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In limit that $n \rightarrow \infty$,
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Intrinsic linewidth $\Delta\lambda$ of emitted photons

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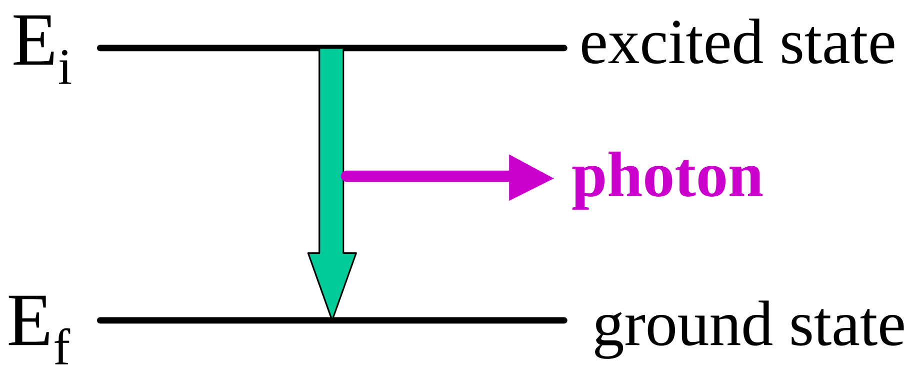

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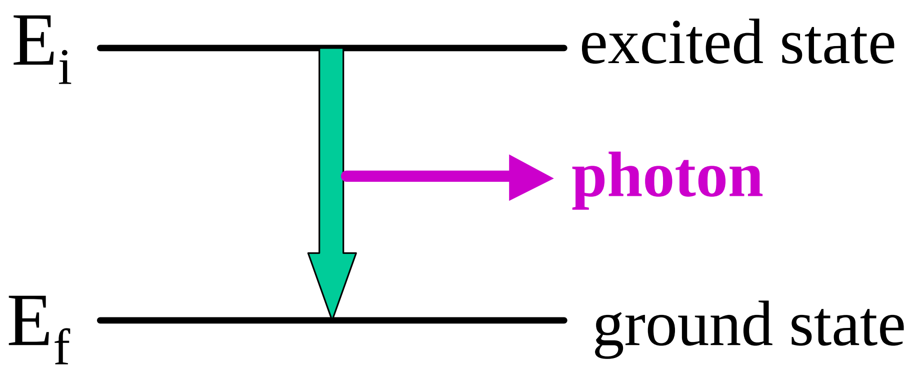

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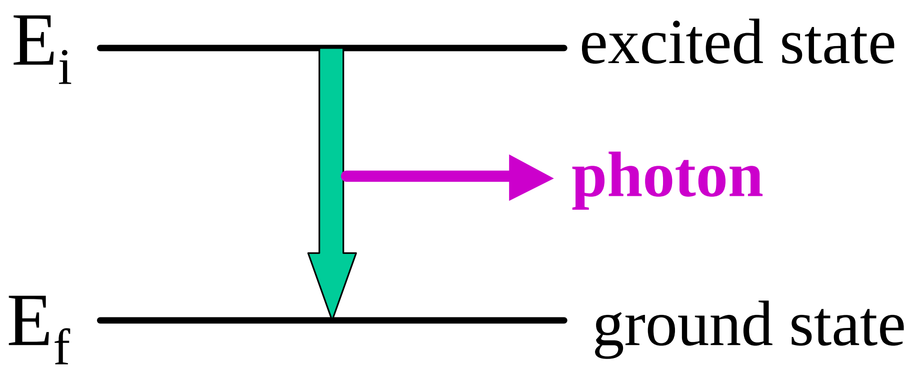

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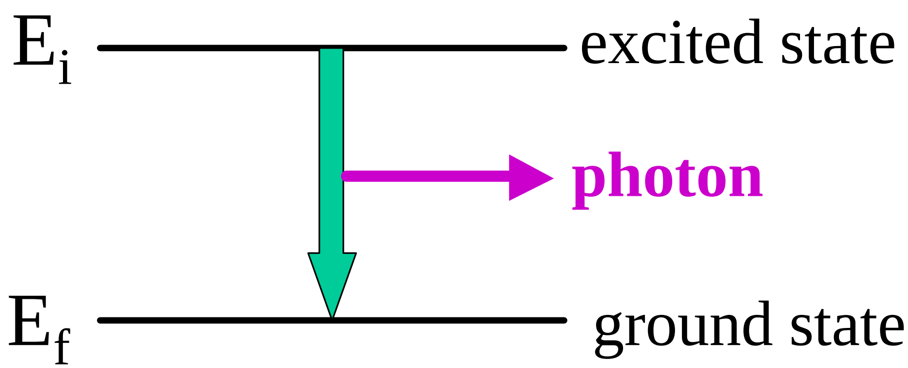

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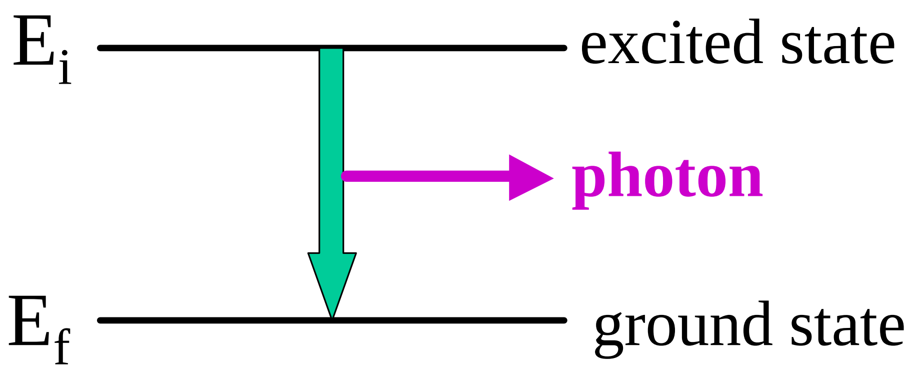

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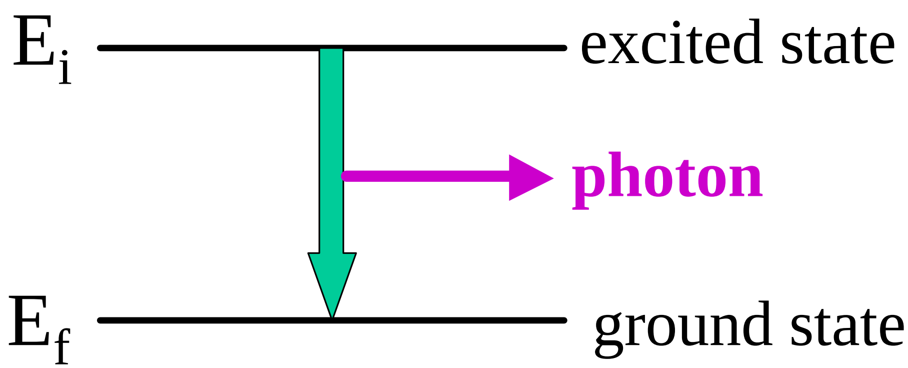

