Physics 215: Introduction to quantum physics
Section A01, Spring 2010

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Website for lecture notes and assignments: http://www.astro.uvic.ca/~jwillis/teaching/teaching.html

Lectures: Elliot 062, Monday and Thursday 8.30-10.00am.

Office hours: Monday 2.00pm – 4.00pm.

Course text: *Modern physics for scientists and engineers* (3rd Edition) by Thornton and Rex. Note that the 2nd Edition of this text would be an acceptable alternative.

Course outline:

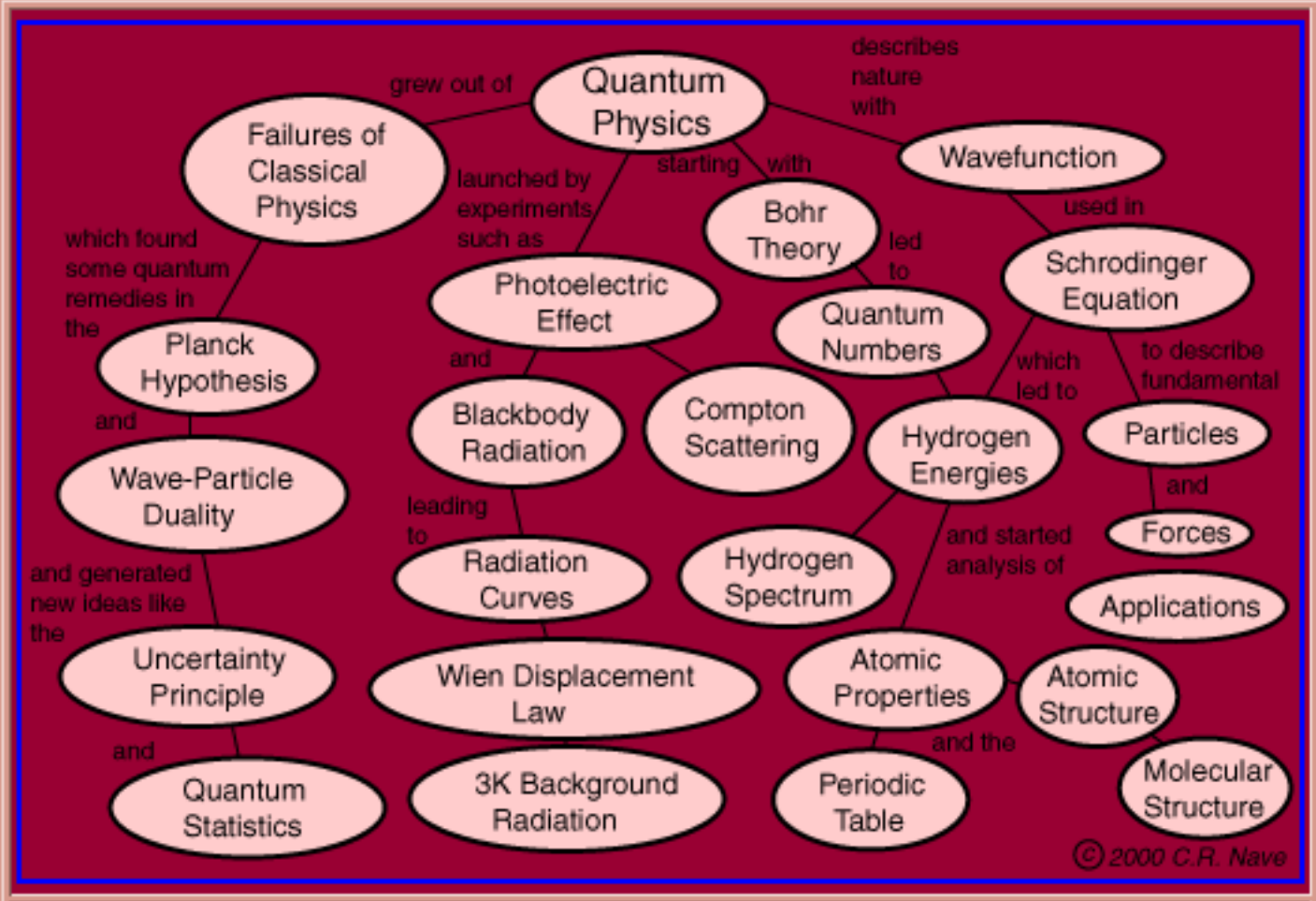
Topic	Description	Thornton & Rex
1	The experimental basis of quantum theory	Chapter 3
2	The structure of the atom	Chapter 4
3	Wave and particle properties of matter and radiation	Chapter 5
4	The Schroedinger wave equation	Chapter 6
5	Quantum tunneling and Simple Harmonic Motion	Chapter 6
6	The Hydrogen atom	Chapter 7

Course assessment:
Assignments: 10%
Laboratory: 20%
Mid-term exam: 25%
Final exam: 45%

A minimum grade of 50% in the laboratory component is required to pass the course.
Approximately ten assignments will be issued through the semester. Assignments will typically be due one week after the issue date. Late assignments will be accepted up to 24 hours after the due date (with a 25% grade penalty) at which point solutions will be posted on the web and no more assignments will be accepted. The mid-term exam will take place at 8.30am in room E062 on Thursday 11th February.

Standard Uvic/Physics department grading conversion of numerical scores to letter grades will be followed.

Use of calculator:
On all examinations the only acceptable calculator is the Sharp EL-510R.
This calculator can be bought in the Bookstore for about $10.
DO NOT bring any other calculator to examinations.



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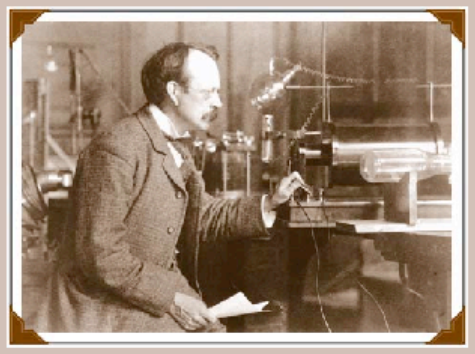
Atomic Structure Timeline



Welcome to the **atomic** structure **timeline** . This site explores discoveries related to **atomic** structure including the electron, proton and neutron. The dates used for events are open to debate since many scientist's spent decades studying a topic. Check the links for more in depth material. **Most of all enjoy** .

Created by Lee Buescher, ScienceDept, Watertown High School Watertown, Wisconsin 53098 USA

Visit these sites for original papers in chemistry.
1. Selected Classic Papers from the History of Chemistry by Carmen Giunta at Le Moyne College.
2. John Parks Chem Team site on Classic Papers from the History of Chemistry

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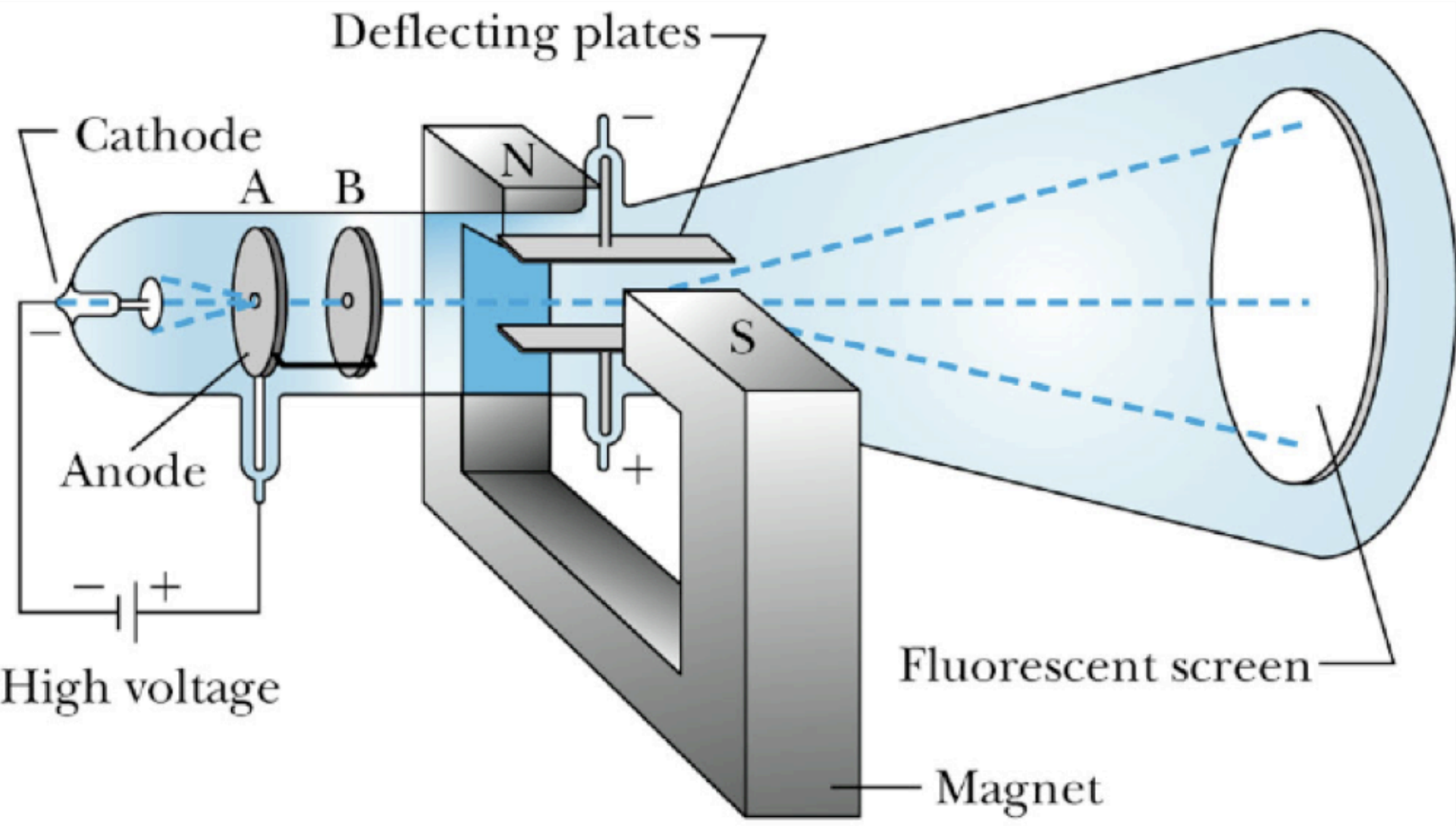
Early theories of the structure of matter were not based upon experiments. As scientists began to study the relationship between several physical phenomenon such as electricity, and magnetism they began to develop different models about atomic structure.

Year	Scientist(s)	Discovery
Greek era	Democritus	"by convention bitter, by convention sweet, but in reality atoms and void"
1704	Isaac Newton	Proposed a mechanical universe with small solid masses in motion.
1803	John Dalton	Proposed an " **atomic** theory" with spherical solid atoms based upon measurable properties of mass.
1832	Michael Faraday	Studied the effect of electricity on solutions, coined term "electrolysis" as a splitting of molecules with electricity, developed laws of electrolysis. Faraday

Done



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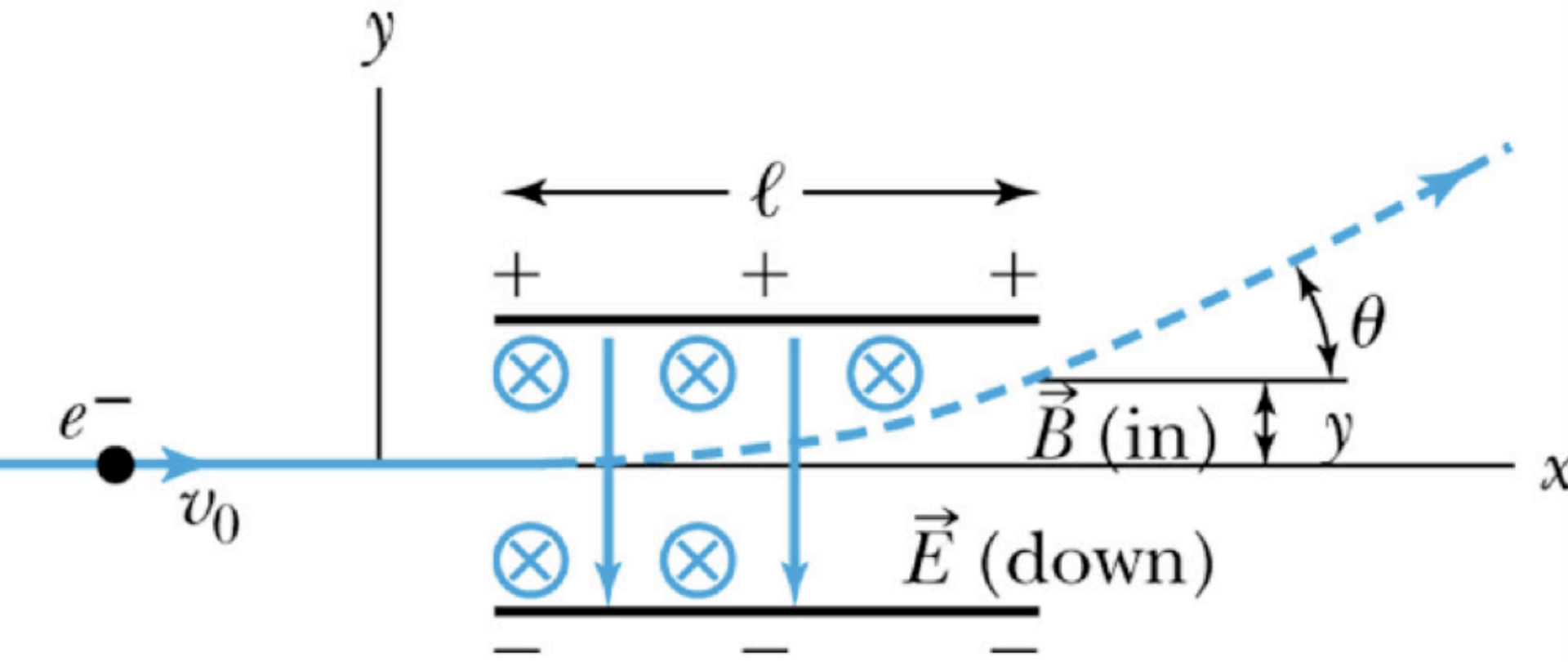

