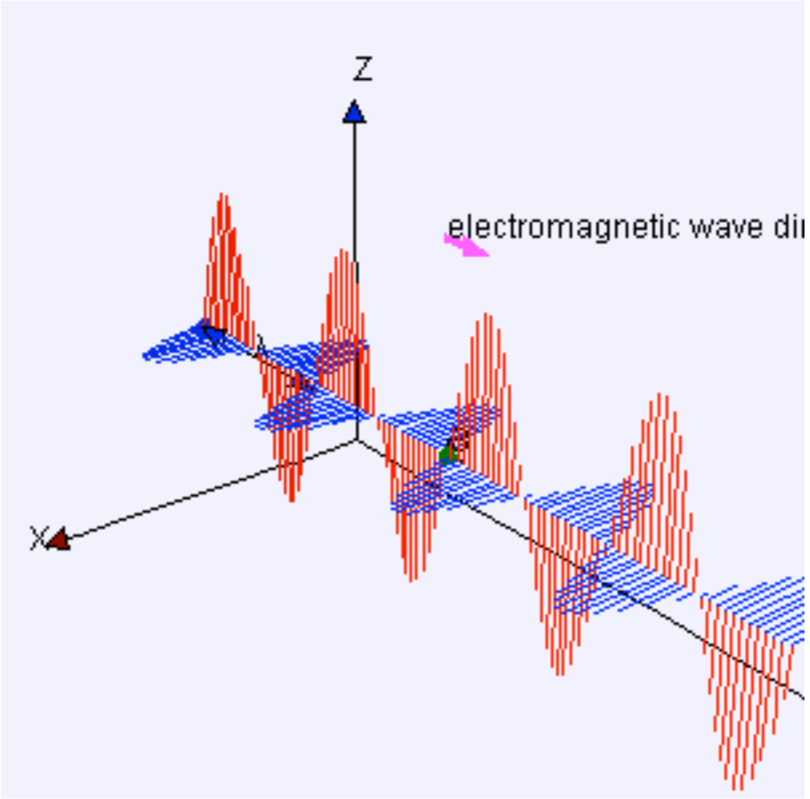
$$\epsilon_0 \mathbf{E}^2 = \epsilon_0 E_0^2 \cos^2(kx - \omega t)$$
$$= \epsilon_0 E_0^2 \cos^2[2\pi(\frac{x}{\lambda} - \nu t)]$$

$$c = \lambda \nu$$

光の振幅（明るさ）を増していけばエネルギーは増加



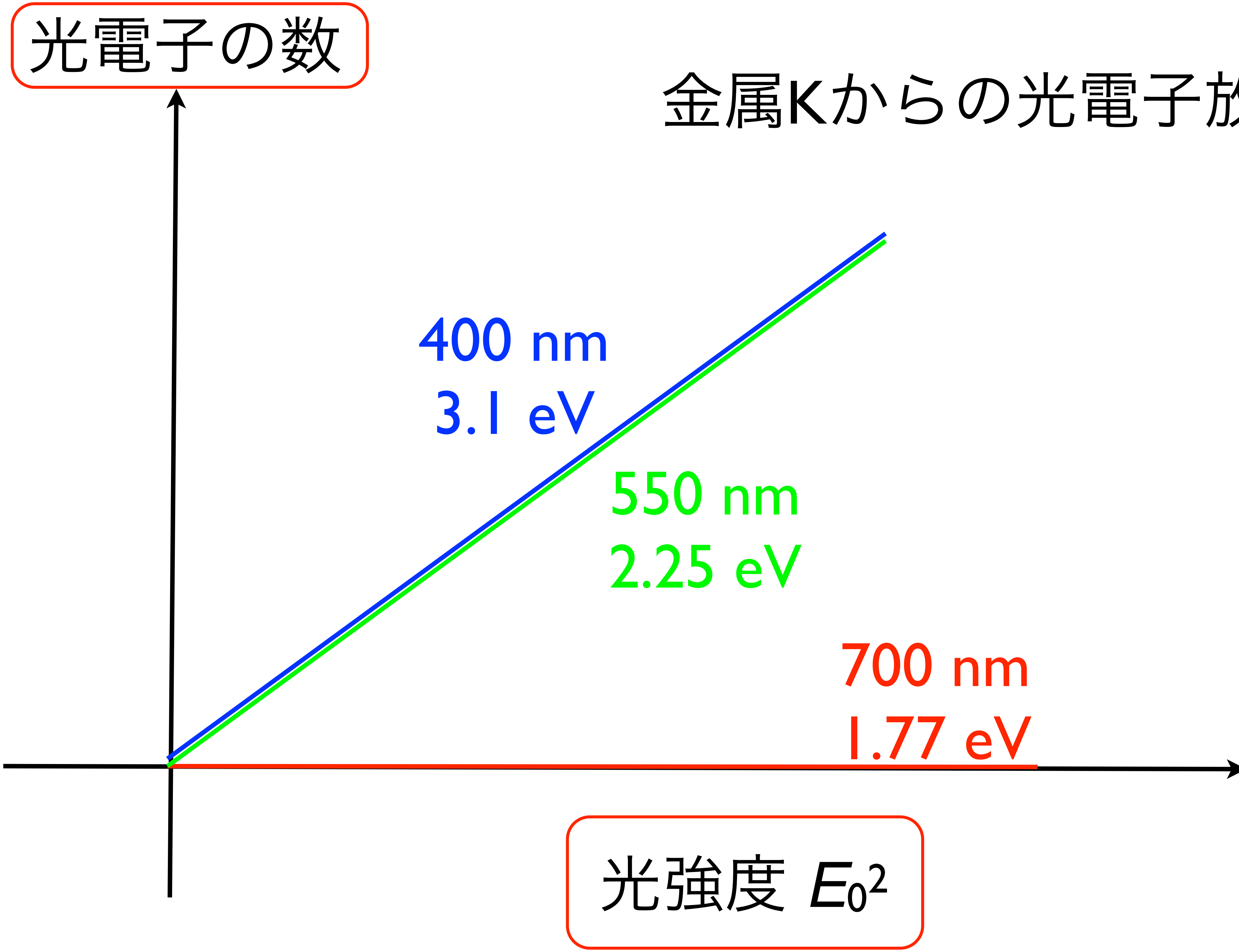
電磁波のエネルギー
(古典)