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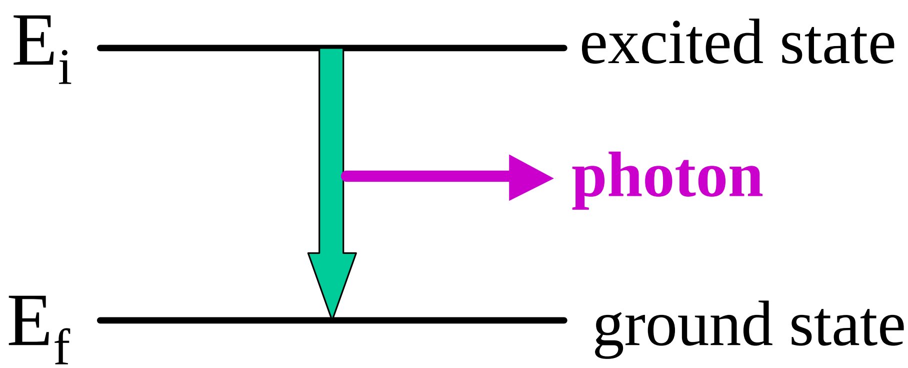

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For **E_{photon} ~ 2 eV** (visible spectrum), D l / l **~ 10^{-8}**.

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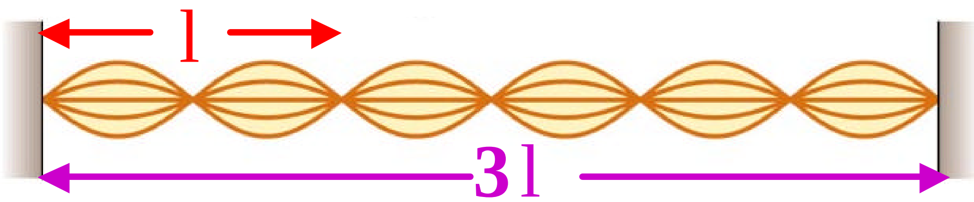

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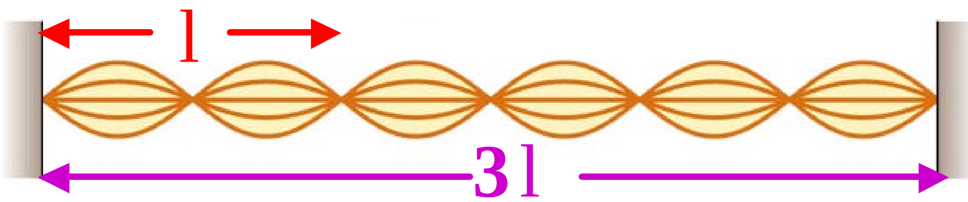

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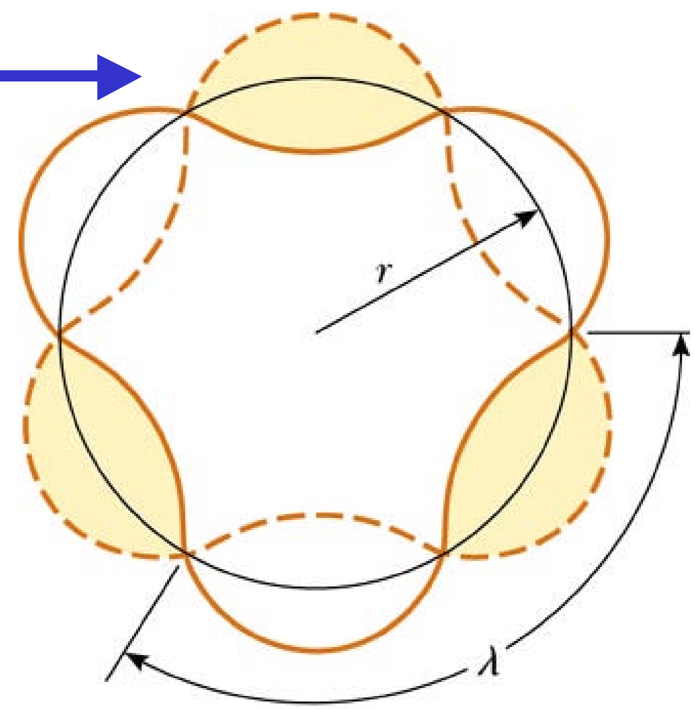

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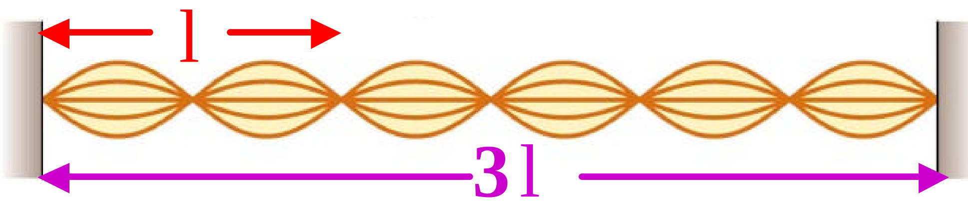

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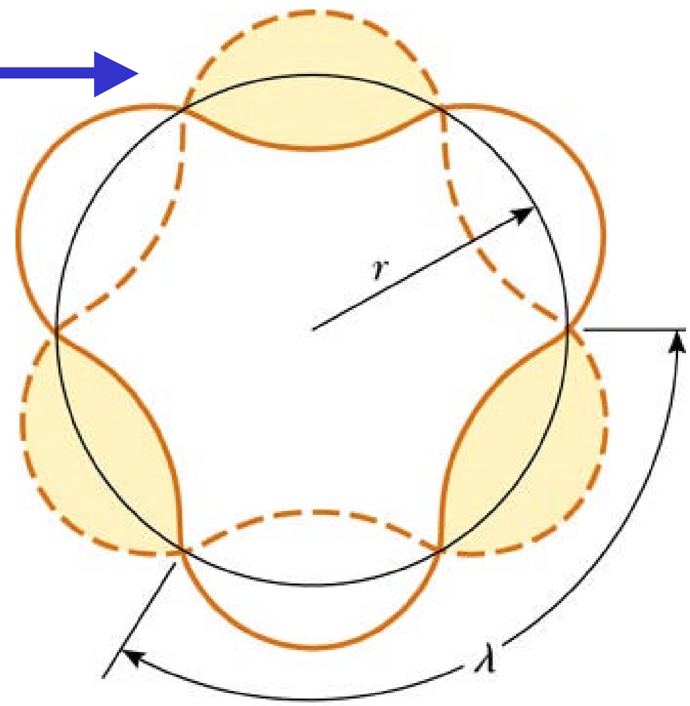