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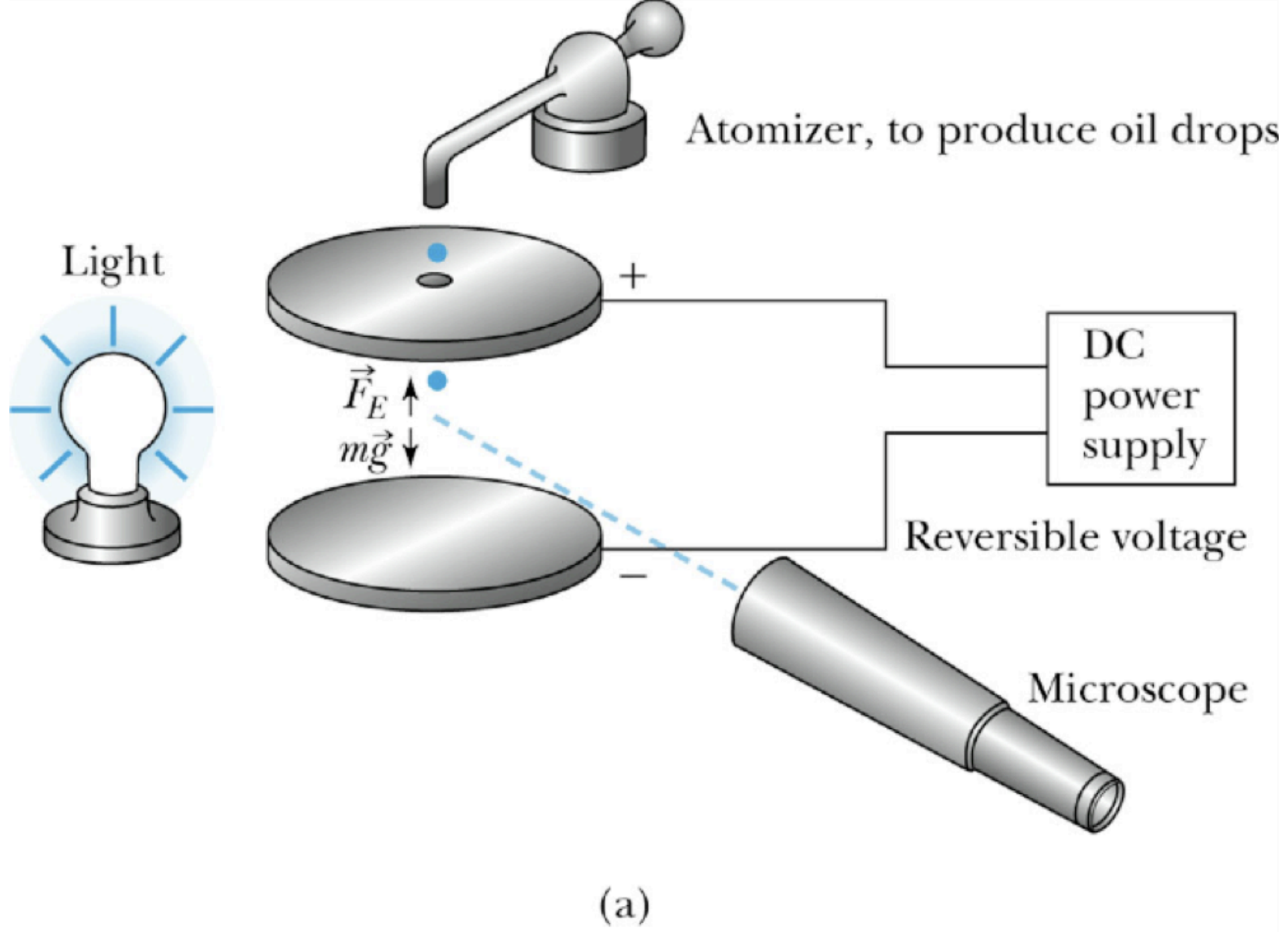

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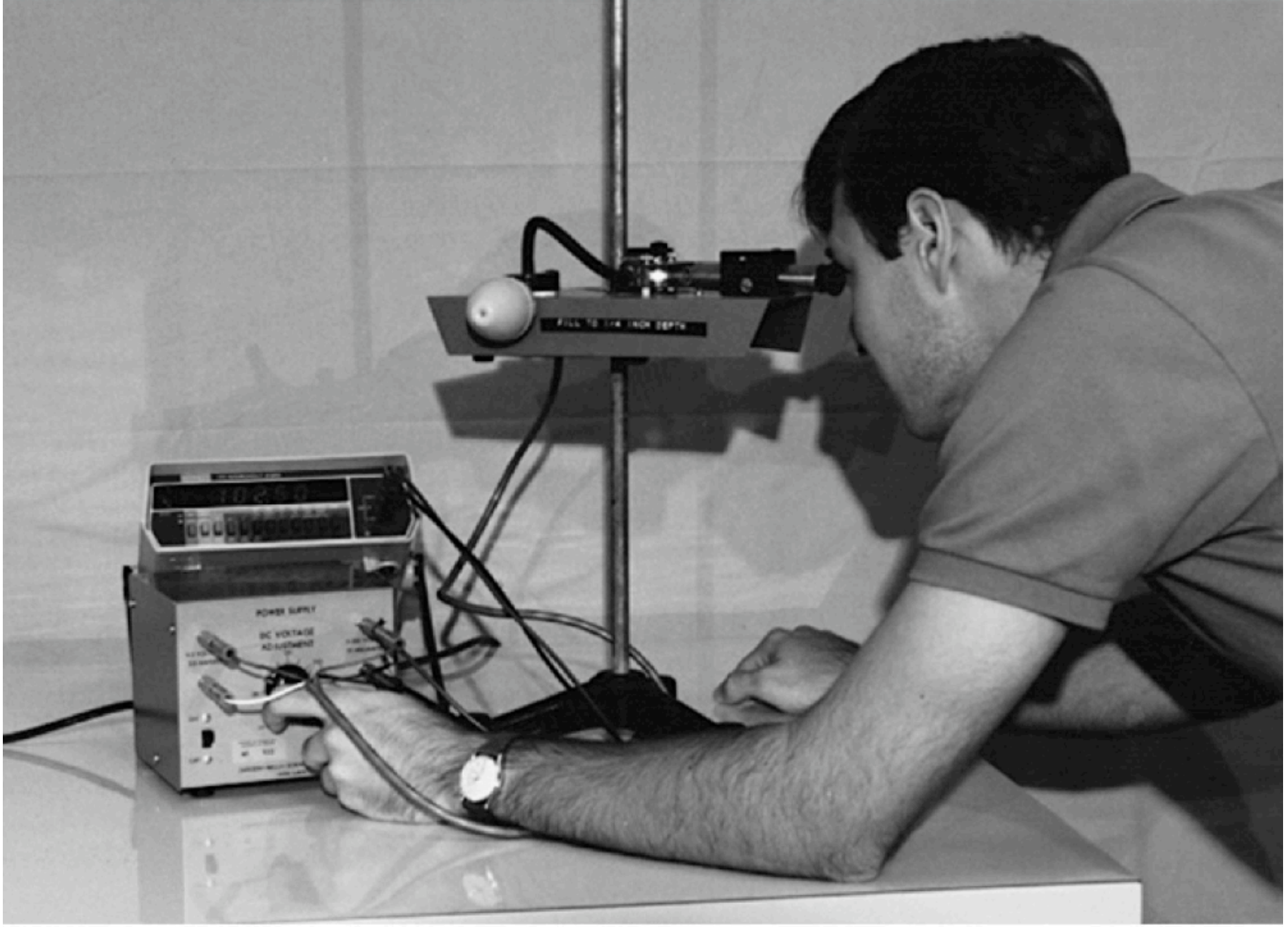

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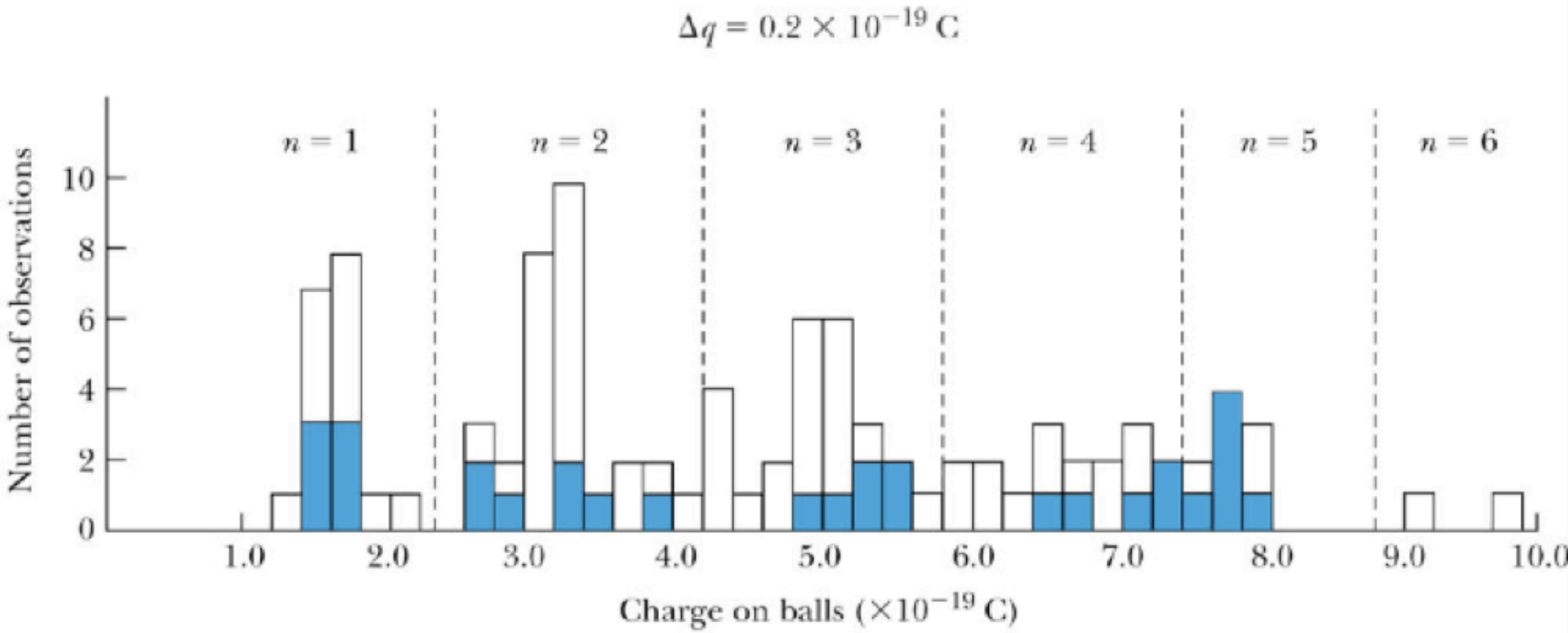

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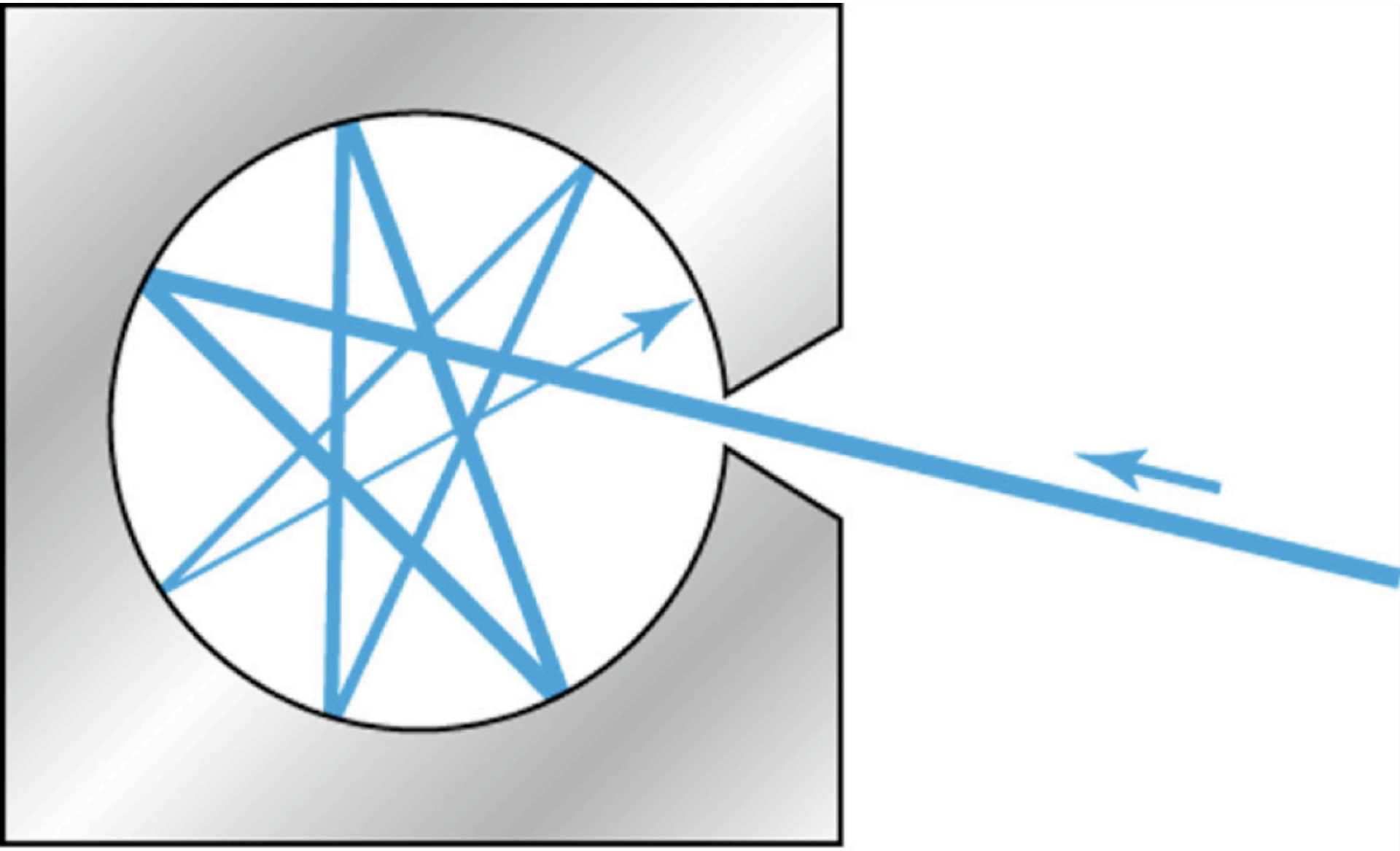

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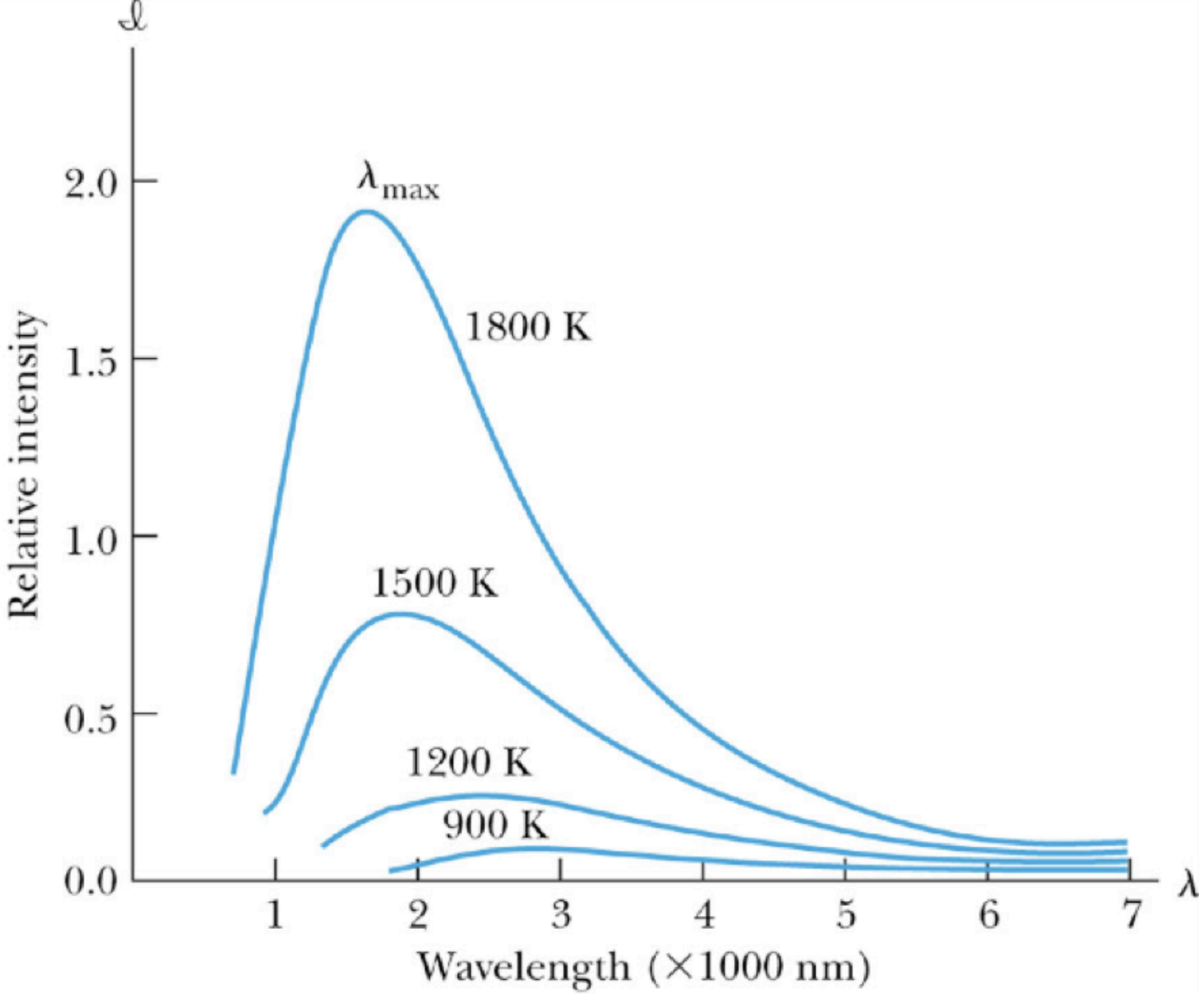