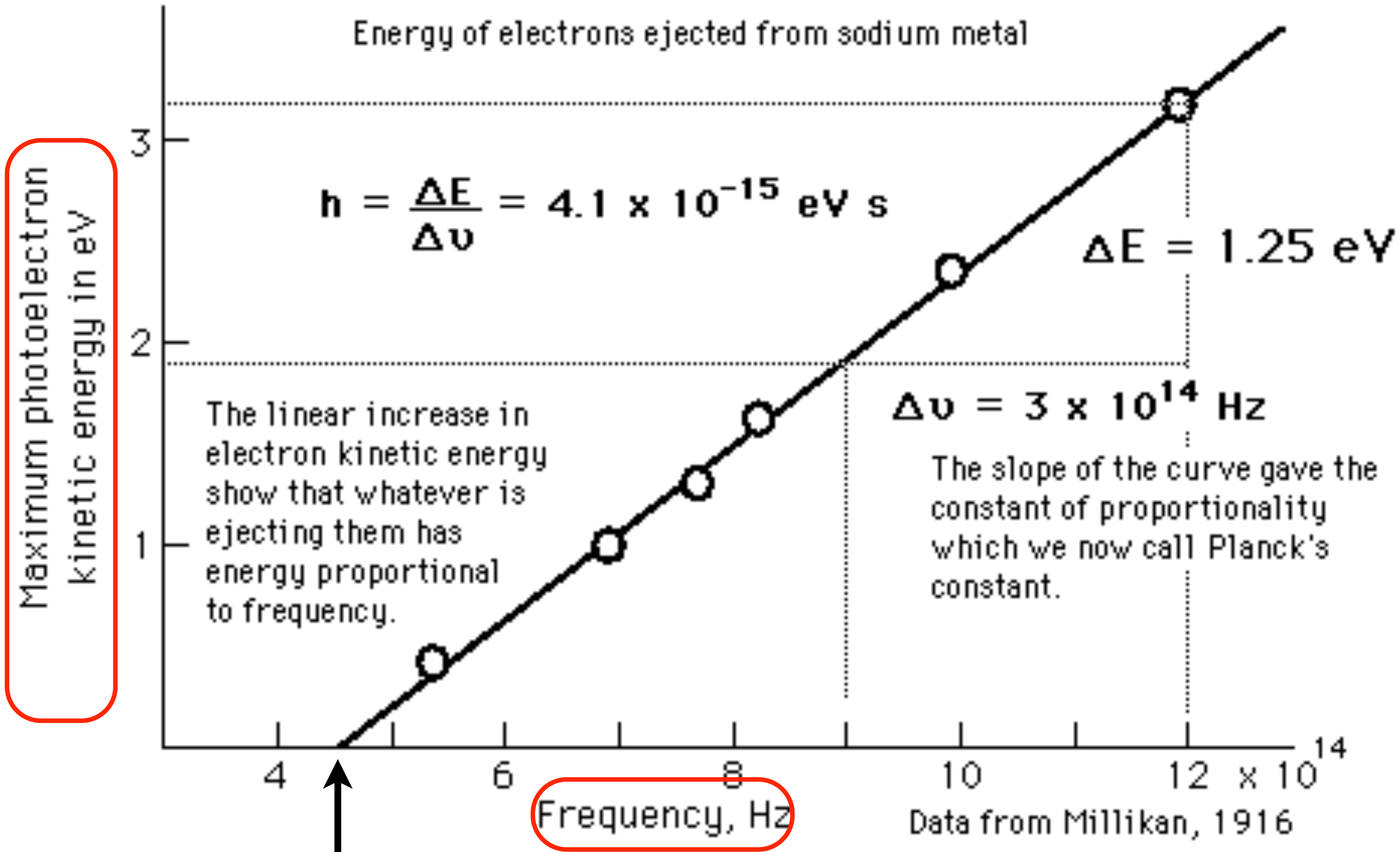


$$\epsilon_0 \mathbf{E}^2 = \epsilon_0 E_0^2 \cos^2(kx - \omega t)$$
$$= \epsilon_0 E_0^2 \cos^2[2\pi(\frac{x}{\lambda} - \nu t)]$$
$$c = \lambda\nu$$