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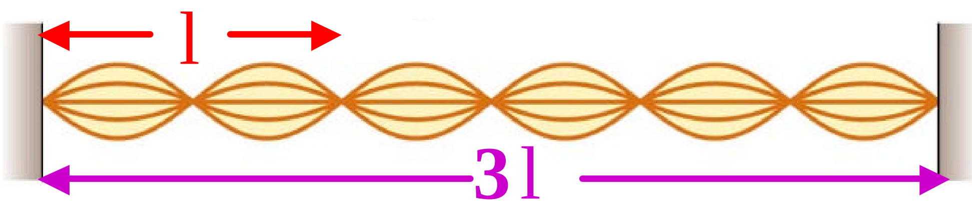

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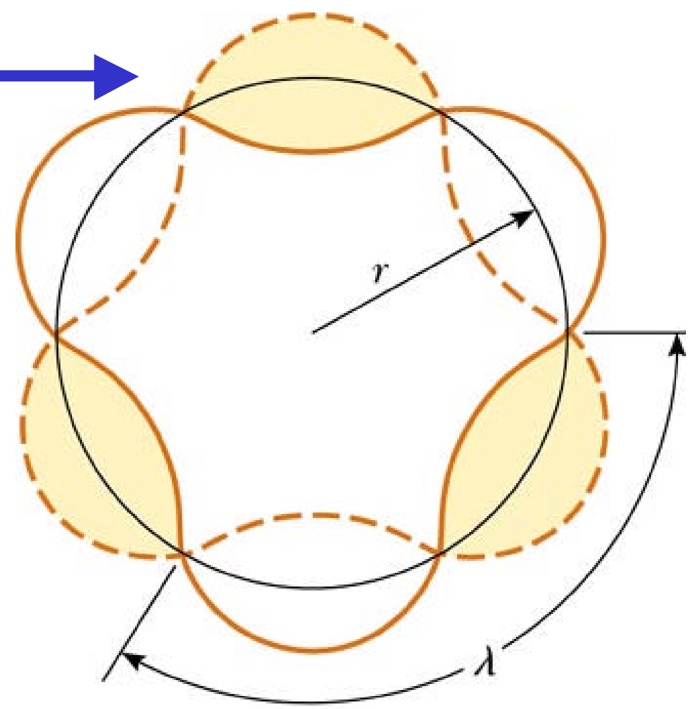

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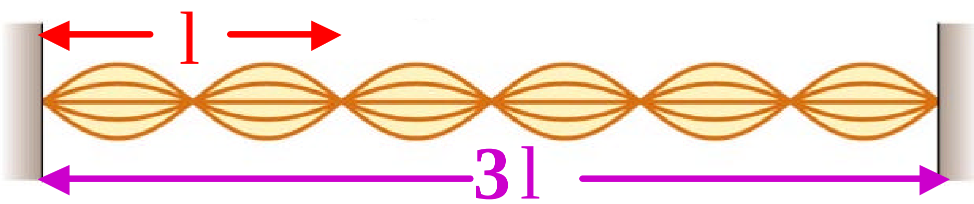

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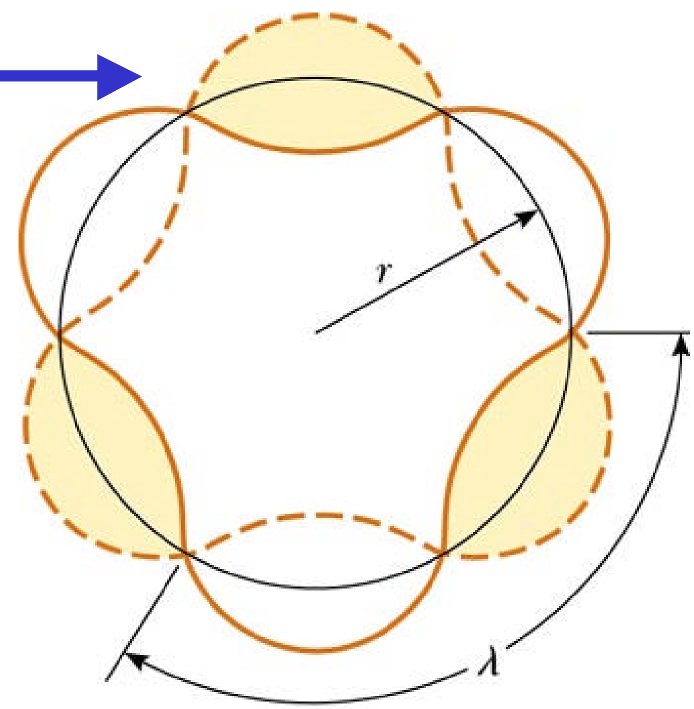

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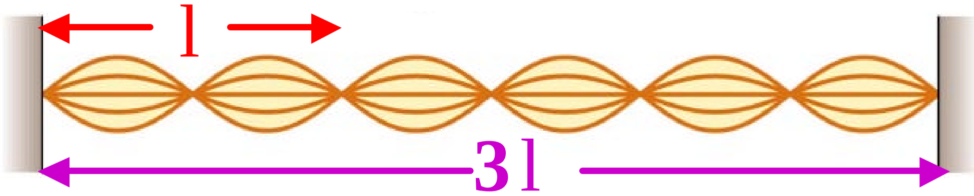

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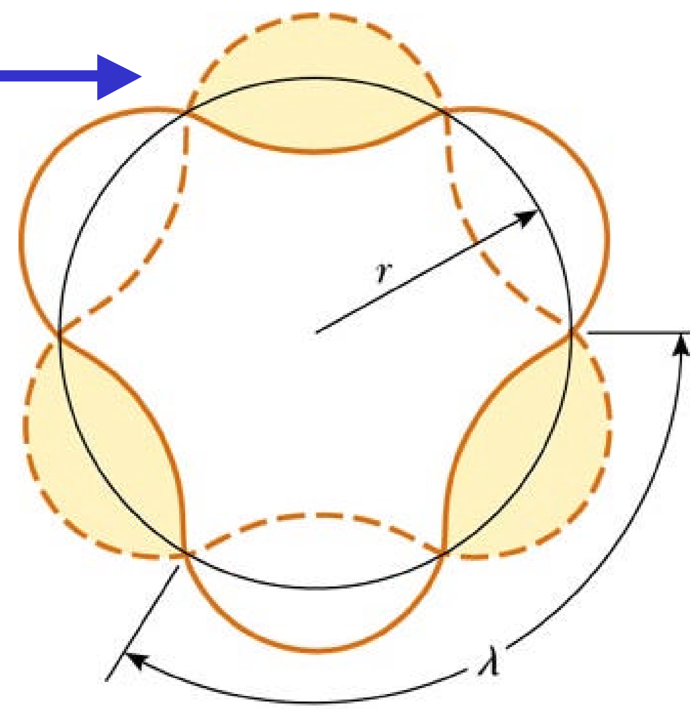