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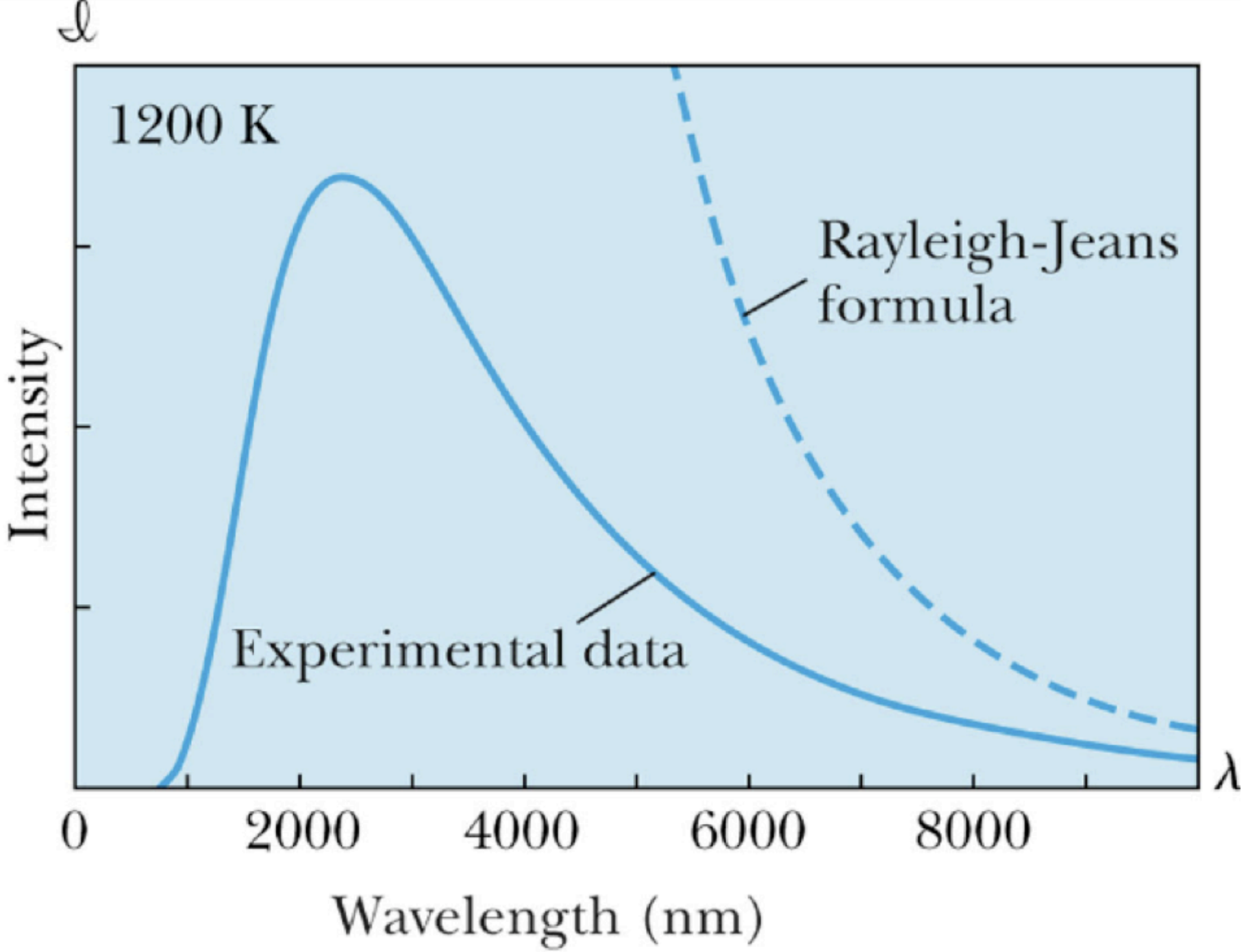

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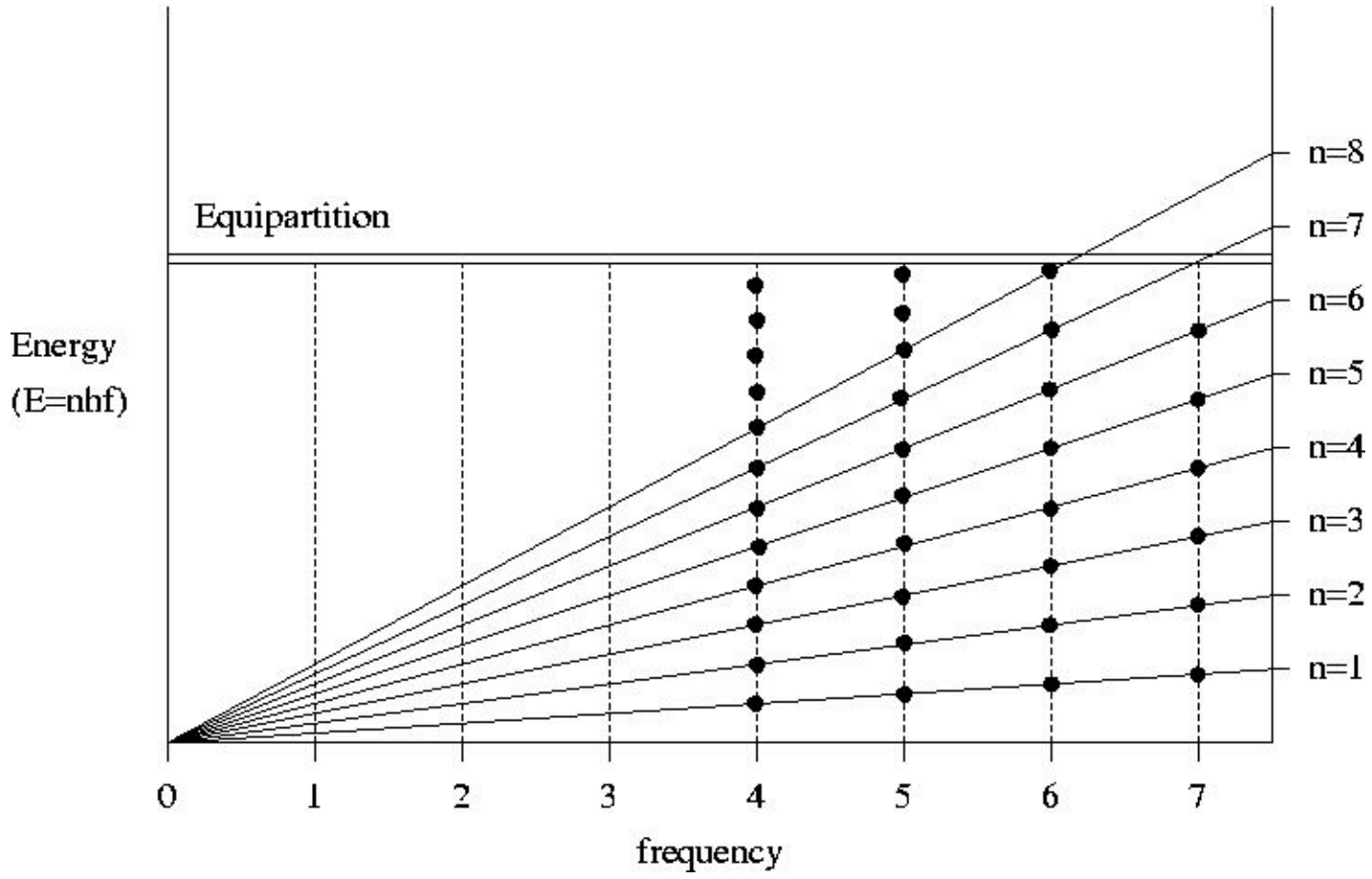
Equipartition
Energy
(E=nhf)
n=8
n=7
n=6
n=5
n=4
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n=1
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2
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4
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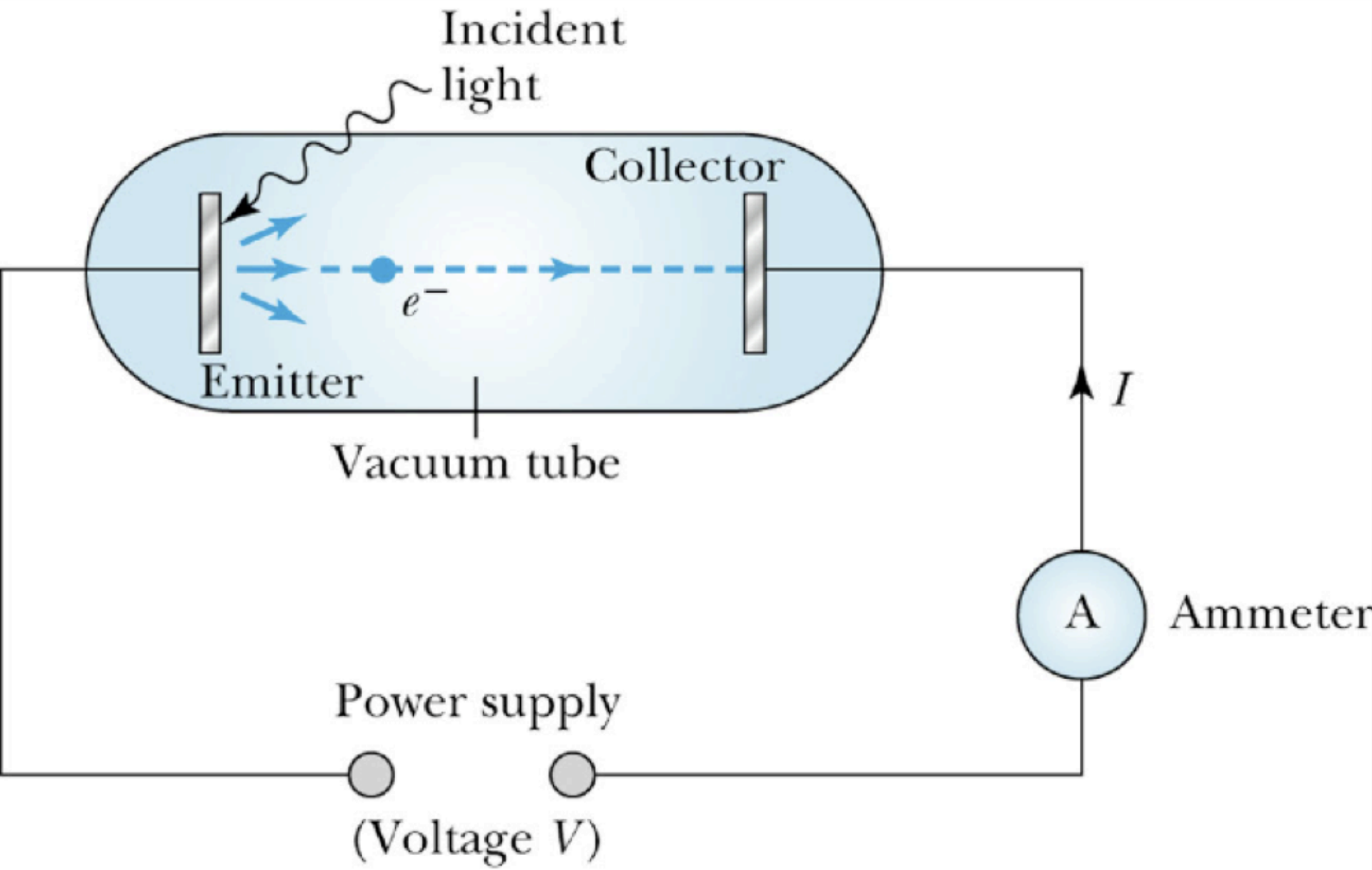
6
7
frequency



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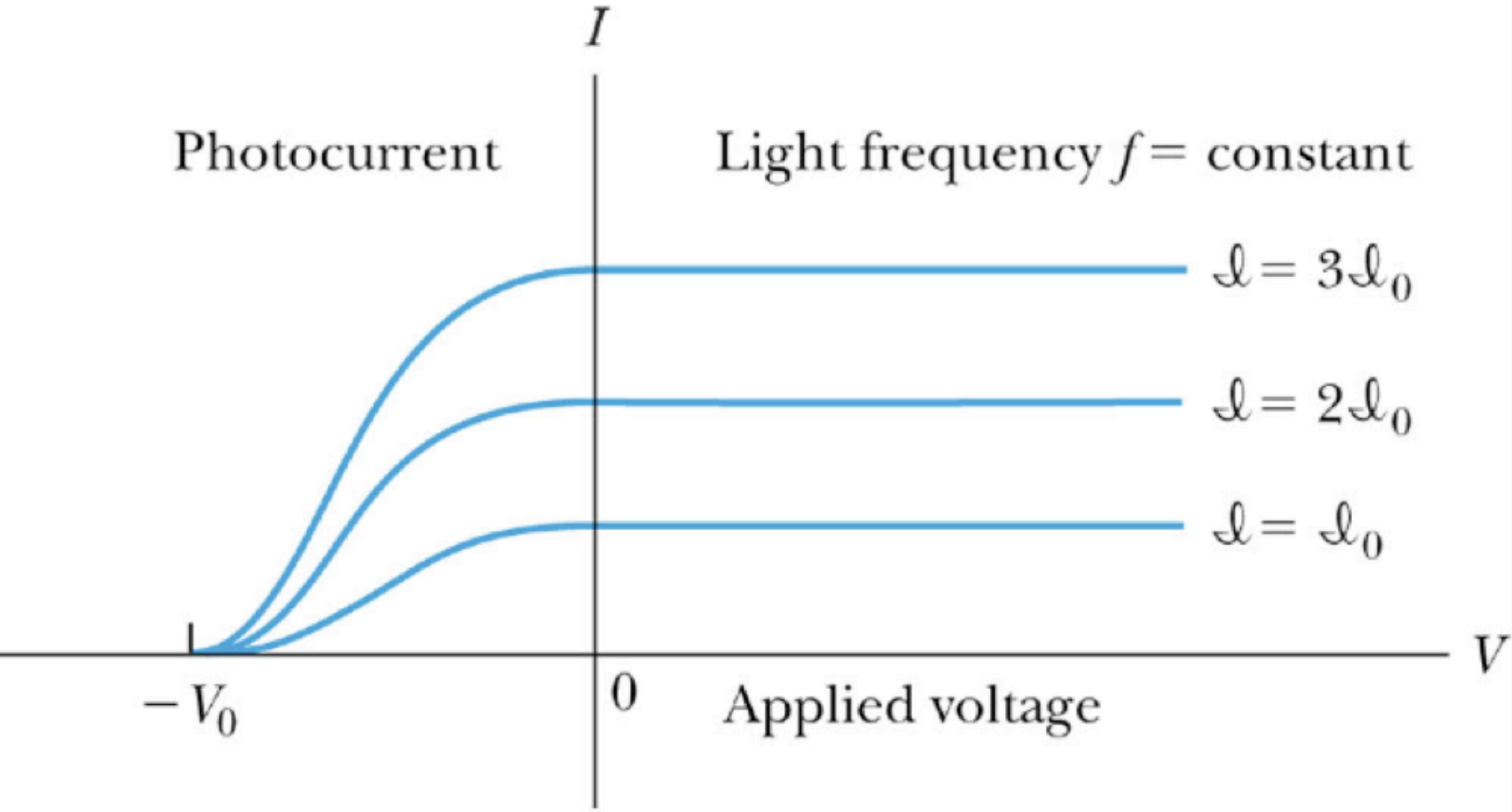