光の振幅（明るさ）を増していけばエネルギーは増加

金属Kからの光電子放出



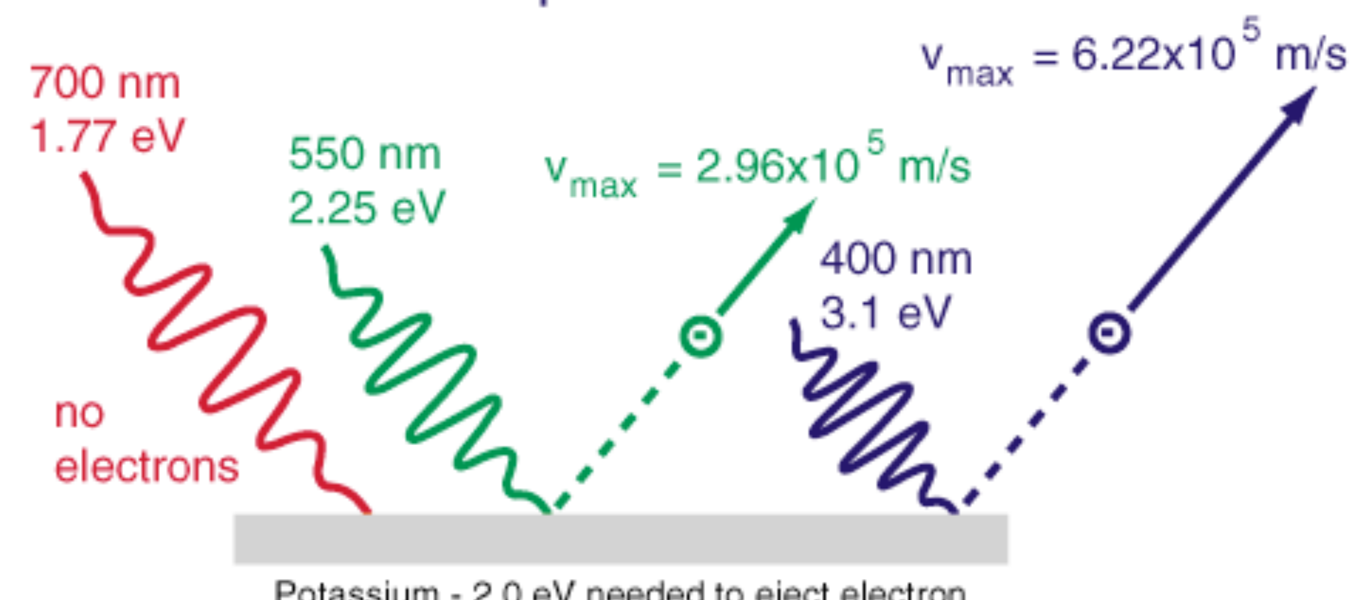


1.9 eV

$$\mathrm{KE} = \frac{1}{2}mv^2 = h\nu - \phi$$