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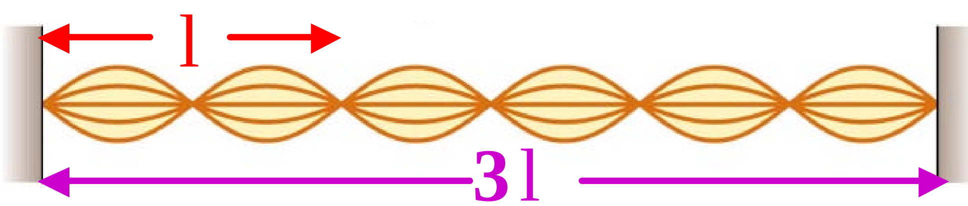

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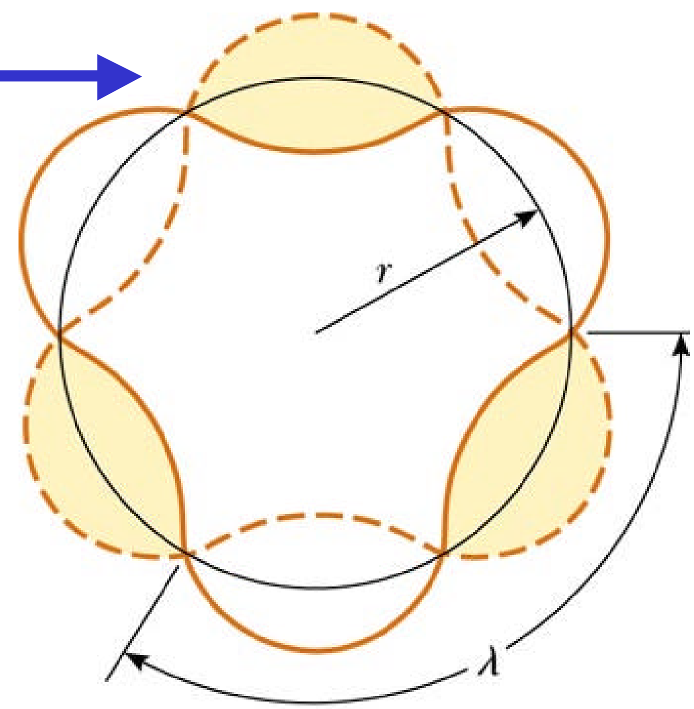

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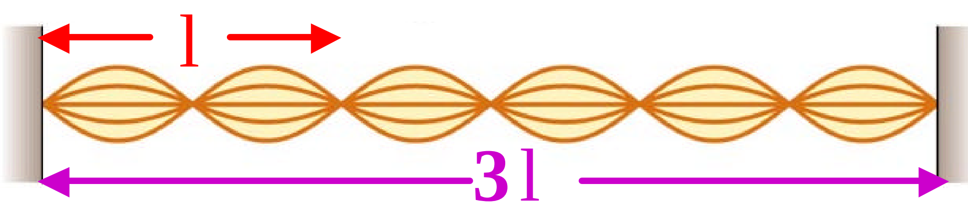

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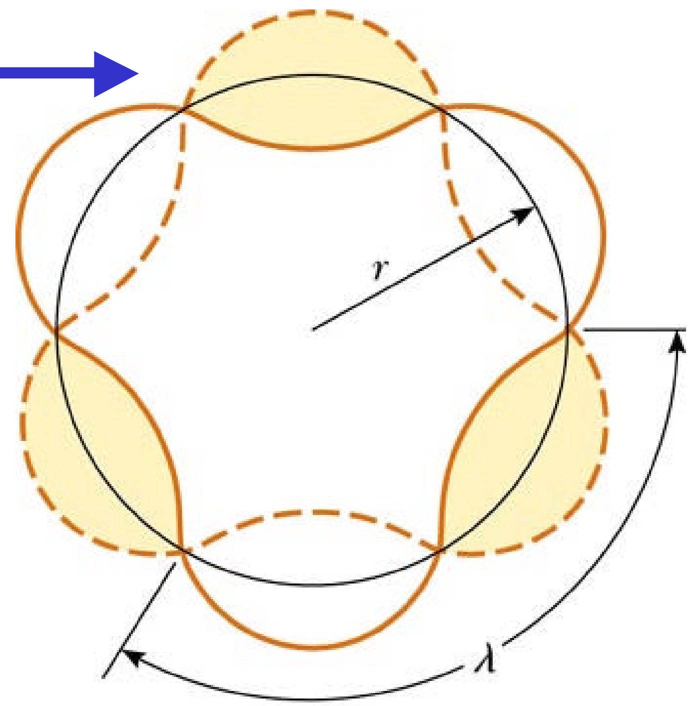

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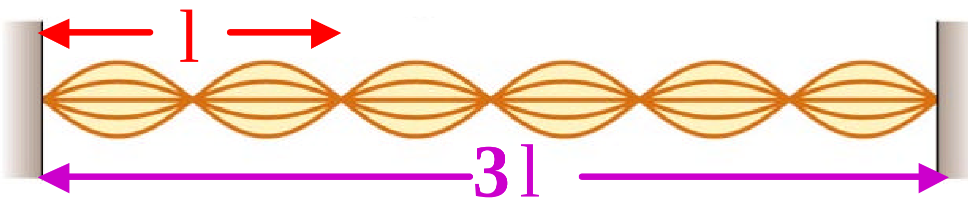

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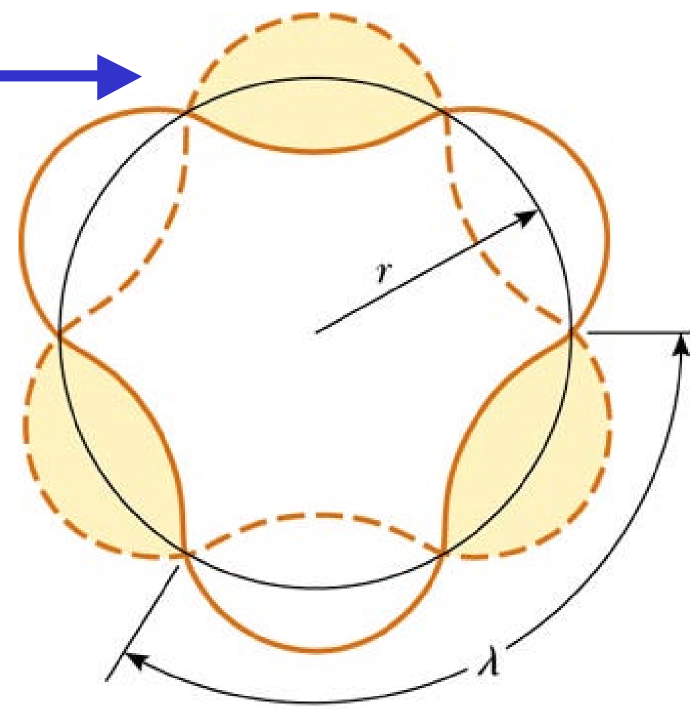