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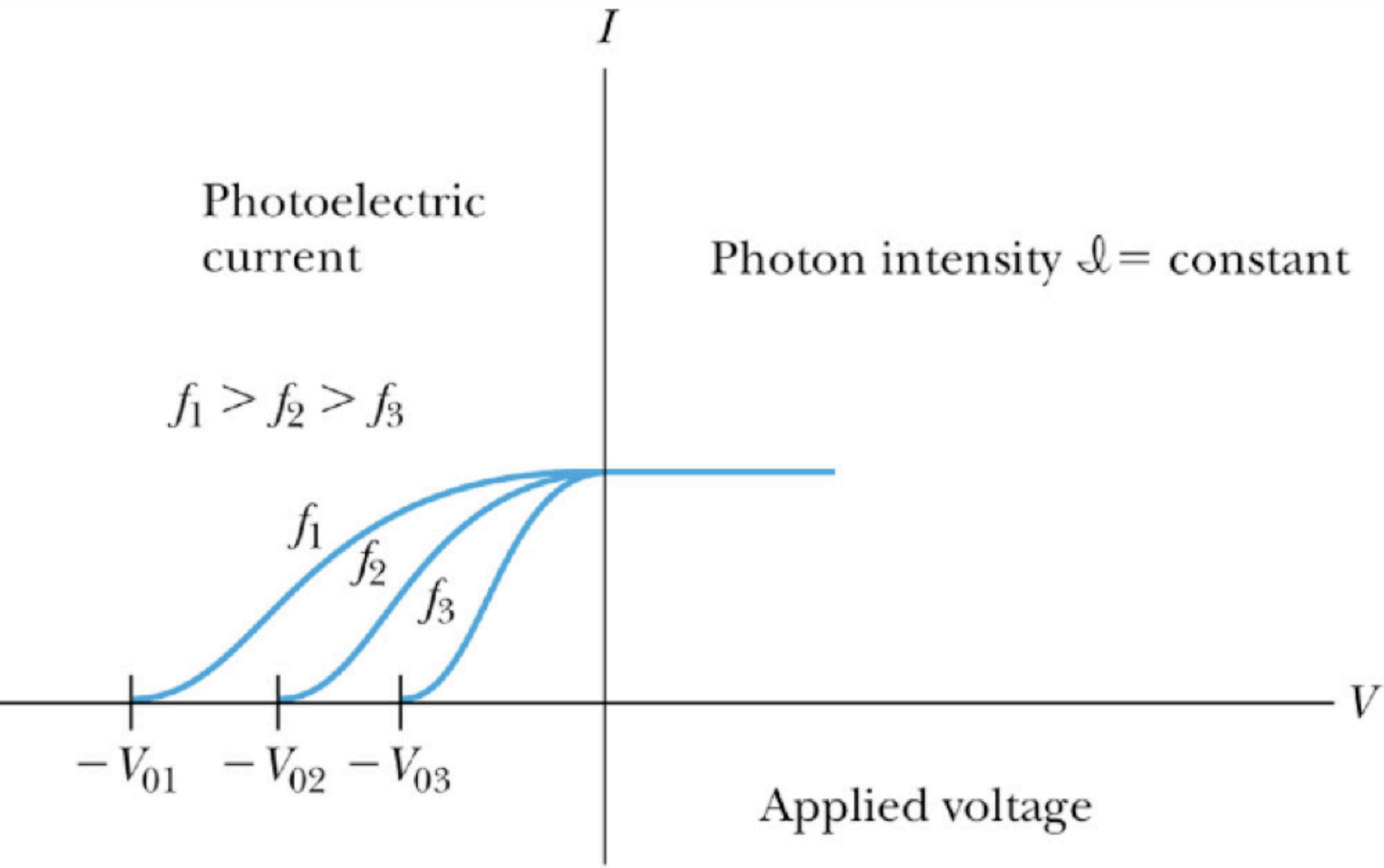

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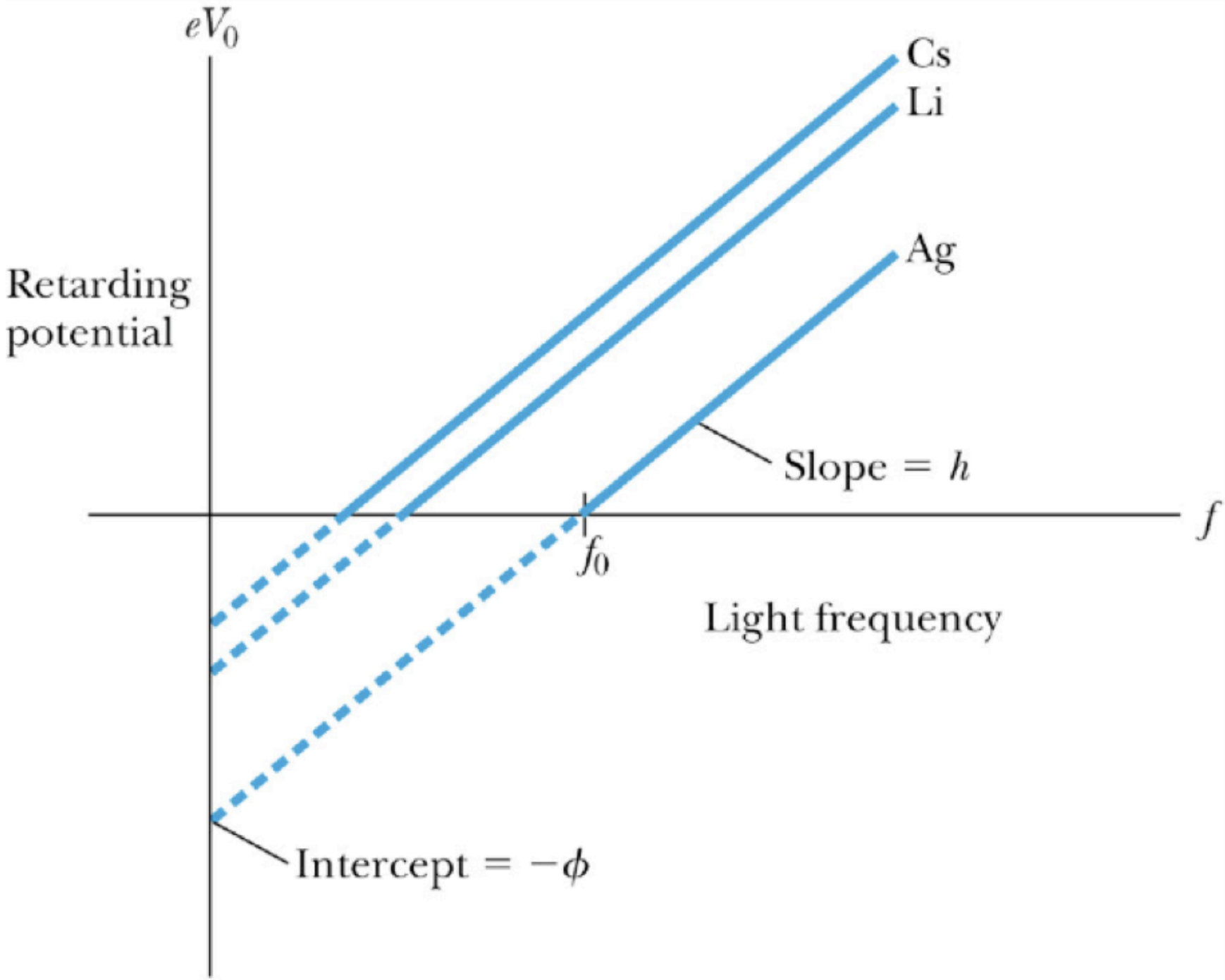

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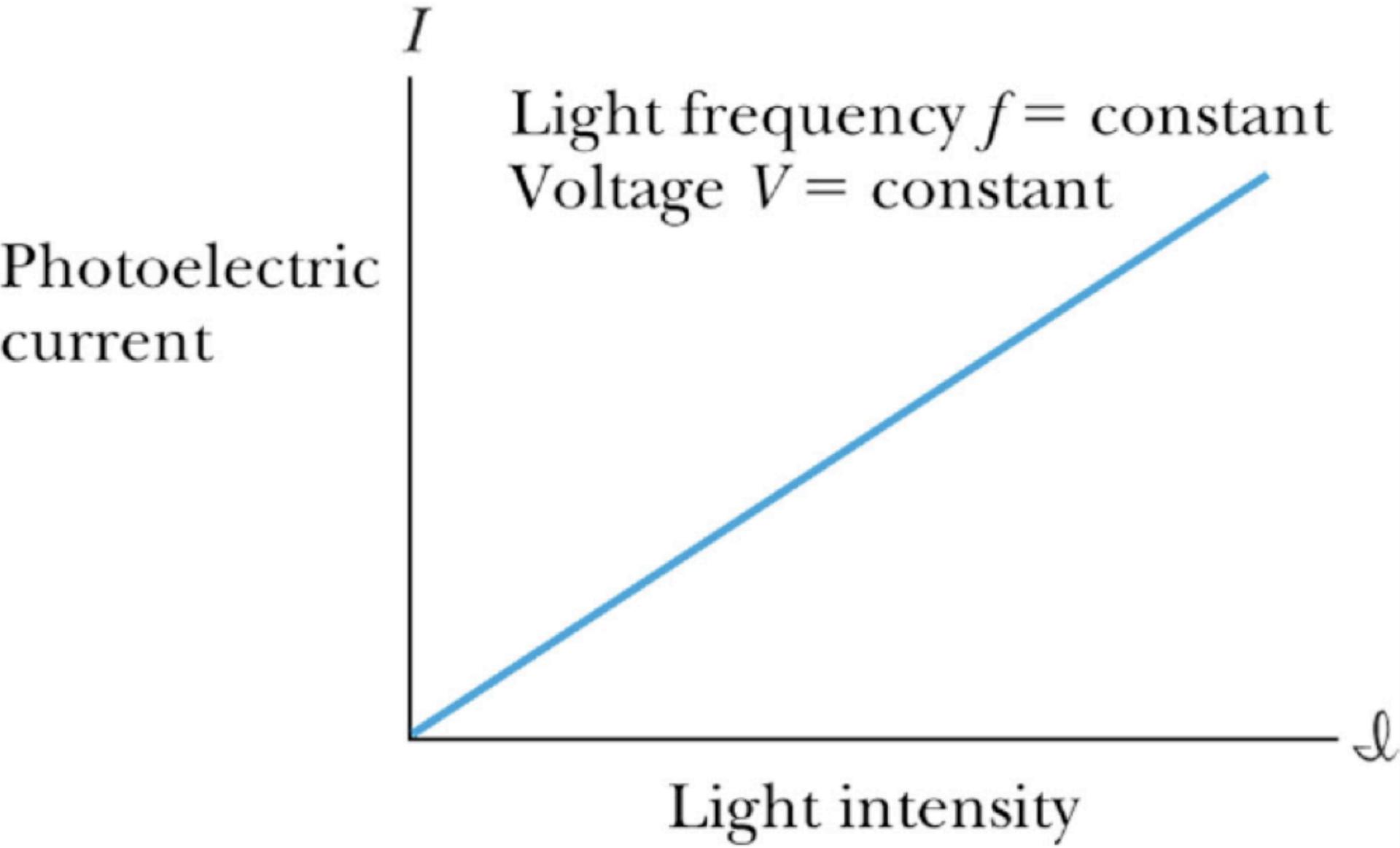

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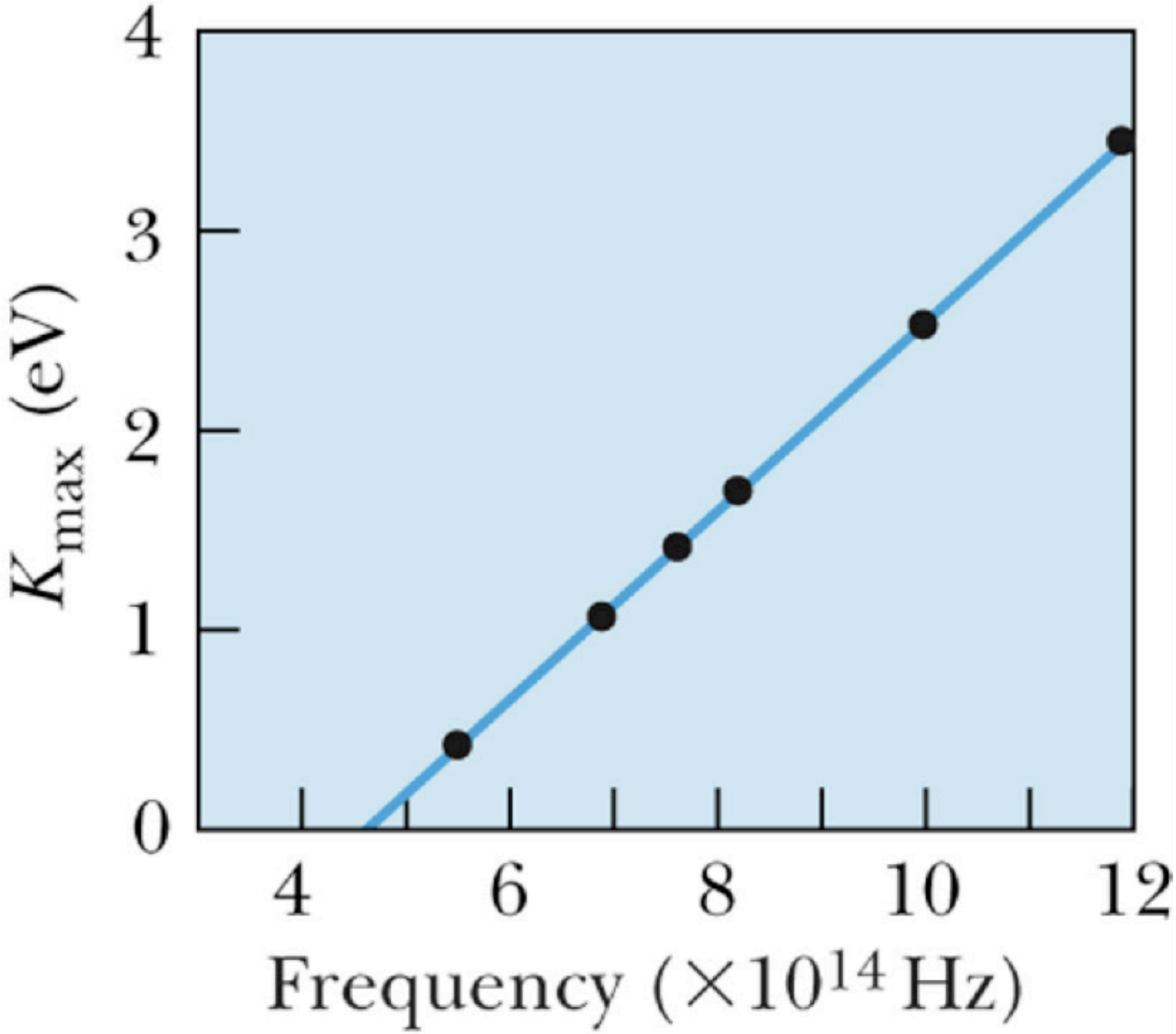