$$h\nu_0 = \phi$$

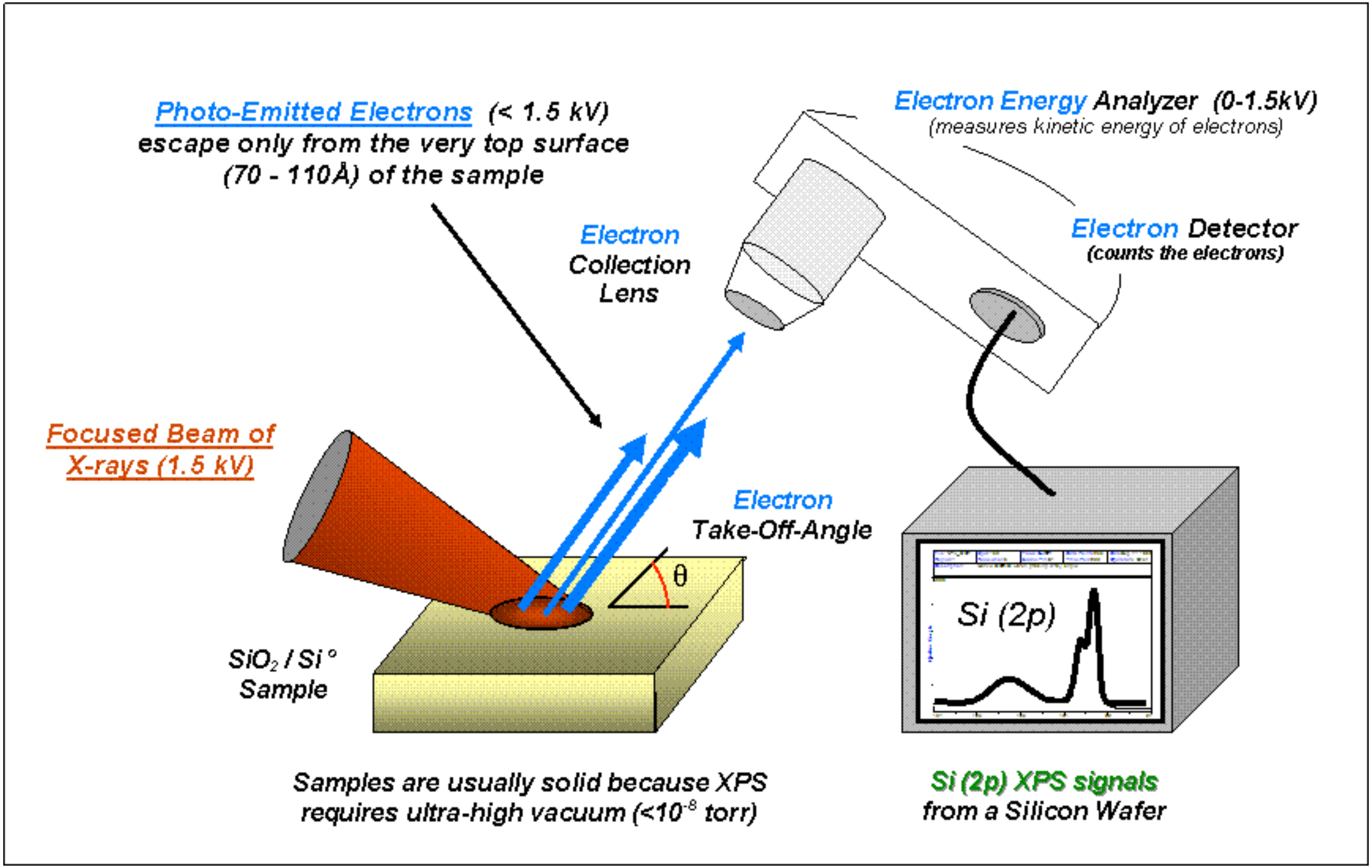
$$E_{photon} = h\nu$$

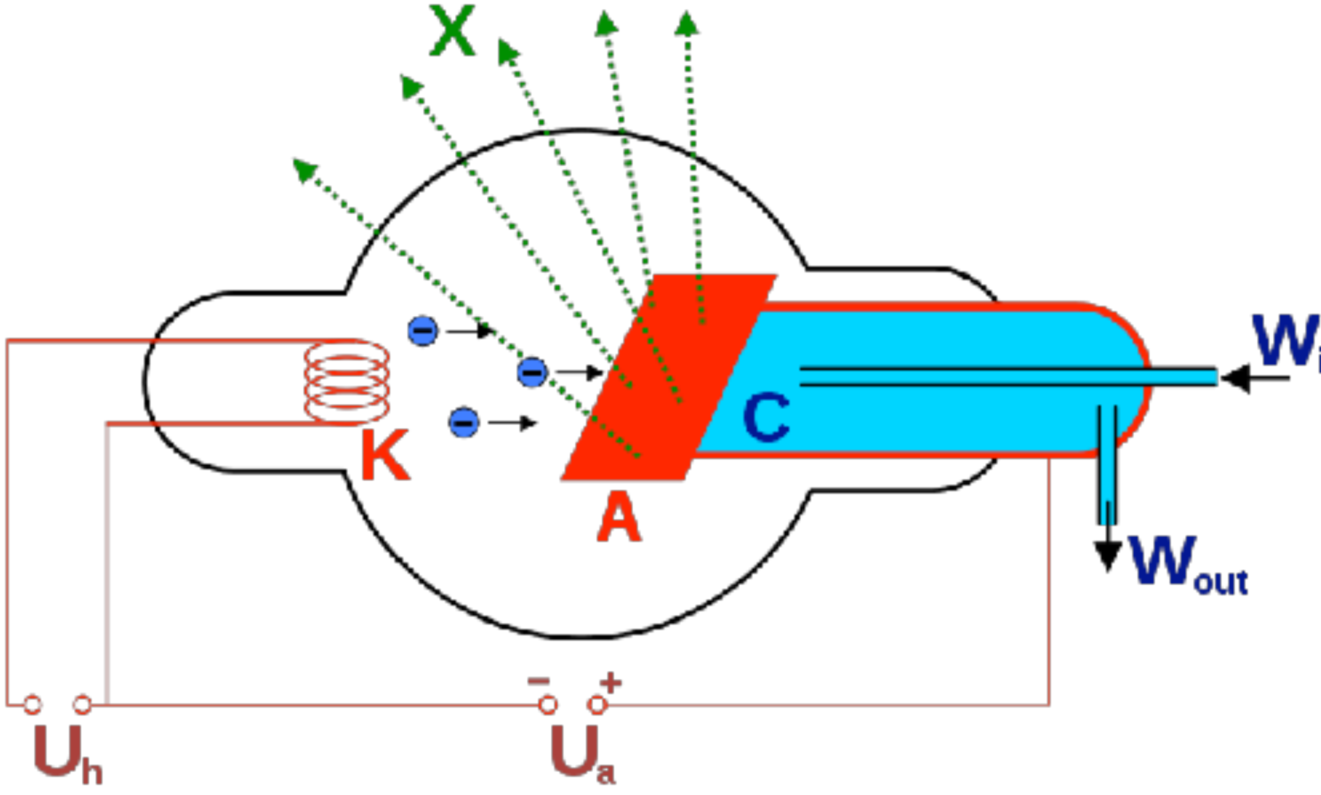