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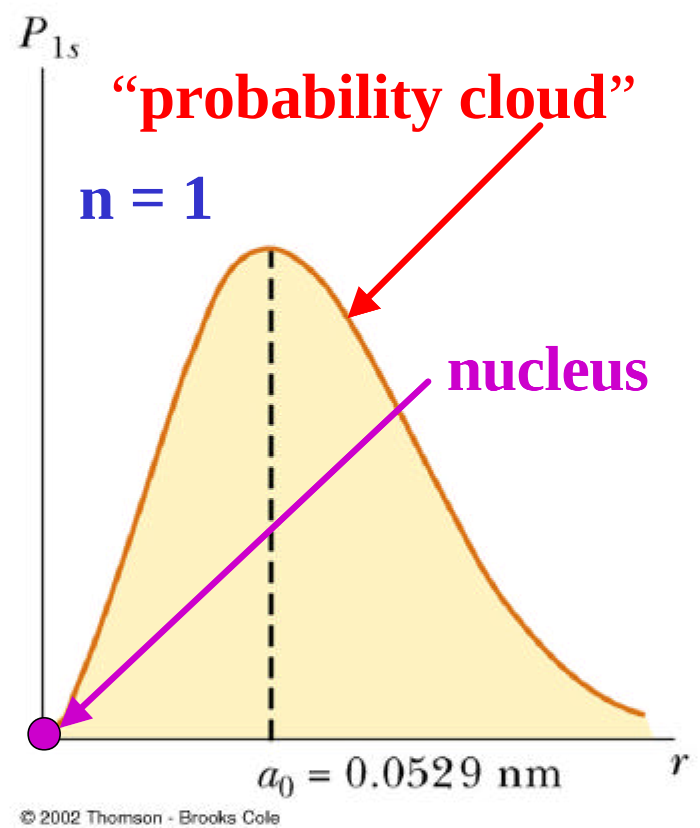

Quantum Mechanics and the Hydrogen Atom (cont.)

Quantum numbers

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Quantum Number	Name	Allowed Values	Number of Allowed States
n	Principal quantum number	$1, 2, 3, \ldots$	Any number
ℓ	Orbital quantum number	$0, 1, 2, \ldots, n-1$	n
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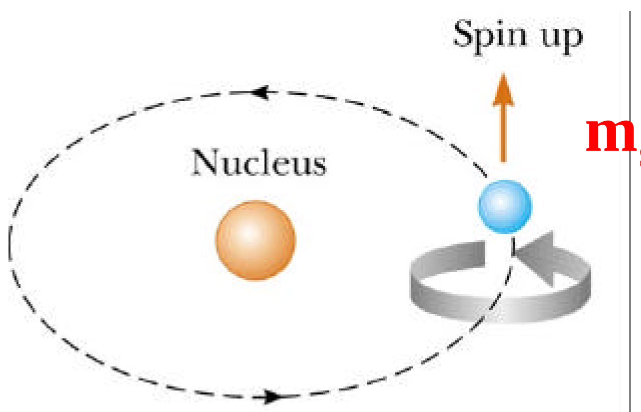

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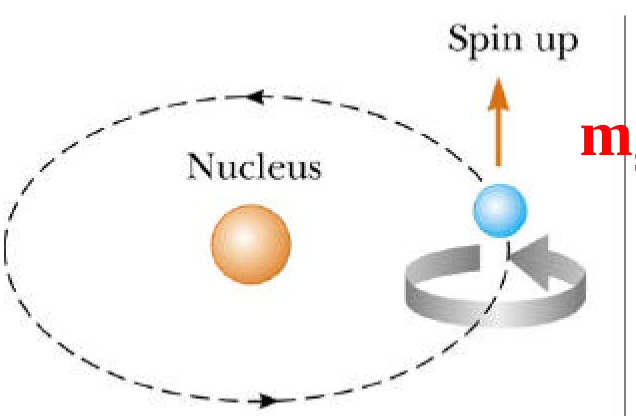

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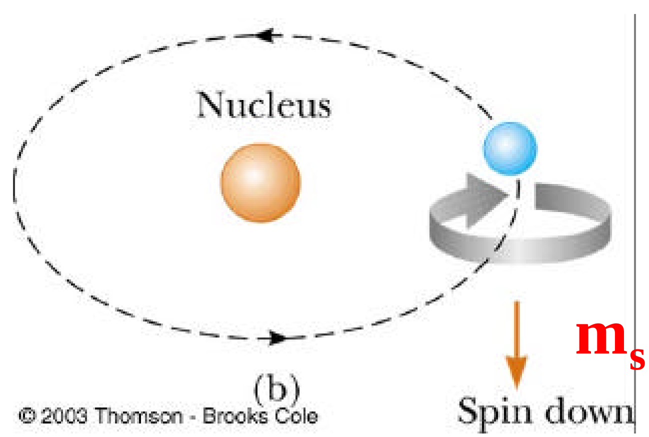

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Pauli Exclusion Principle (1925) and the Periodic Table

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No two electrons in an atom can ever be in the same quantum state; that is, no two electrons in the same atom can have exactly the same value for the set of quantum numbers: **n, *l*, m_l, m_s**.

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TABLE 28.3 Number of Electrons in Filled Subshells and Shells

Shell	Subshell	Number of Electrons in Filled Subshell	Number of Electrons in Filled Shell
K ($n = 1$)	$s(\ell = 0)$	2	2
L ($n = 2$)	$s(\ell = 0)$	2	8
	$p(\ell = 1)$	6	
M ($n = 3$)	$s(\ell = 0)$	2	18
	$p(\ell = 1)$	6	
	$d(\ell = 2)$	10	
N ($n = 4$)	$s(\ell = 0)$	2	32
	$p(\ell = 1)$	6	
	$d(\ell = 2)$	10	
	$f(\ell = 3)$	14	