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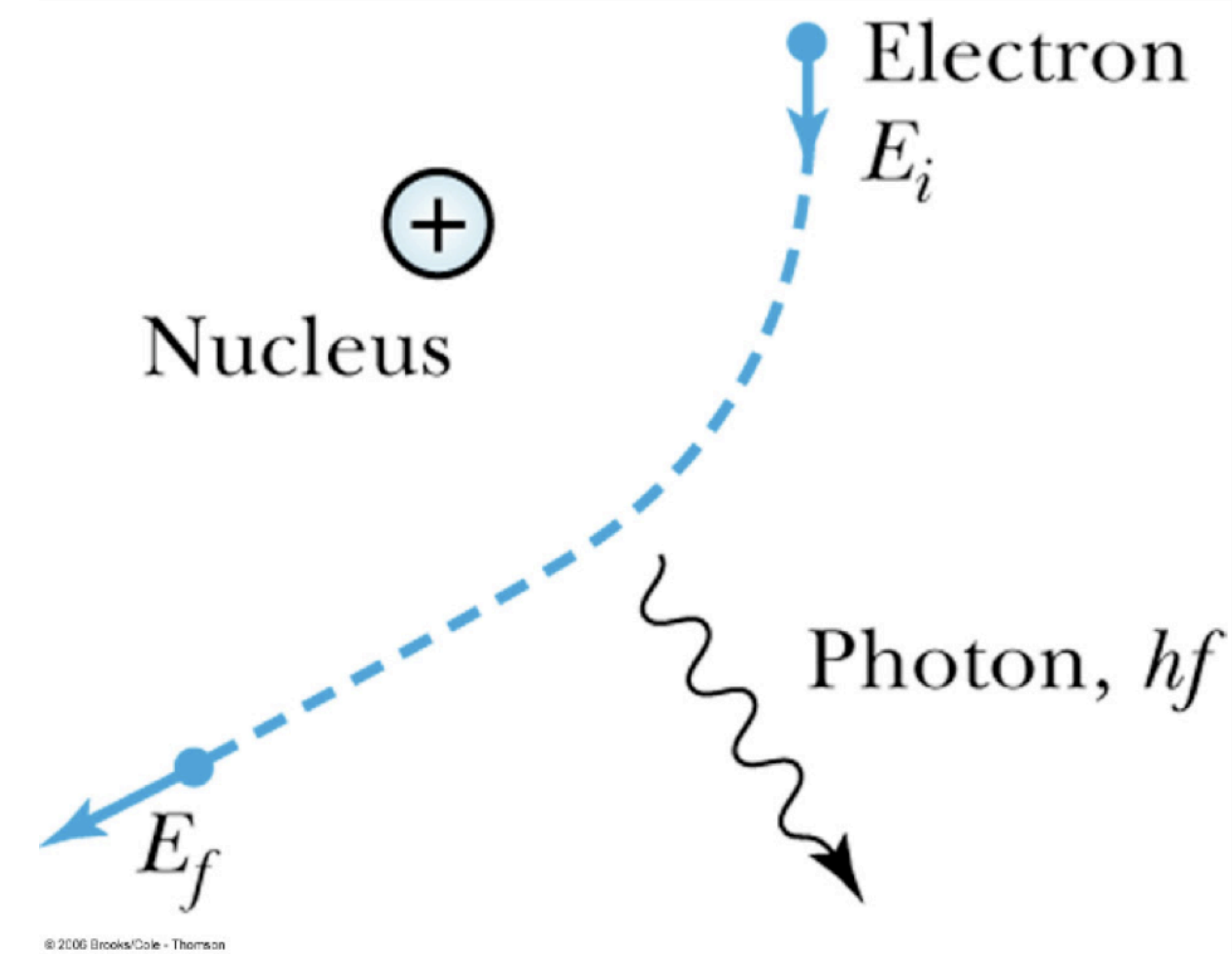

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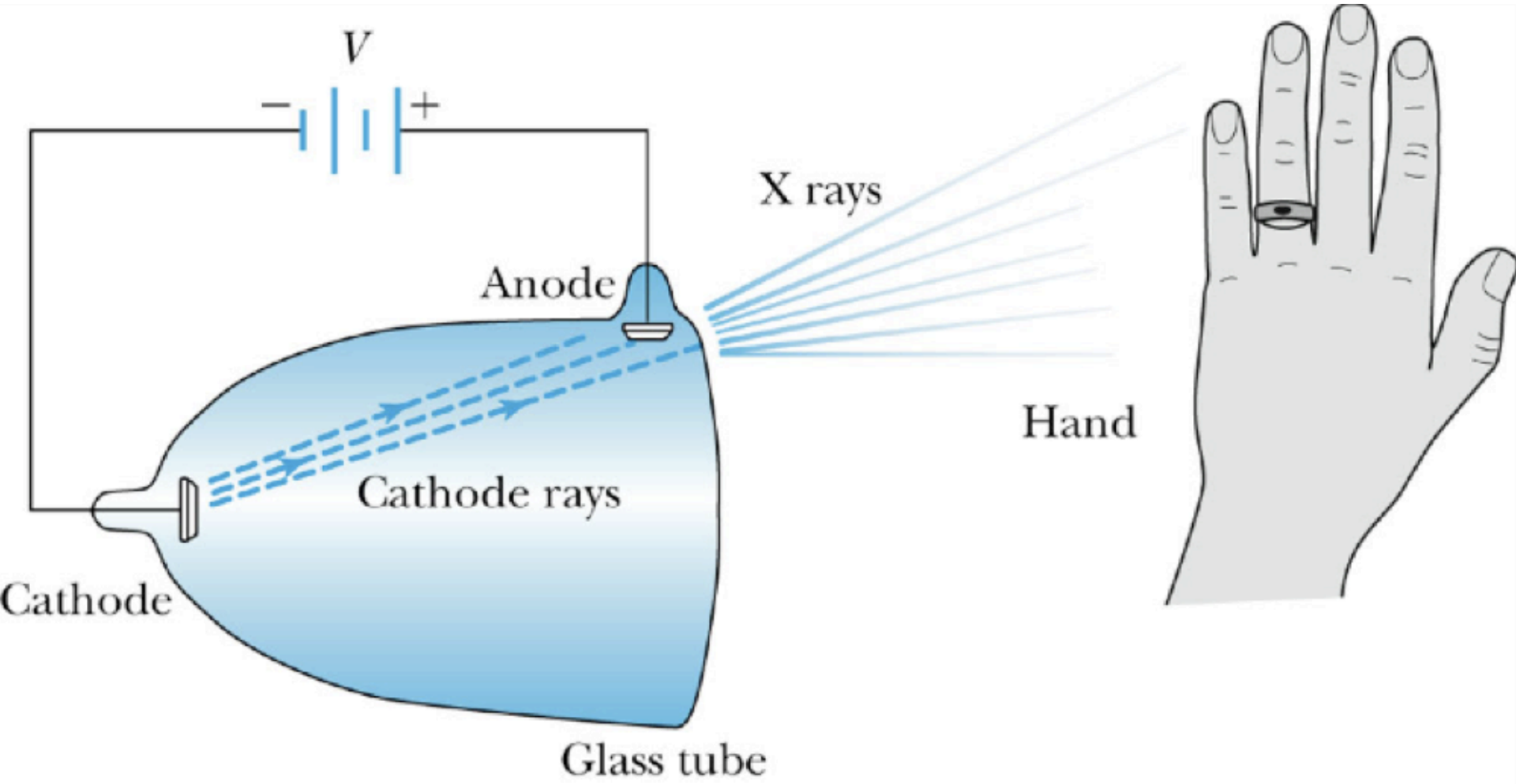

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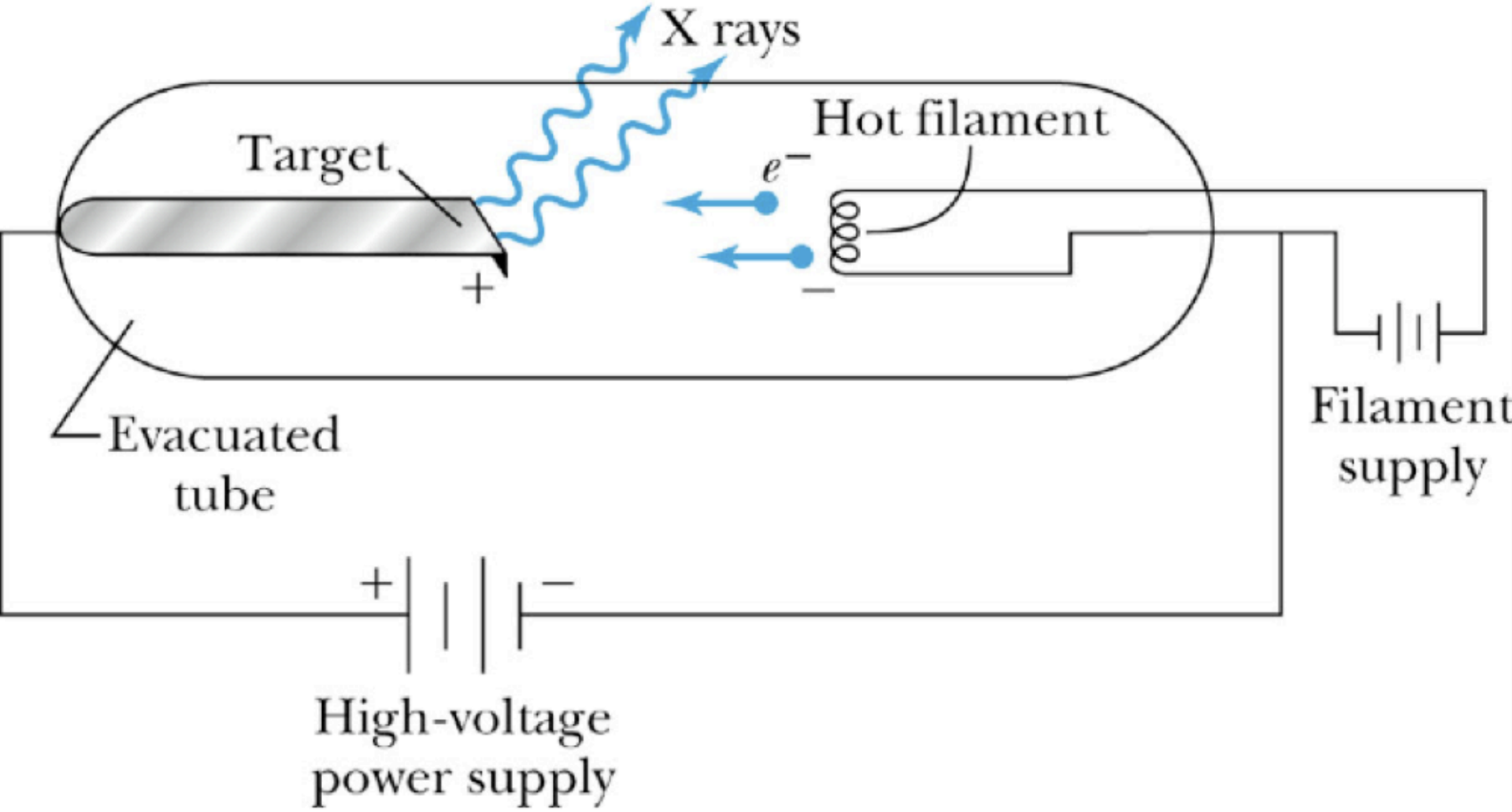

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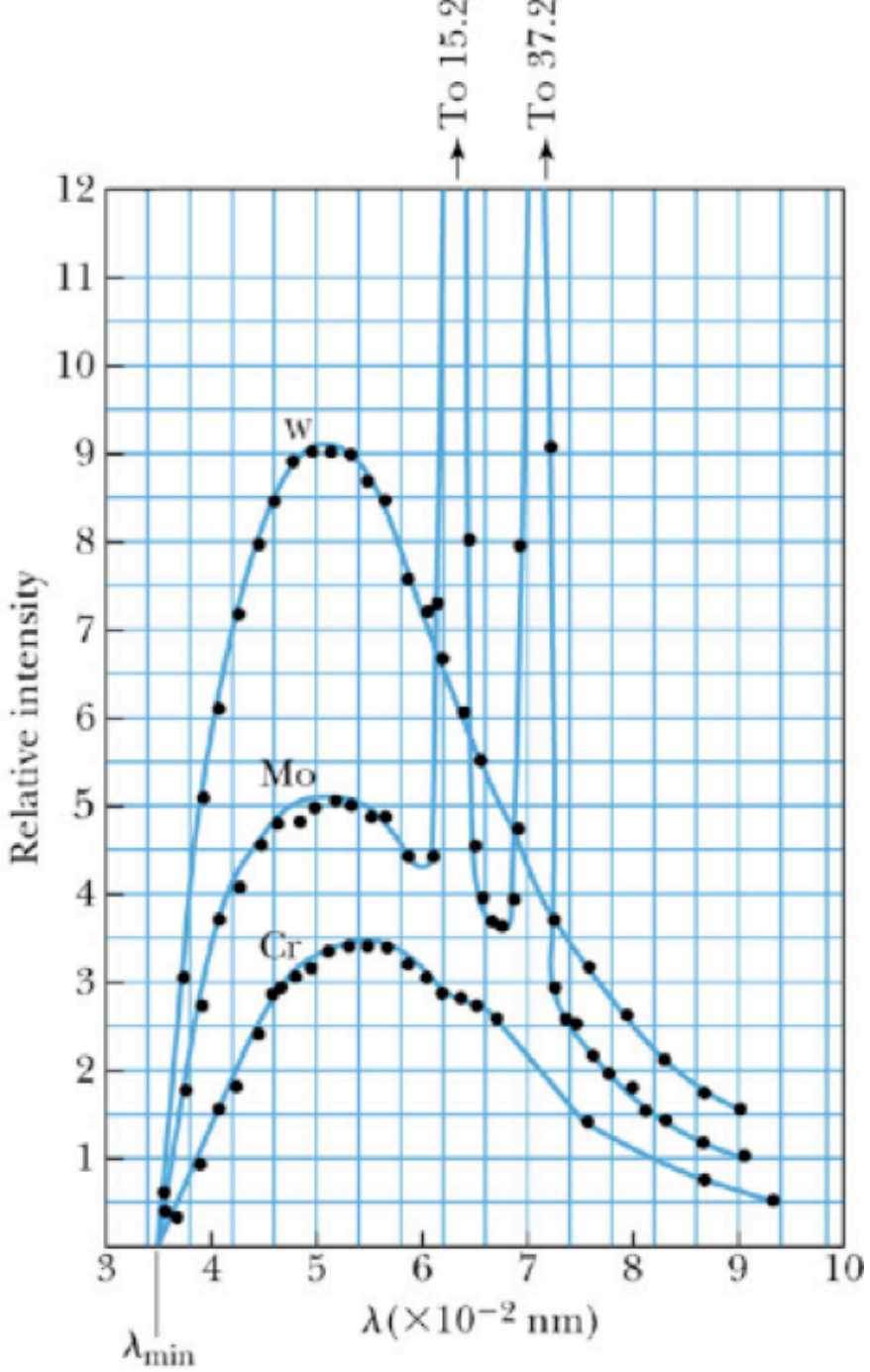