Photoelectric effect

$$h = 4.135667513 \times 10^{-15}\,\mathrm{eV\ s}$$

X線光電子分光 (X-ray photoelectron spectroscopy)




X
K
A
C
W
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Ua
−
+

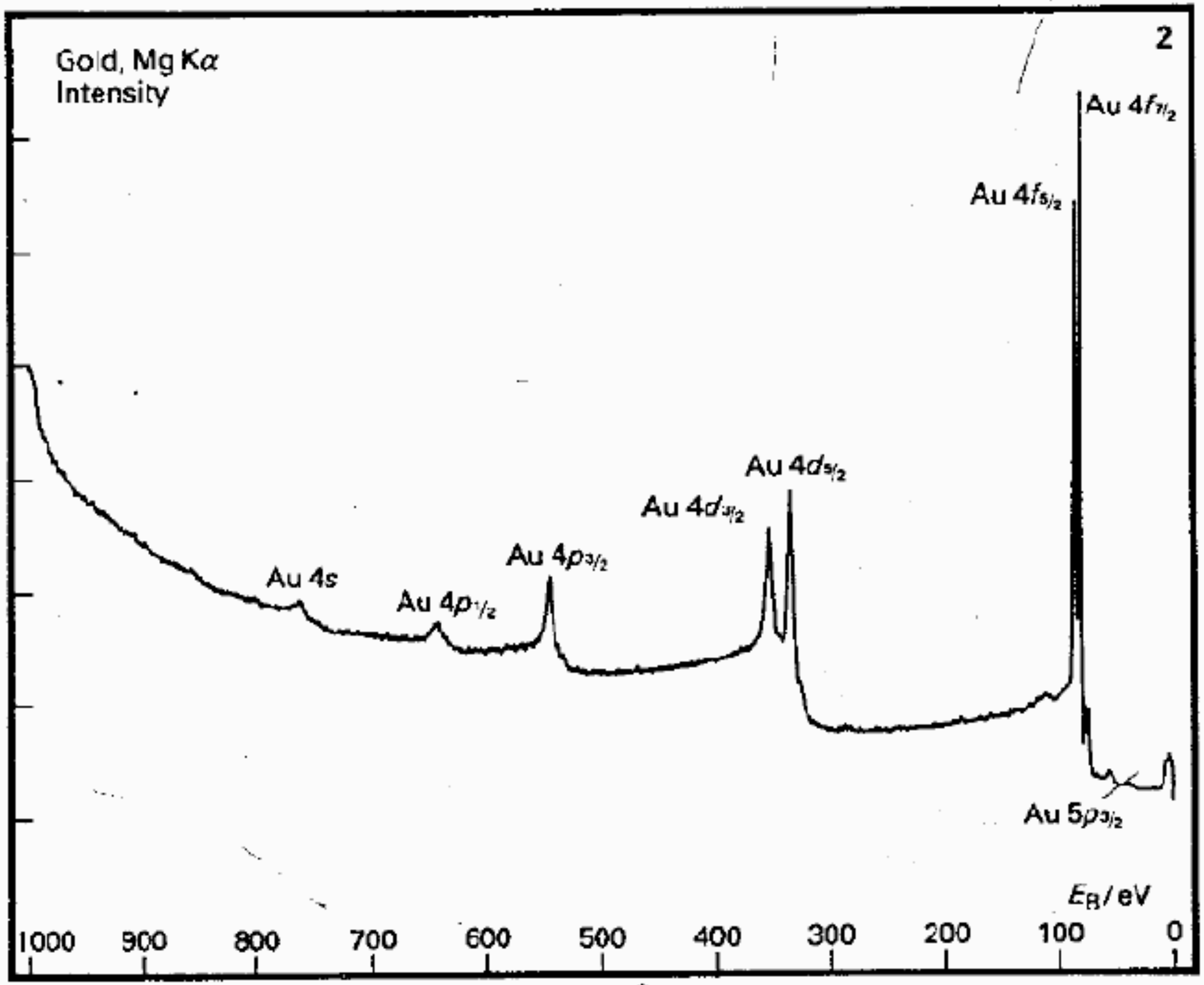
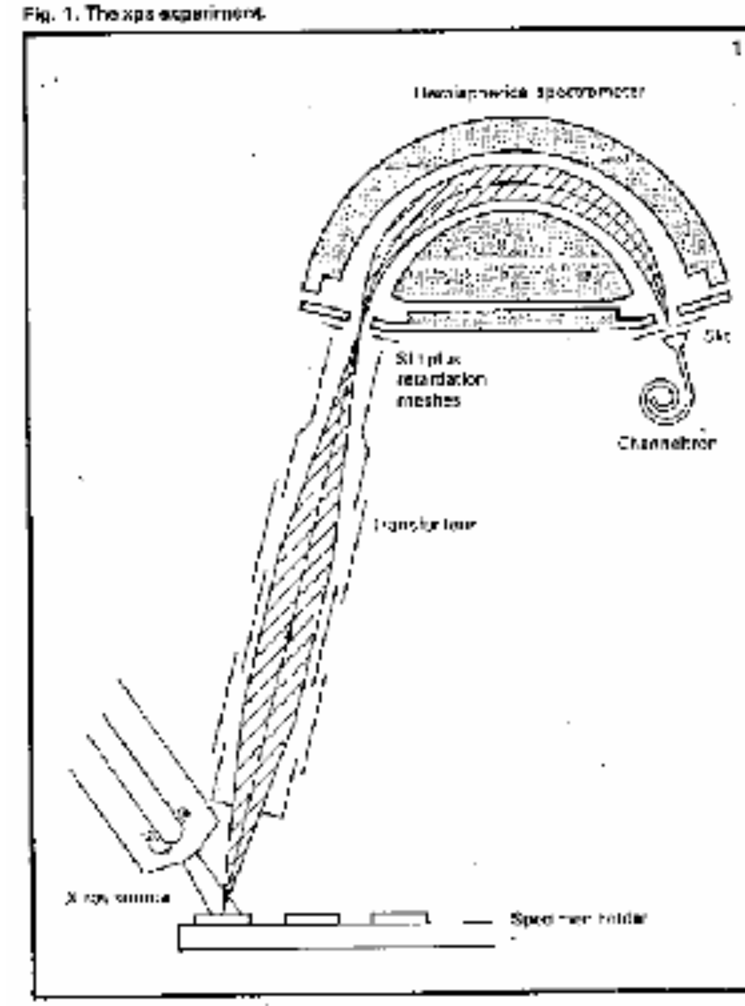