TABLE 28.4	Electronic Configuration of Some Elements

Z	Symbol	Ground-State Configuration	Ionization Energy (eV)	Z	Symbol	Ground-State Configuration	Ionization Energy (eV)
1	H	$1s^1$	13.595	19	K	[Ar] $4s^1$	4.339
2	He	$1s^2$	24.581	20	Ca	$4s^2$	6.111
				21	Sc	$3d4s^2$	6.54
3	Li	[He] $2s^1$	5.390	22	Ti	$3d^24s^2$	6.83
4	Be	$2s^2$	9.320	23	V	$3d^34s^2$	6.74
5	B	$2s^22p^1$	8.296	24	Cr	$3d^54s^1$	6.76
6	C	$2s^22p^2$	11.256	25	Mn	$3d^54s^2$	7.432
7	N	$2s^22p^3$	14.545	26	Fe	$3d^64s^2$	7.87
8	O	$2s^22p^4$	13.614	27	Co	$3d^74s^2$	7.86
9	F	$2s^22p^5$	17.418	28	Ni	$3d^84s^2$	7.633
10	Ne	$2s^22p^6$	21.559	29	Cu	$3d^{10}4s^1$	7.724
				30	Zn	$3d^{10}4s^2$	9.391
11	Na	[Ne] $3s^1$	5.138	31	Ga	$3d^{10}4s^24p^1$	6.00
12	Mg	$3s^2$	7.644	32	Ge	$3d^{10}4s^24p^2$	7.88
13	Al	$3s^23p^1$	5.984	33	As	$3d^{10}4s^24p^3$	9.81
14	Si	$3s^23p^2$	8.149	34	Se	$3d^{10}4s^24p^4$	9.75
15	P	$3s^23p^3$	10.484	35	Br	$3d^{10}4s^24p^5$	11.84
16	S	$3s^23p^4$	10.357	36	Kr	$3d^{10}4s^24p^6$	13.996
17	Cl	$3s^23p^5$	13.01				
18	Ar	$3s^23p^6$	15.755				

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4	Be		$2s^2$	9.320	23	V		$3d^34s^2$	6.74
5	B		$2s^22p^1$	8.296	24	Cr		$3d^54s^1$	6.76
6	C		$2s^22p^2$	11.256	25	Mn		$3d^54s^2$	7.432
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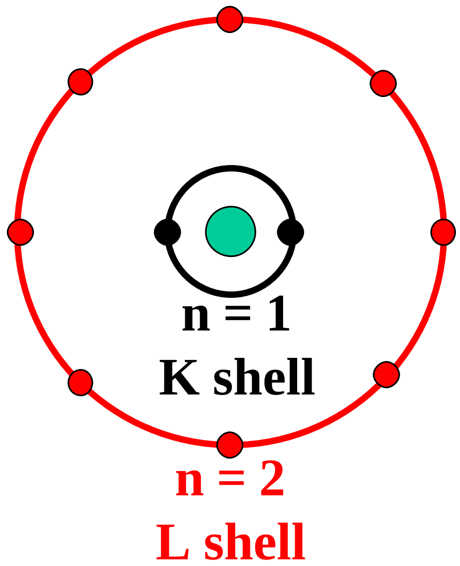
State 1



Characteristic X-rays

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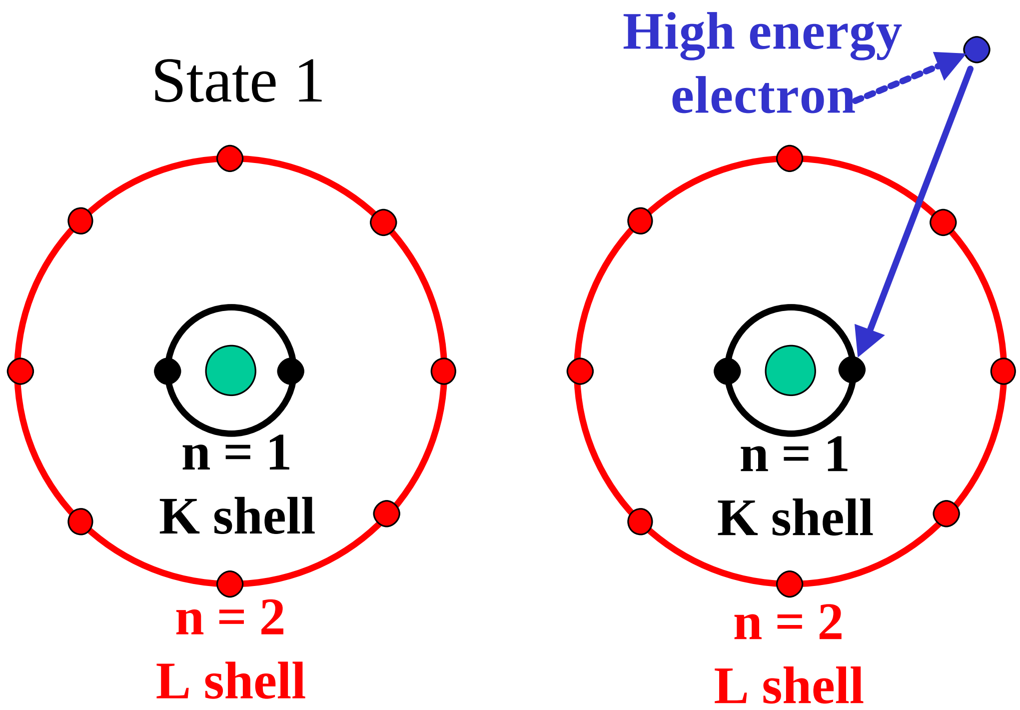

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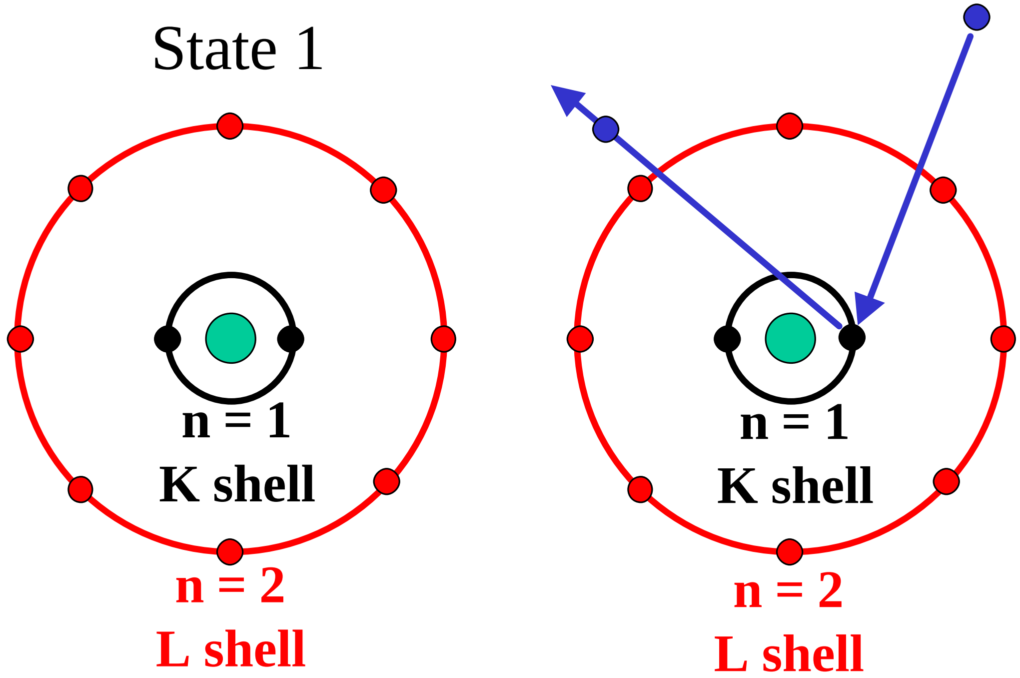