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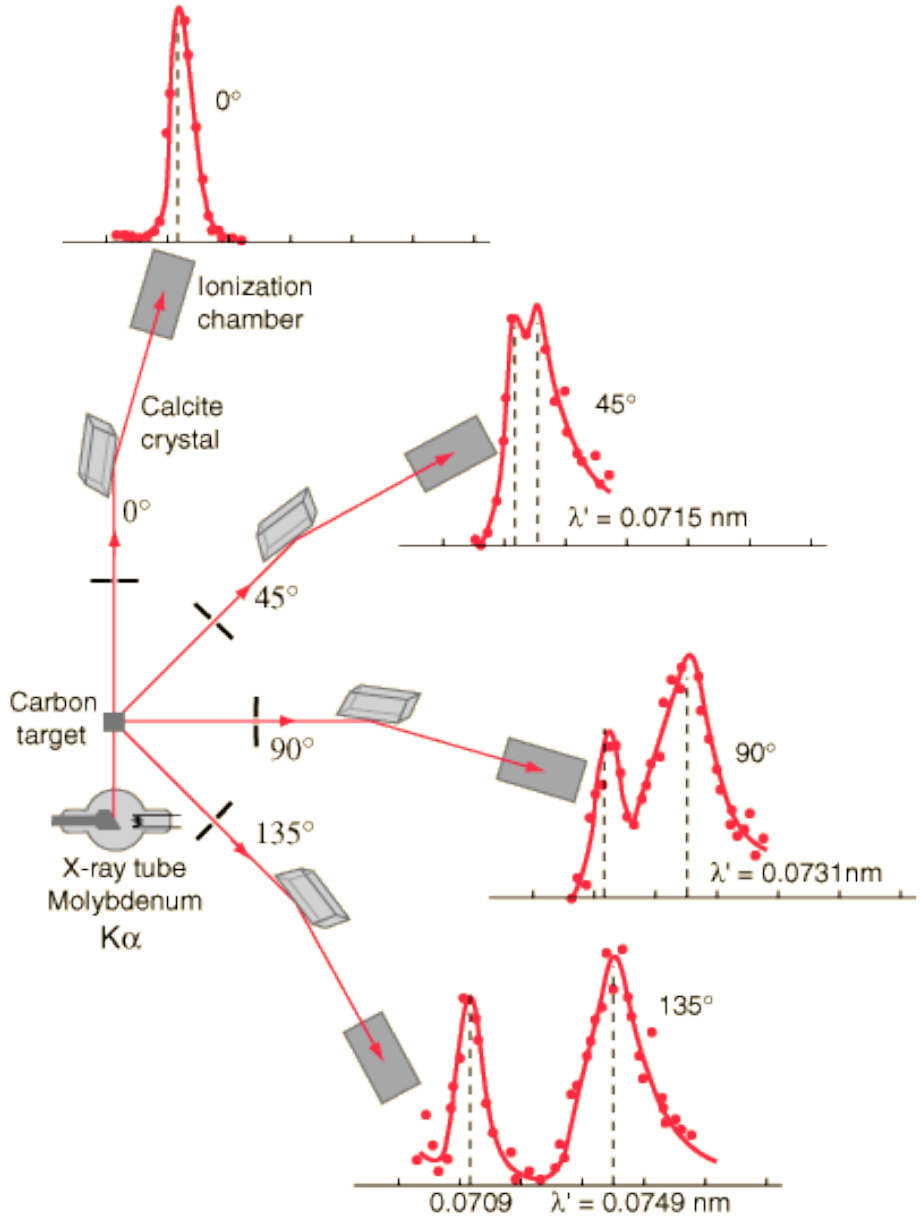
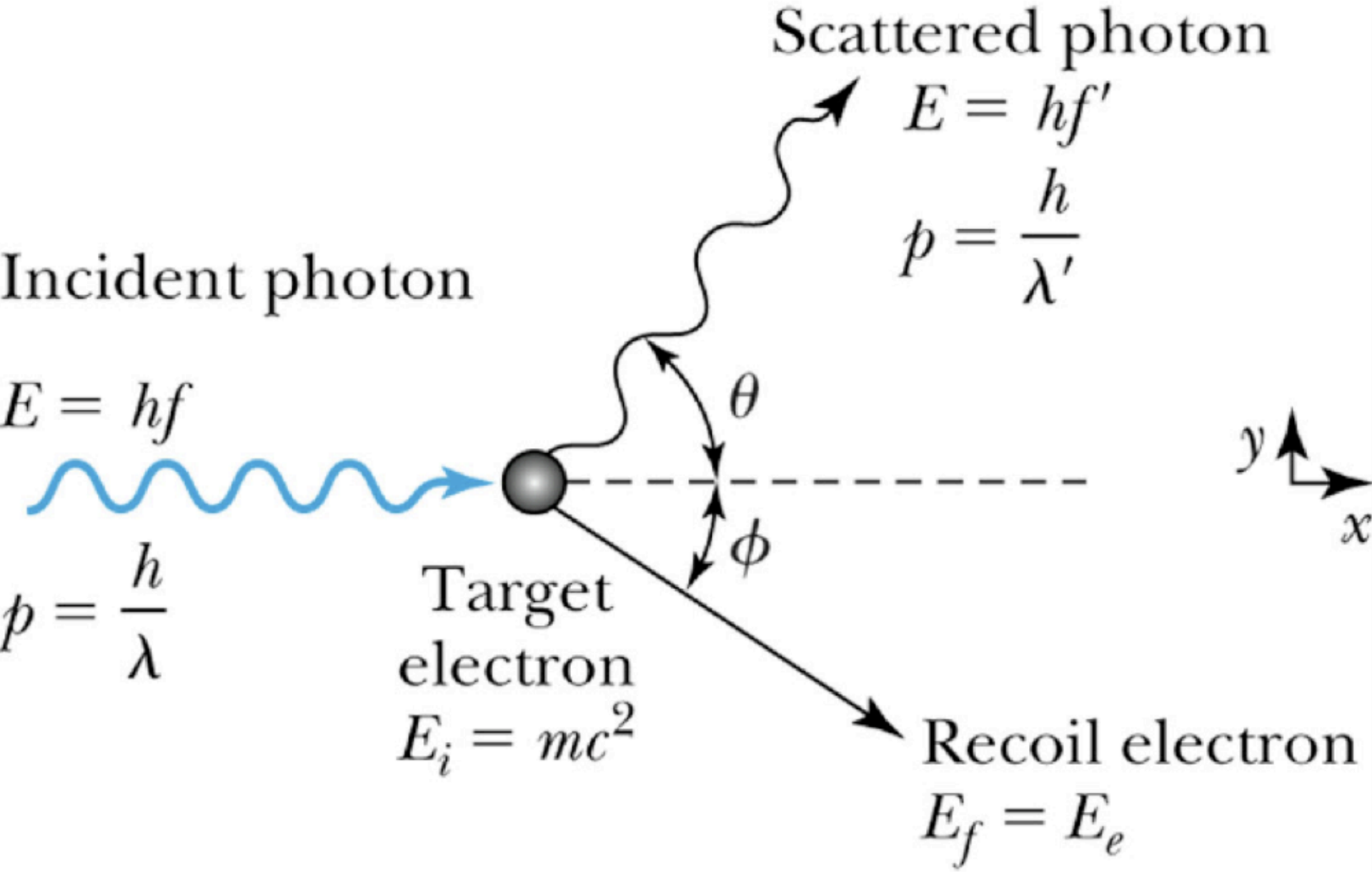

0°
Ionization chamber
Calcite crystal
0°
45°
45°
λ' = 0.0715 nm
Carbon target
90°
90°
λ' = 0.0731nm
135°
X-ray tube
Molybdenum
Kα
135°
0.0709
λ' = 0.0749 nm



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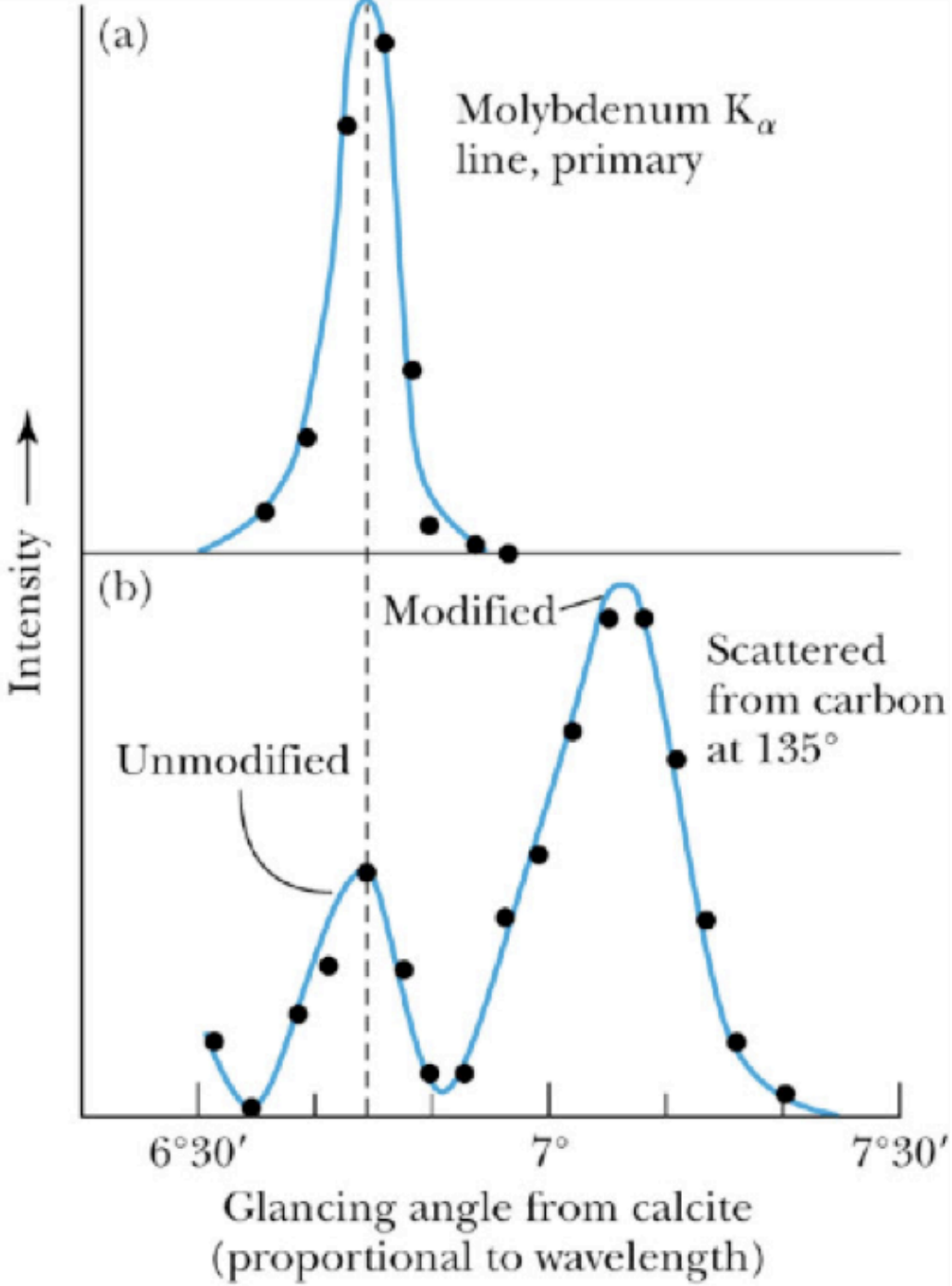

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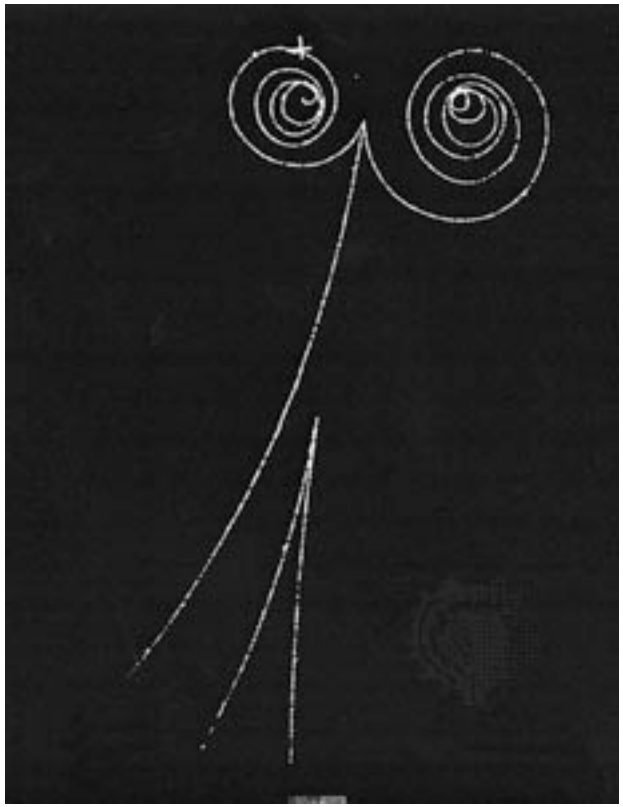
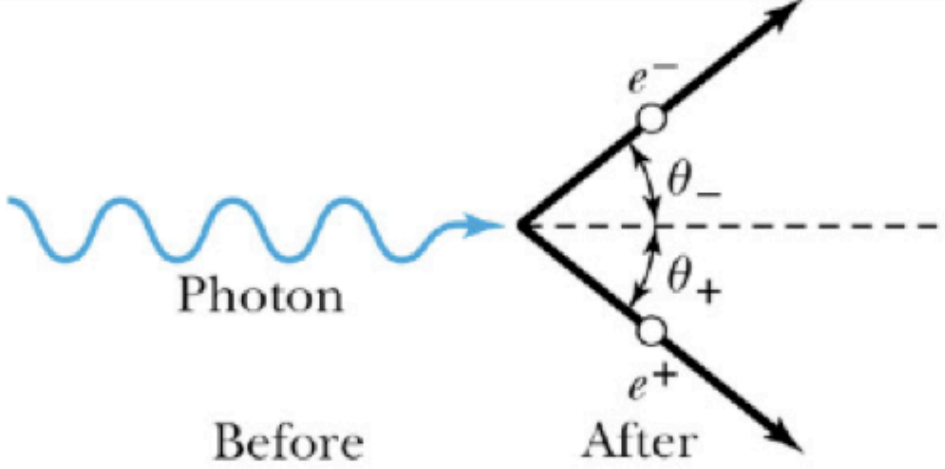
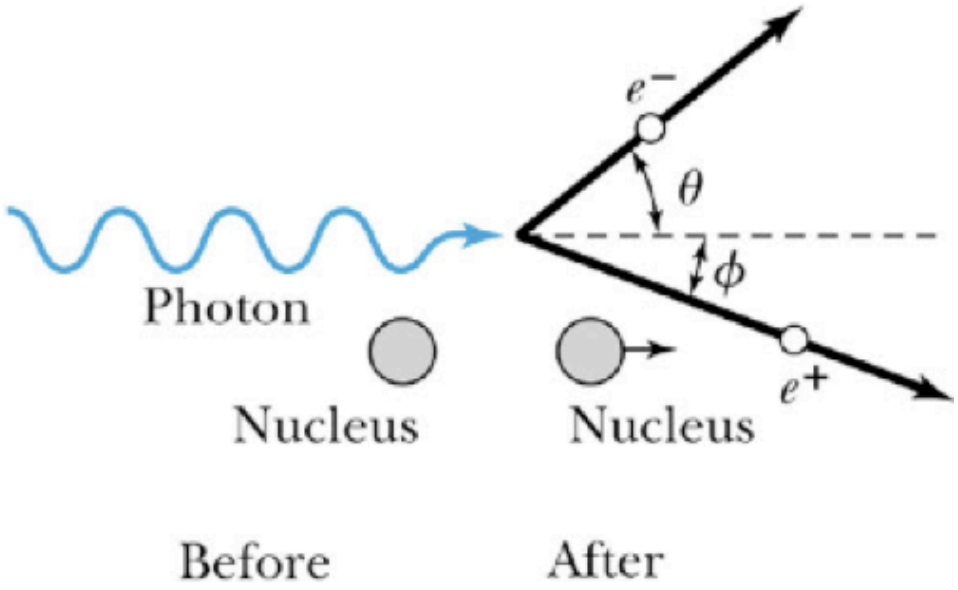




(a) Free space (**cannot occur**)



(b) Beside nucleus

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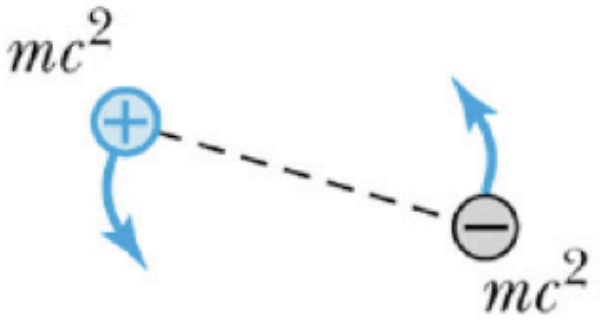
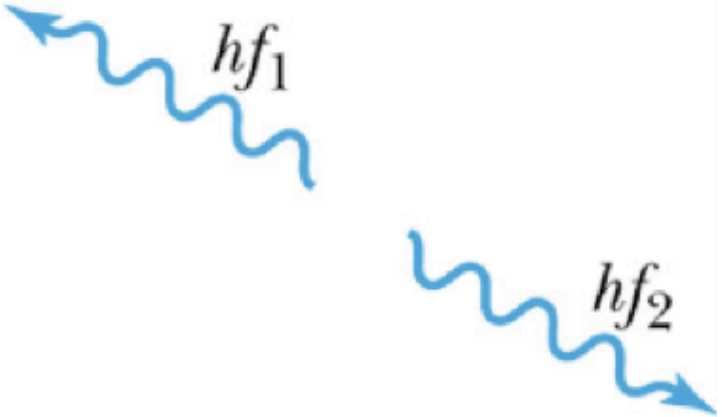


(a) Positronium, before decay (schematic only)