Fig. 2. The gold xps spectrum using Mg*K*α radiation.[3]

Fig. 1. The xps experiment.



Au

4p splitting 96.40 eV

4d splitting 18.10 eV

4f splitting 3.67 eV

XPS

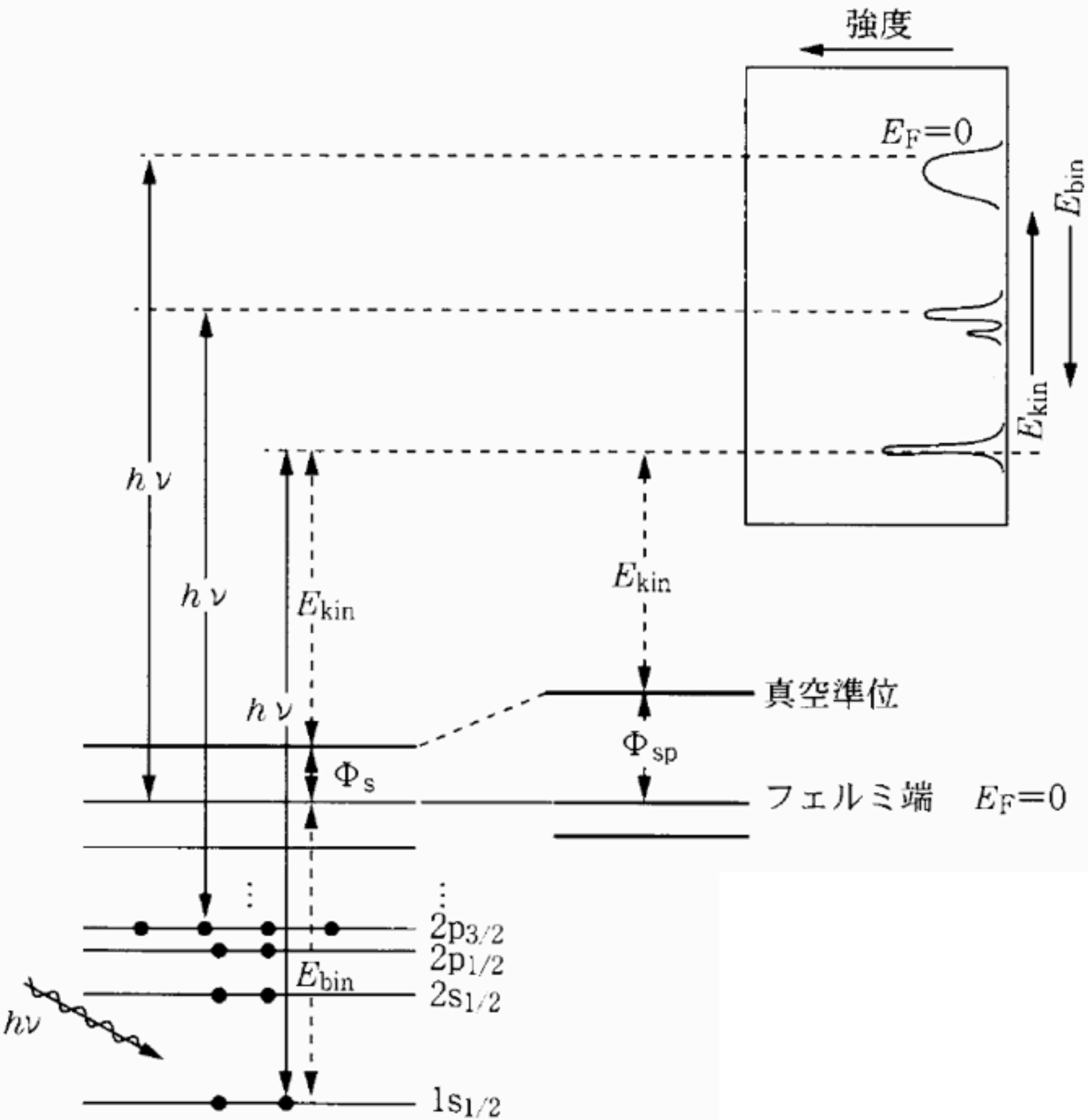


図 2-15　XPS の原理

XPS

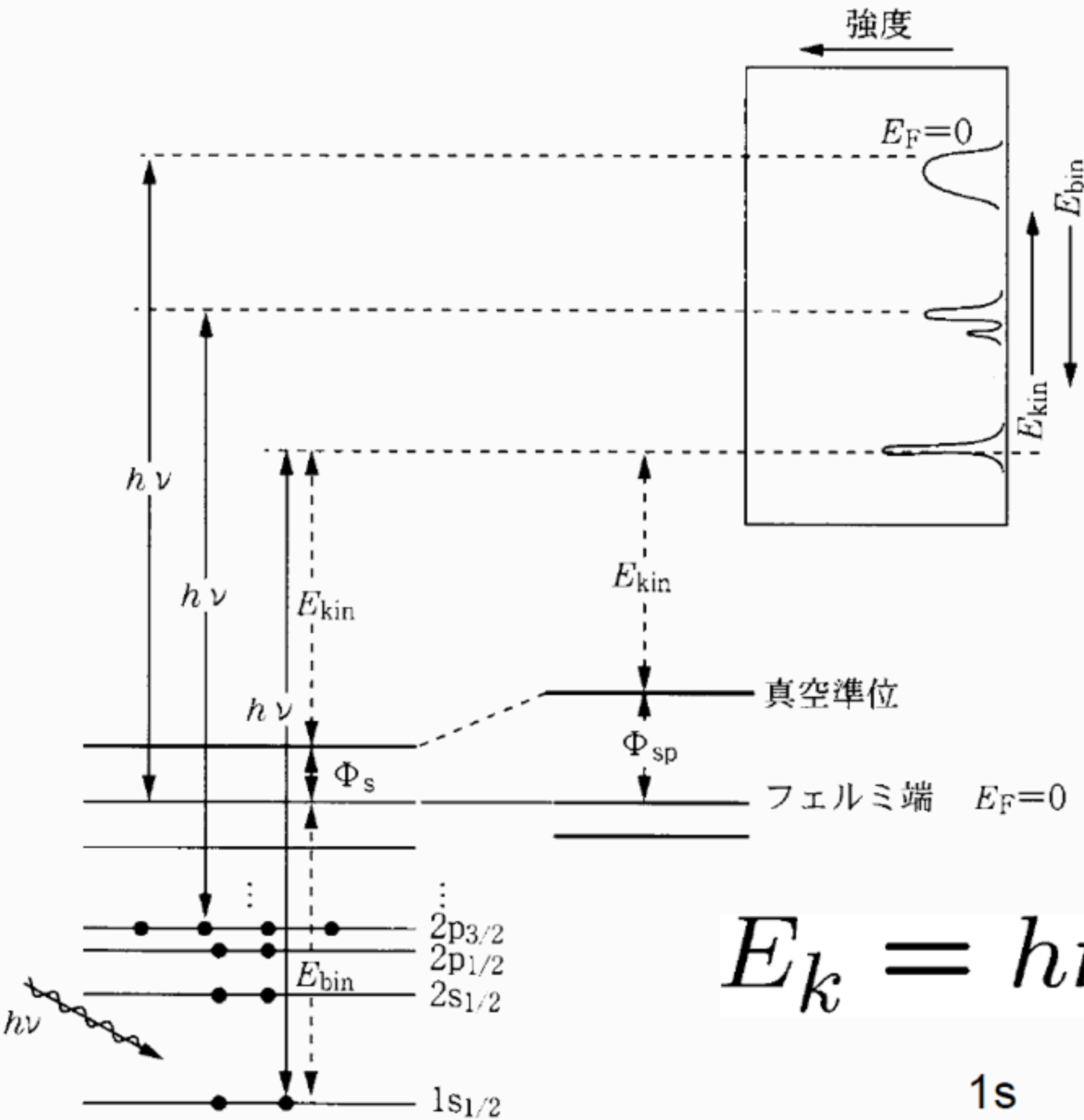


図 2-15 XPS の原理

$$E_k = h\nu - E_b - \Phi$$

	1s	2s	2p1/2	2p3/2
12 Mg	1303.0+			
16 S	2472	230.9	163.6*	162.5*

n,l,m: 1s, (2s, 2p), (3s,3p,3d), (4s, 4p, 4d, 4f),...

縮退　2　2　6　　2　6　10　　2　6　10 14

2(2*l*+1)

スピン軌道相互作用による微細構造

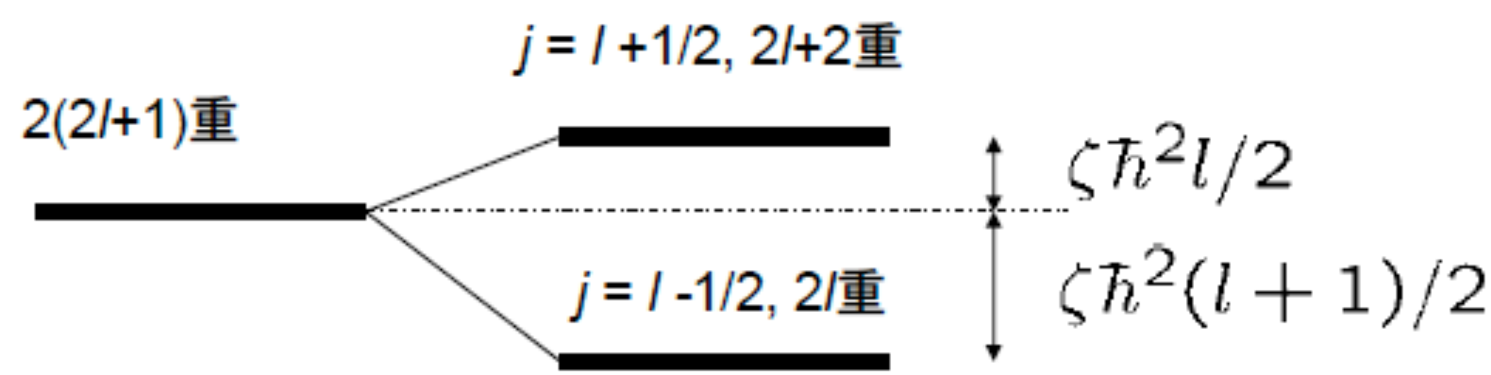
$$H' = \zeta \mathbf{l} \cdot \mathbf{s}$$

主量子数*n*, 方位量子数*l*, 内量子数*j*

nl_j

$1s_{1/2}$ $2s_{1/2}$ $2p_{1/2}(2)$ $2p_{3/2}(4)$

$3s_{1/2}$ $3p_{1/2}$ $3p_{3/2}$ $3d_{3/2}(4)$ $3d_{5/2}(6)$



l=0, j=1/2　　*l=1, j=1/2,3/2*　　*l=2, j=3/2, 5/2*

s: $j = s_{1/2}$　　*p* : $j=p_{1/2}$, $j=p_{3/2}$　　*d*: $d_{3/2}$, $d_{5/2}$

縮退　2　　2　4　　4　6

	$l=0,\ j=1/2$	$l=1,\ j=1/2, 3/2$	$l=2,\ j=3/2,\ 5/2$
	s: $j = s_{1/2}$	p : $j=p_{1/2}$, $j=p_{3/2}$	d: $d_{3/2}$, $d_{5/2}$
縮退	2	2　　4	4　　6

Au

4p splitting 96.40 eV

4d splitting 18.10 eV

4f splitting 3.67 eV