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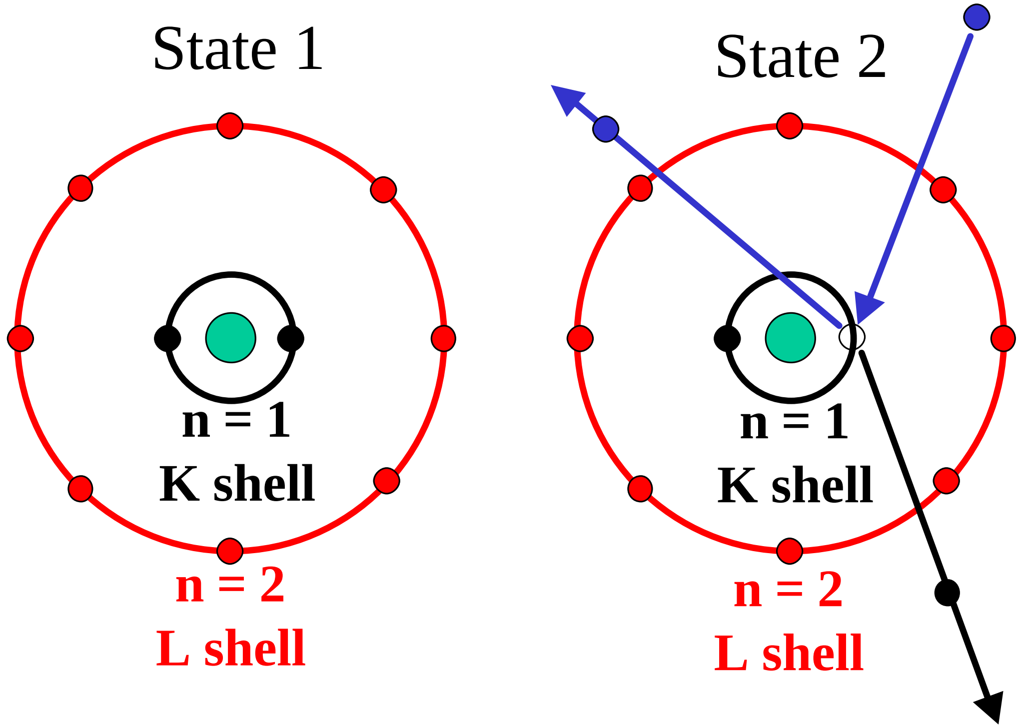

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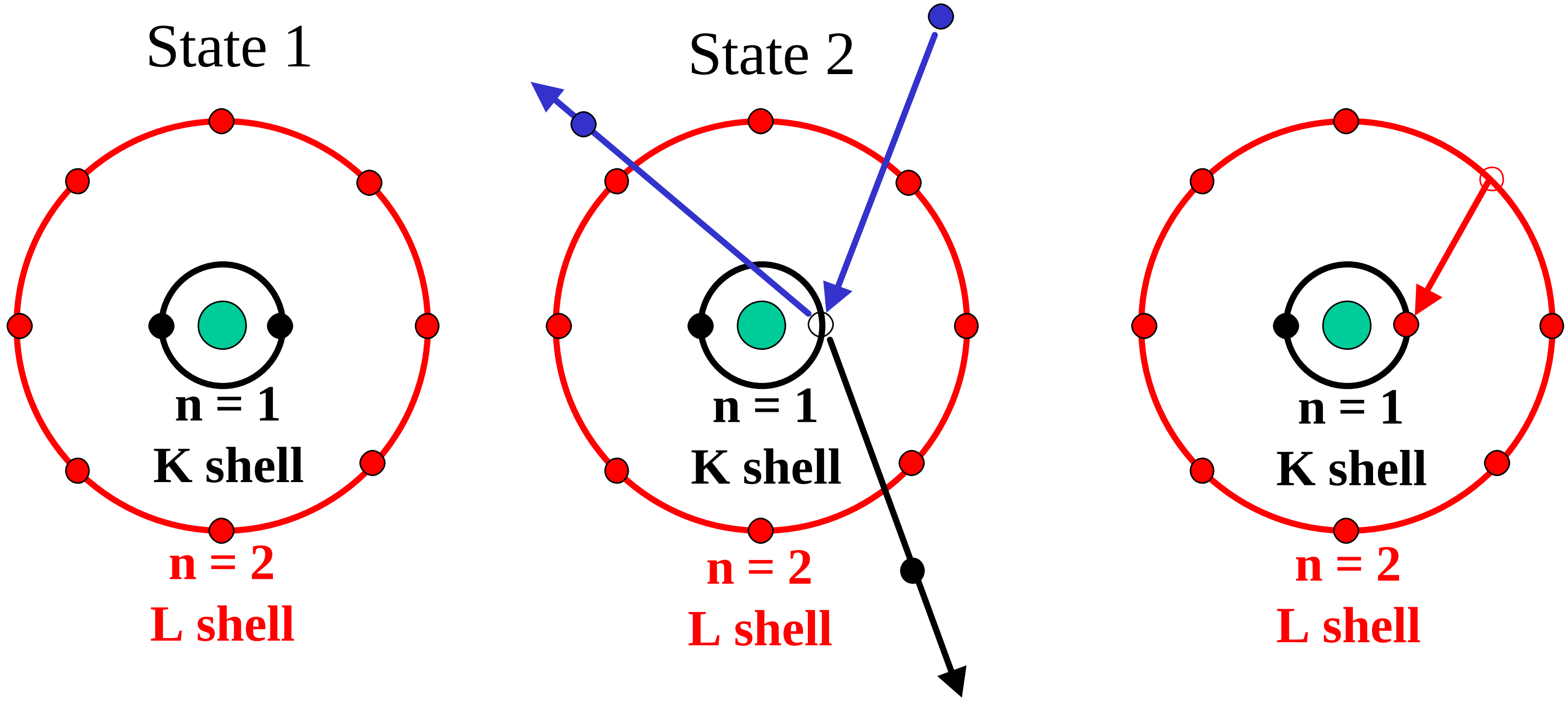