(b) After annihilation

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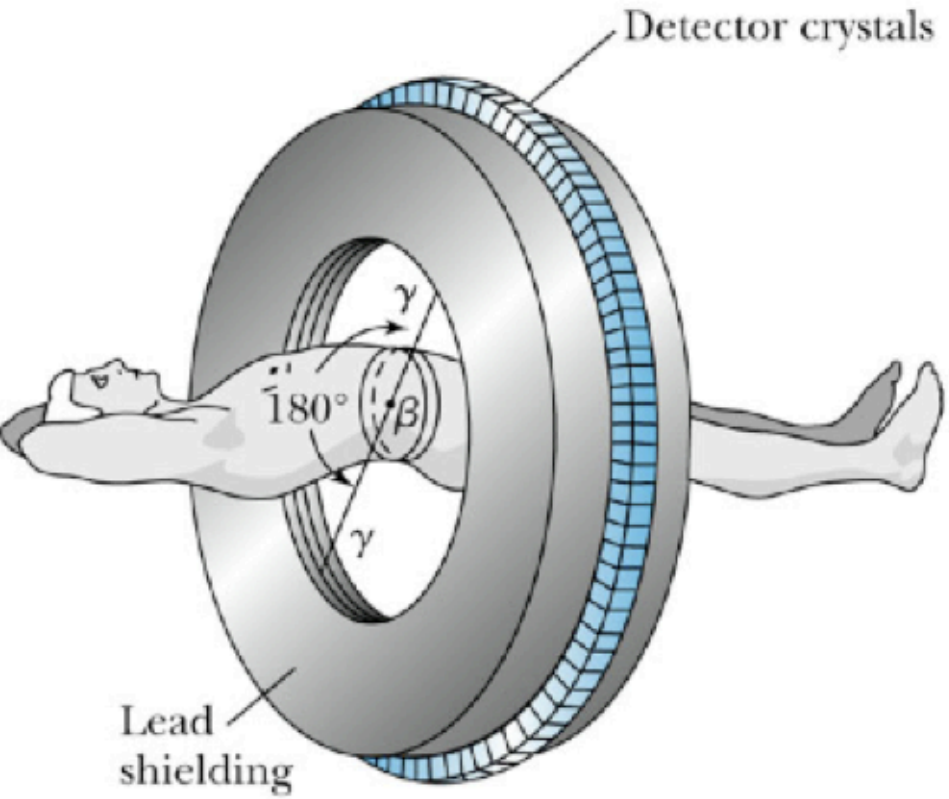

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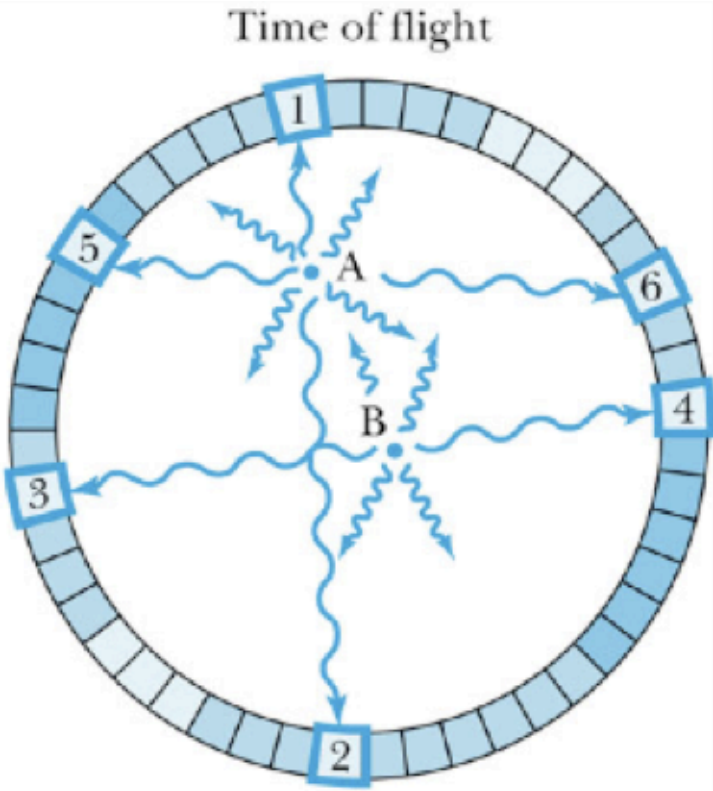

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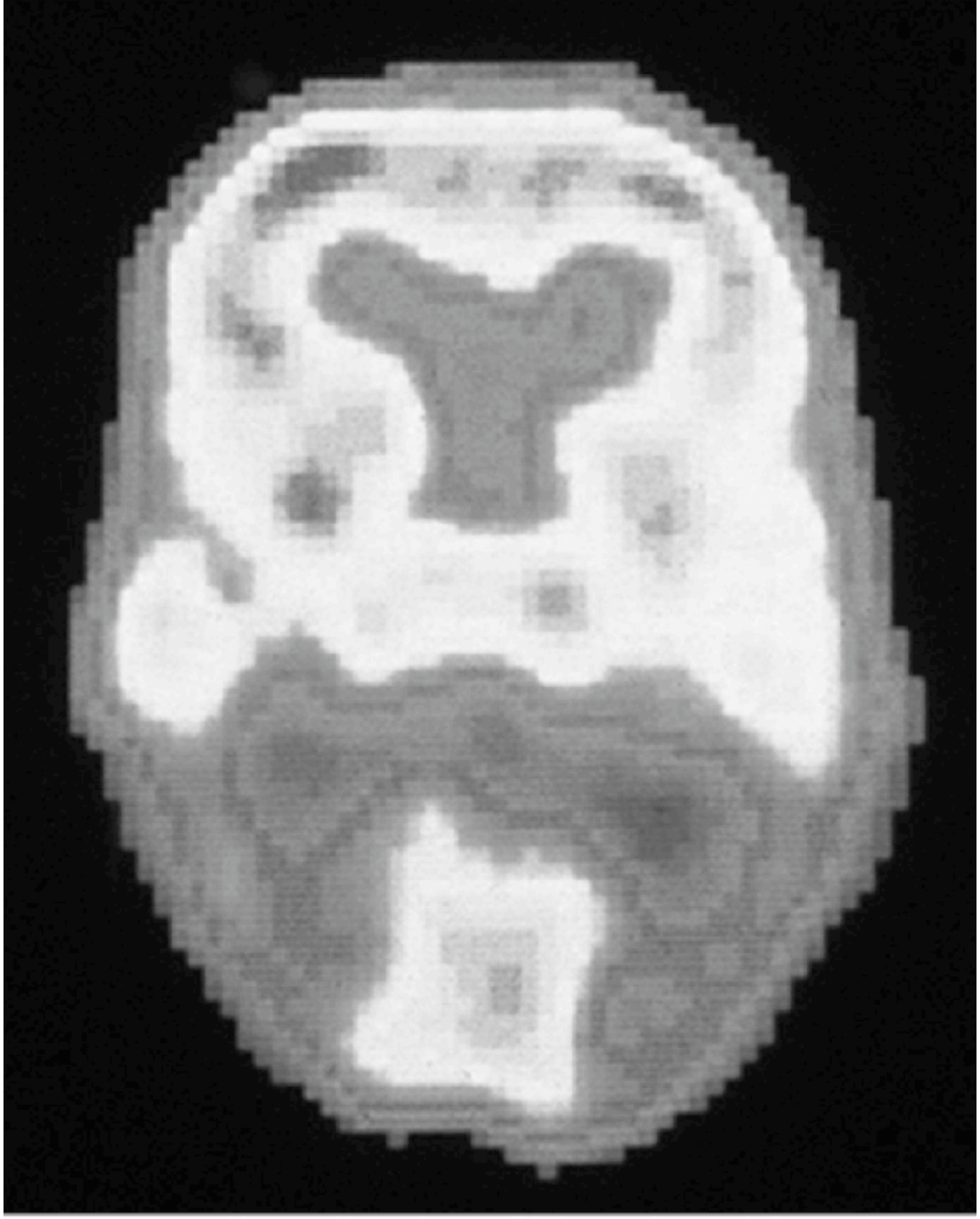

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Table 3.1 Student Measurements in Millikan Experiment

Particle	Voltage (V)	q ($\times 10^{-19}$ C)	Particle	Voltage (V)	q	Particle	Voltage (V)	q
1	−30.0	−7.43	11	−126.3	−1.77	21	−31.5	−7.08
2	+28.8	+7.74	12	−83.9	−2.66	22	−66.8	−3.34
3	−28.4	−7.85	13	−44.6	−5.00	23	+41.5	+5.37
4	+30.6	+7.29	14	−65.5	−3.40	24	−34.8	−6.41
5	−136.2	−1.64	15	−139.1	−1.60	25	−44.3	−5.03
6	−134.3	−1.66	16	−64.5	−3.46	26	−143.6	−1.55
7	+82.2	+2.71	17	−28.7	−7.77	27	+77.2	+2.89
8	+28.7	+7.77	18	−30.7	−7.26	28	−39.9	−5.59
9	−39.9	−5.59	19	+32.8	+6.80	29	−57.9	−3.85
10	+54.3	+4.11	20	−140.8	+1.58	30	+42.3	+5.27

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Table 3.2 Hydrogen Series of Spectral Lines

Discoverer (year)	Wavelength	n	k
Lyman (1916)	Ultraviolet	1	>1
Balmer (1885)	Visible, ultraviolet	2	>2
Paschen (1908)	Infrared	3	>3
Brackett (1922)	Infrared	4	>4
Pfund (1924)	Infrared	5	>5

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Table 3.3 Work Functions

Element	ϕ (eV)	Element	ϕ (eV)	Element	ϕ (eV)
Ag	4.64	K	2.29	Pd	5.22
Al	4.20	Li	2.93	Pt	5.64
C	5.0	Na	2.36	W	4.63
Cs	1.95	Nd	3.2	Zr	4.05
Cu	4.48	Ni	5.22		
Fe	4.67	Pb	4.25		

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Table 3.4 Results of Compton Scattering

Energy or Momentum	Initial System	Final System
Photon energy	hf	hf'
Photon momentum in x direction (p_x)	$\frac{h}{\lambda}$	$\frac{h}{\lambda'}\cos\theta$
Photon momentum in y direction (p_y)	0	$\frac{h}{\lambda'}\sin\theta$
Electron energy	mc^2	$E_e = mc^2 + \text{K.E.}$
Electron momentum in x direction (p_x)	0	$p_e\cos\phi$
Electron momentum in y direction (p_y)	0	$-p_e\sin\phi$

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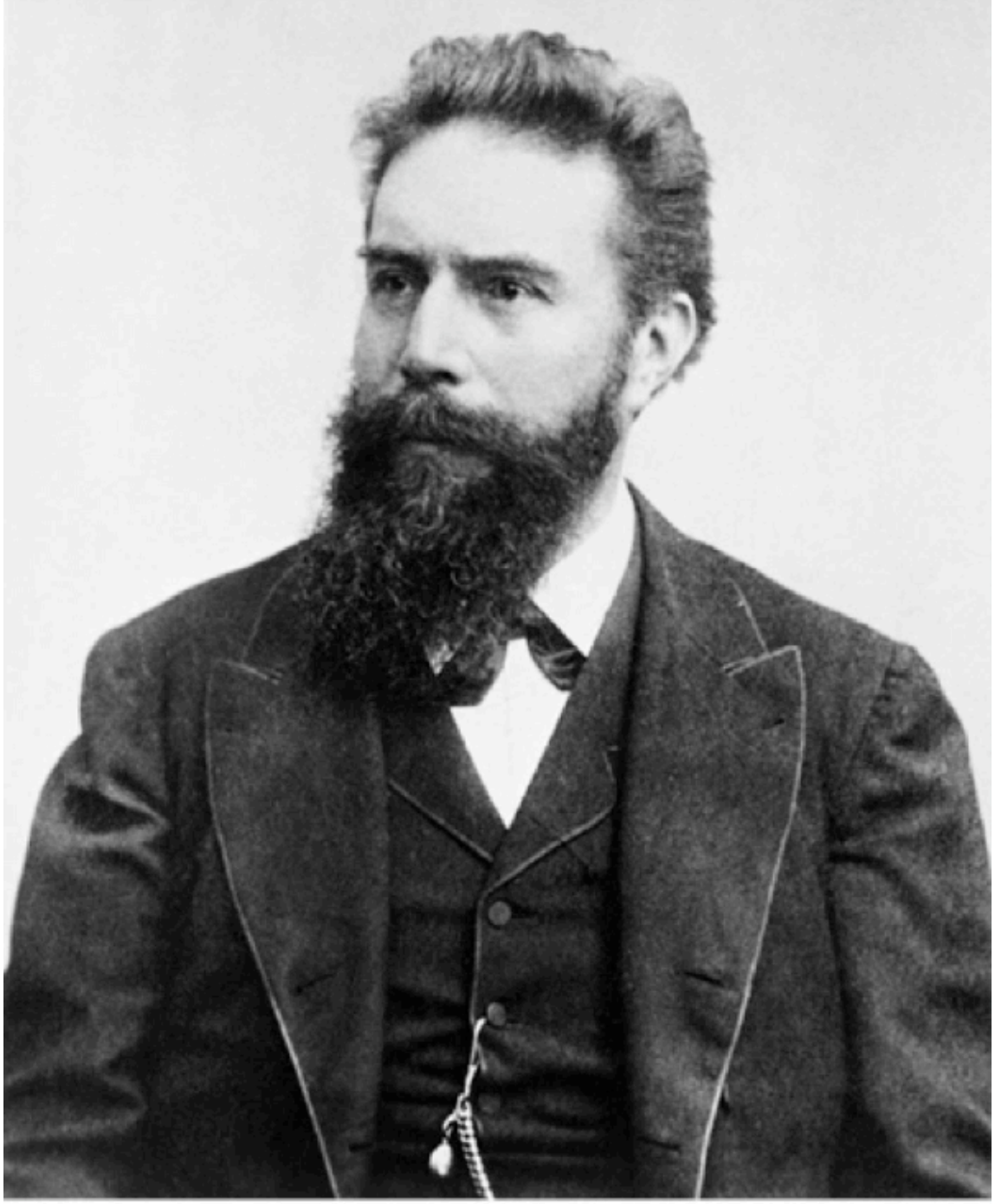

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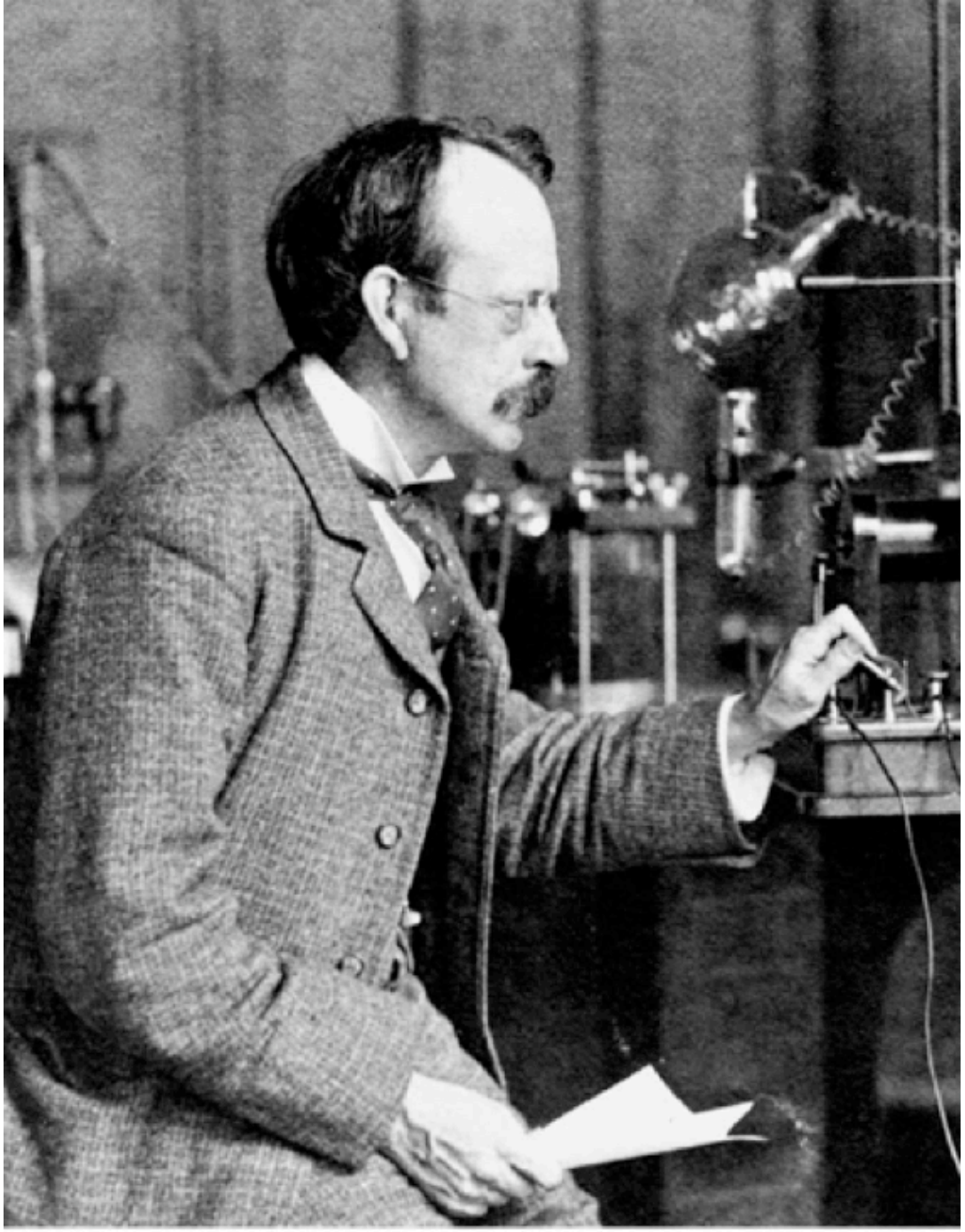