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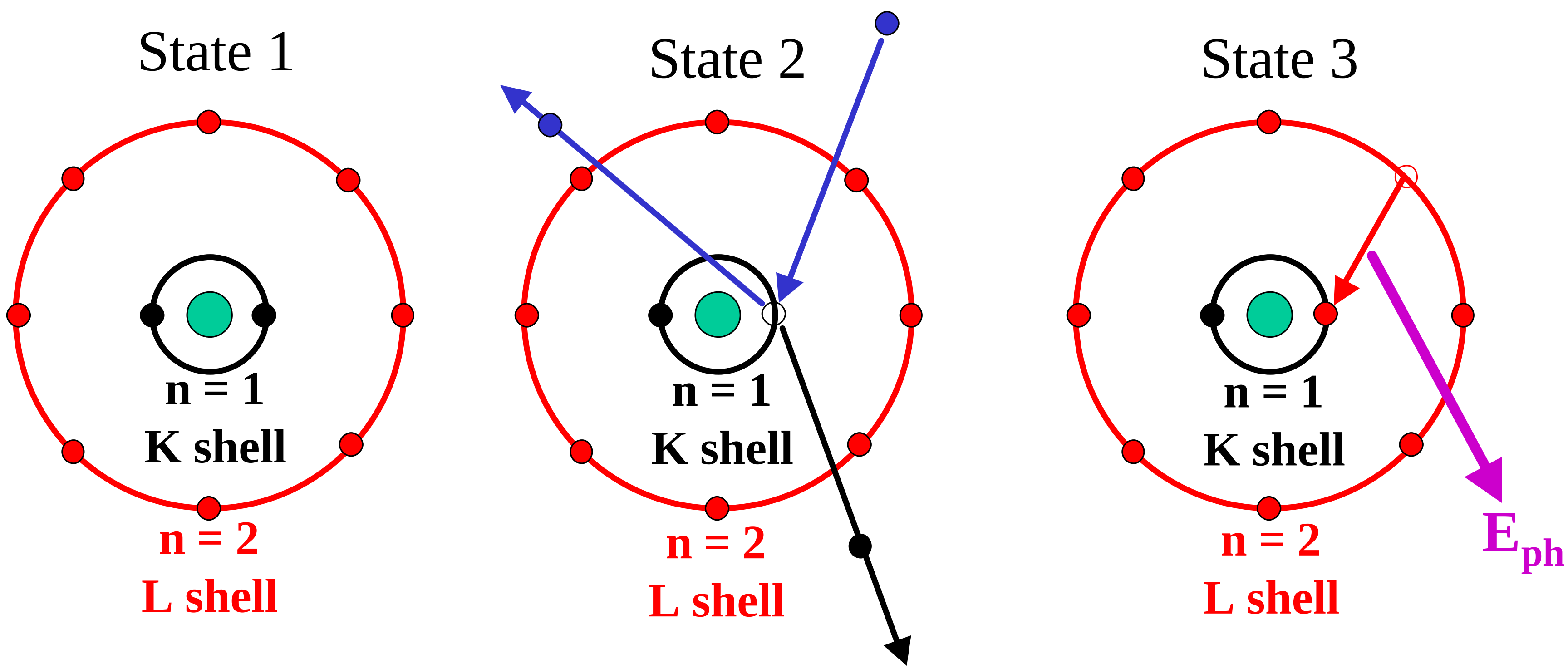

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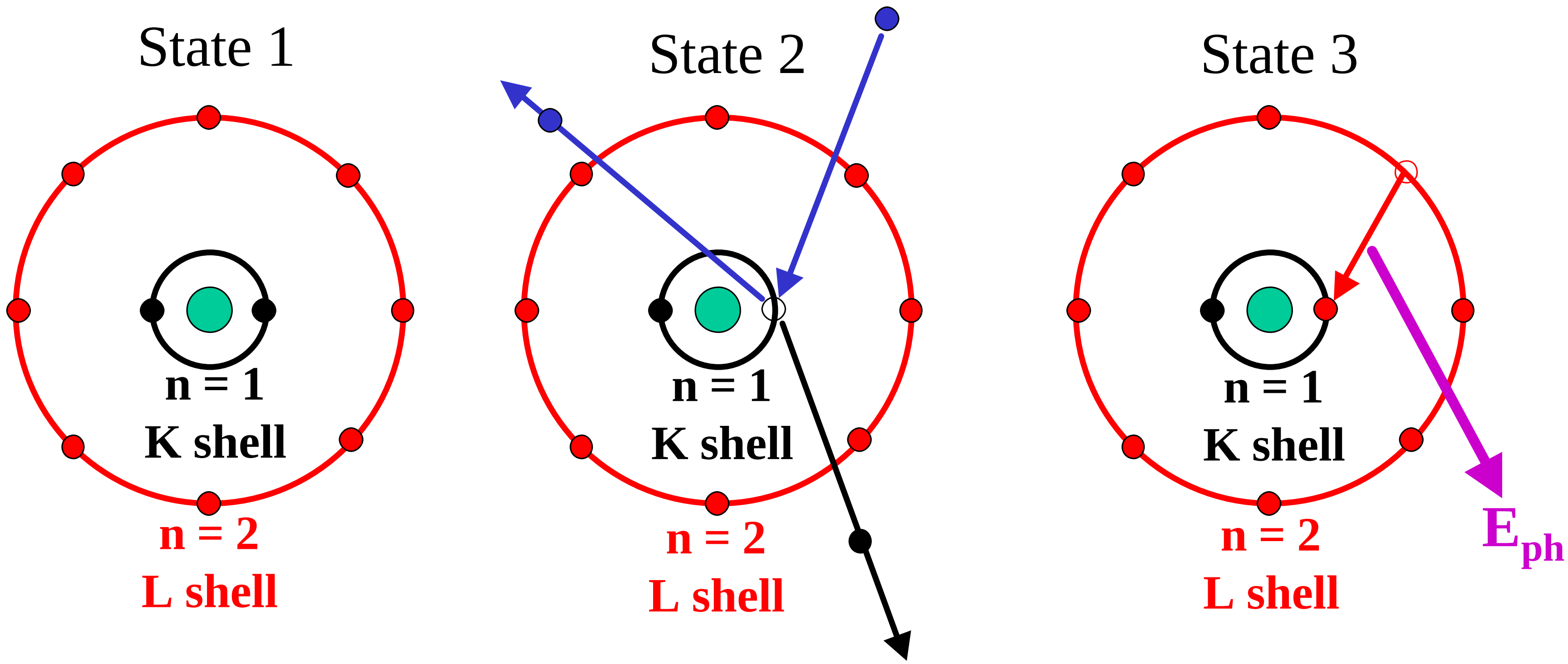

In K shell for State 1, each electron partially shields the other. Thus effective nuclear charge ≡ Z_{eff} = 42 – 1 = 41. In State 2, there is only one electron between L-shell electrons and nucleus, thus Z_{eff} = 42 –1 = 41.

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