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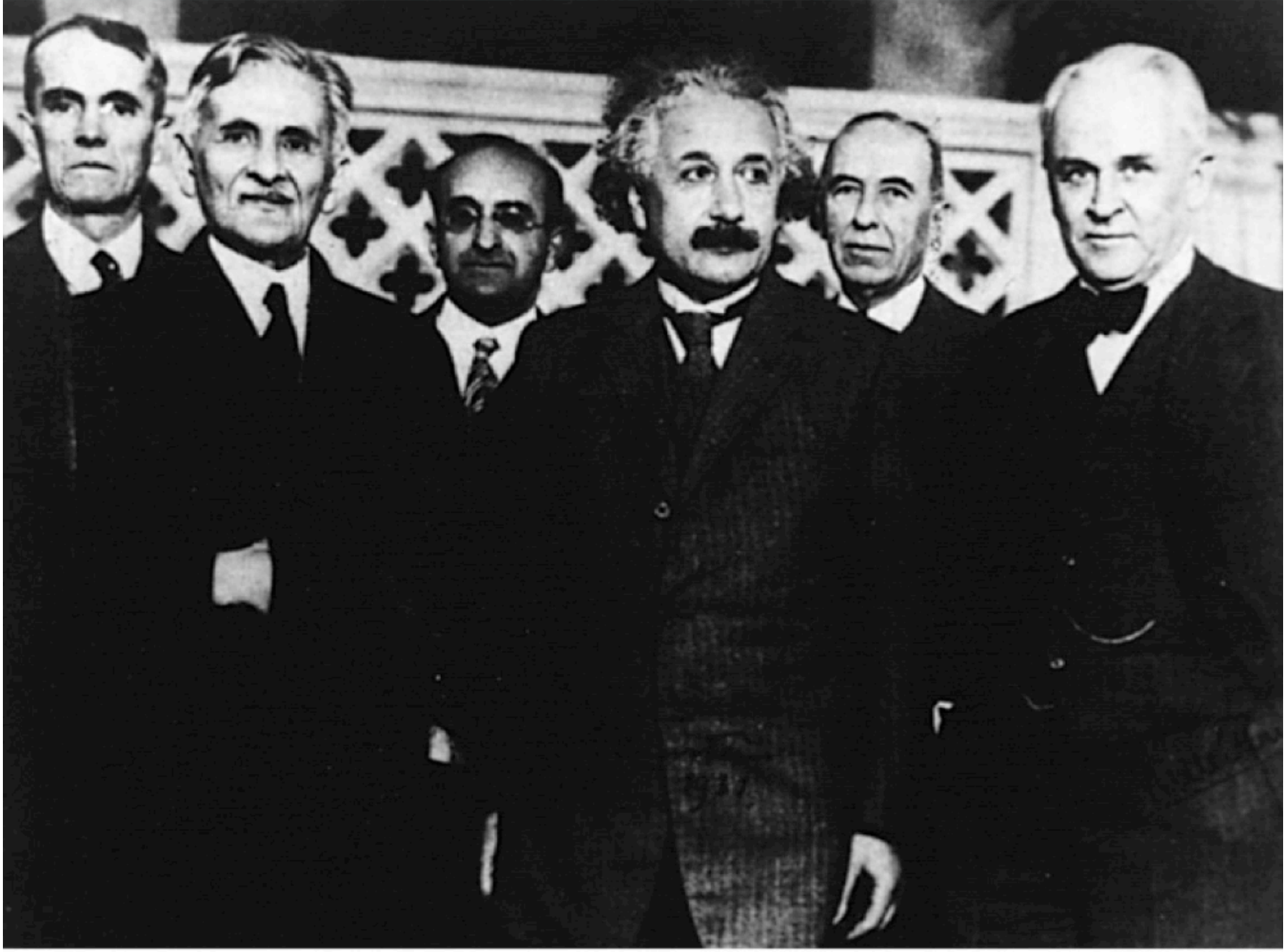

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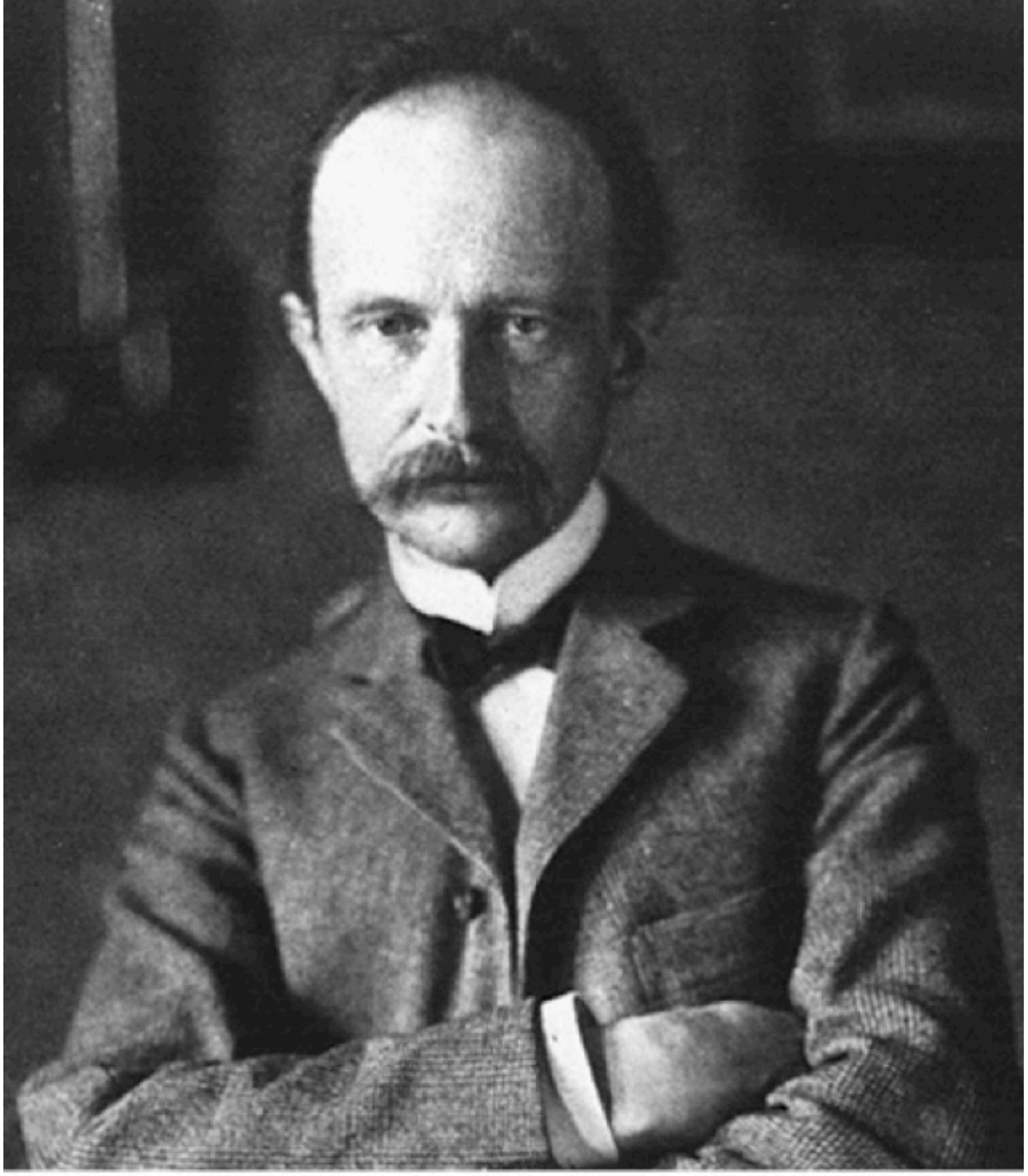

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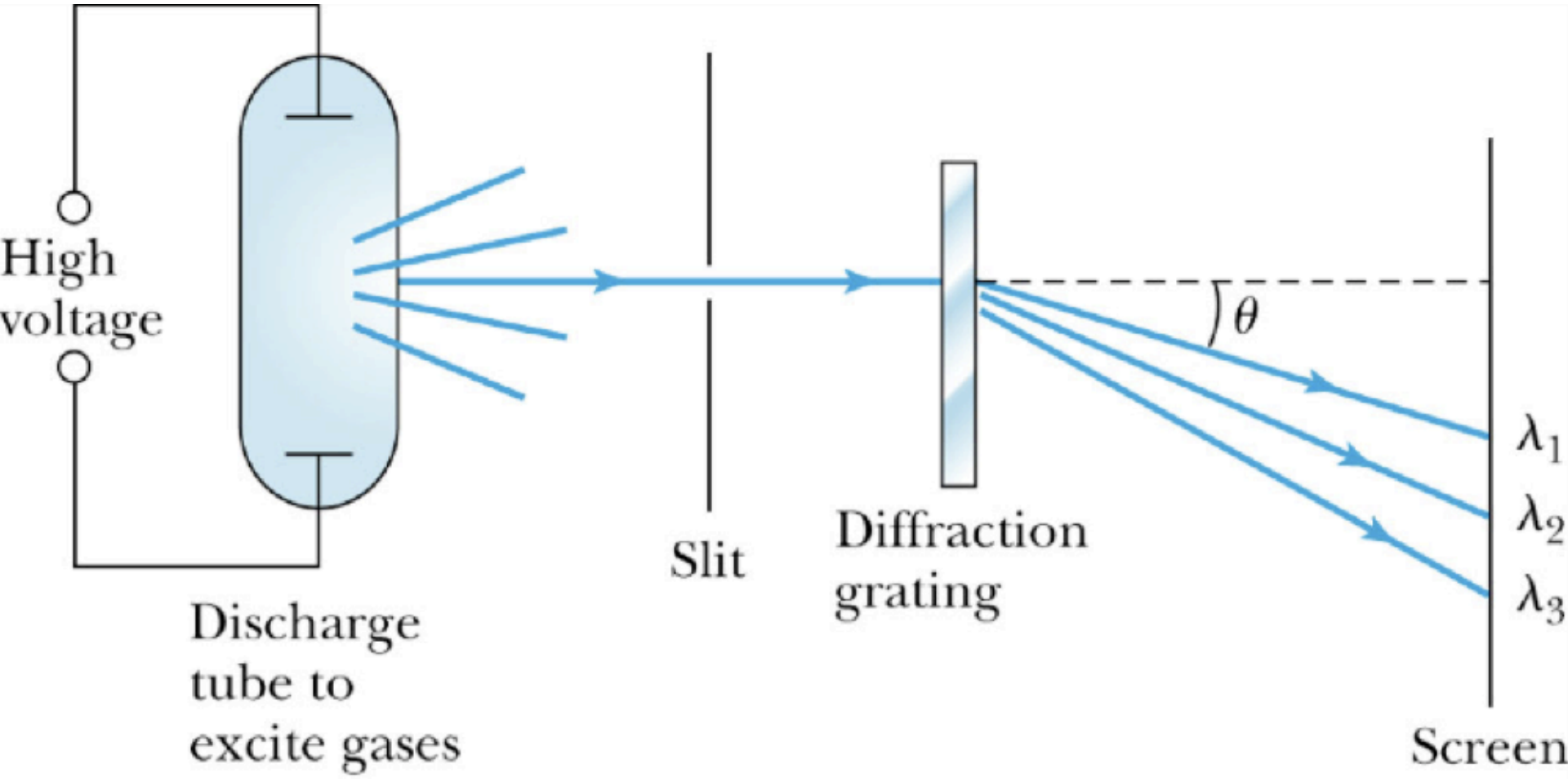

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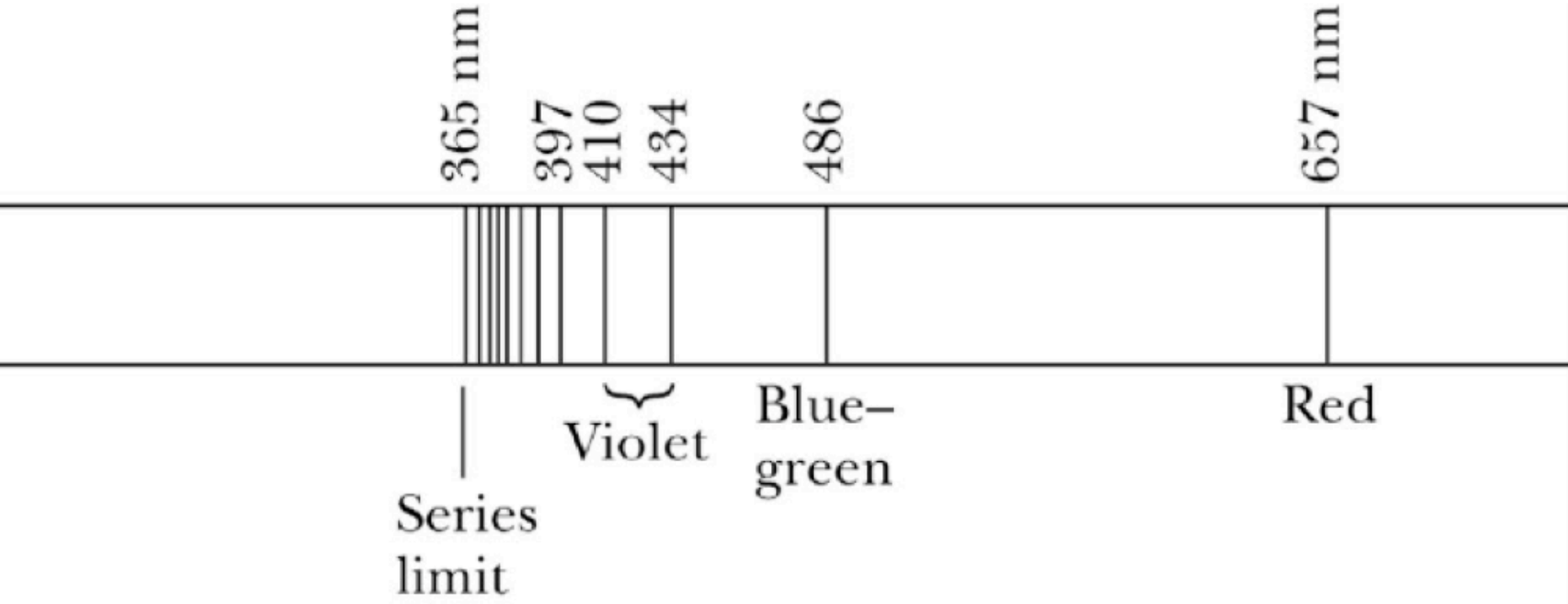

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