## Quantum Mechanics Physics 237

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#### When the wind speed is at least 30 mph .....



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# Spherical coordinates are used to solve the Schrödinger equation.

![](_page_2_Figure_1.jpeg)

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#### Solutions single-electron atom.

Table	7-2	Some E	igenfunctions for the One-Electron Atom	<sup>0.5</sup>
Quantum Numbers				0.4 [] []
n	1	m	Eigenfunctions	
1	0	0	$\psi_{100} = \frac{1}{\sqrt{\pi}} \left(\frac{Z}{a_0}\right)^{3/2} e^{-Zr/a_0}$	$\begin{array}{c c} n = 1 \\ l = 0 \\ 0.2 \\ \end{array}$
2	0	0	$\psi_{200} = \frac{1}{4\sqrt{2\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \left(2 - \frac{Zr}{a_0}\right) e^{-Zr/2a_0}$	0.1
2	1	0	$\psi_{210} = \frac{1}{4\sqrt{2\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \frac{Zr}{a_0} e^{-Zr/2a_0} \cos\theta$	$0 \begin{bmatrix} i \\ k \end{bmatrix} = \begin{bmatrix} k \\ 5 \end{bmatrix} \begin{bmatrix} i \\ 10 \end{bmatrix}$
2	1	±1	$\psi_{21\pm 1} = \frac{1}{8\sqrt{\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \frac{Zr}{a_0} e^{-Zr/2a_0} \sin \theta \ e^{\pm i\varphi}$	$\begin{array}{c} 0.2 \\ 0.1 \\ \hline \\ 0.1 \\ \hline \\ \end{array} \right) = \begin{array}{c} 0.2 \\ n = 2, \ l = 0 \\ 0.01 \\ \hline \\ 0.01 \\ \hline \\ \end{array} \right)$
3	0	0	$\psi_{300} = \frac{1}{81\sqrt{3\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \left(27 - 18\frac{Zr}{a_0} + 2\frac{Z^2r^2}{a_0^2}\right) e^{-Zr/3a_0}$	
3	1	0	$\psi_{310} = \frac{\sqrt{2}}{81\sqrt{\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \left(6 - \frac{Zr}{a_0}\right) \frac{Zr}{a_0} e^{-Zr/3a_0} \cos\theta$	$\begin{array}{c} \mathbf{C} \\ \mathbf{C} \\ \mathbf{R} \\ \mathbf{N} \\ \mathbf{N} \\ 0.1$
3	1	±1	$\psi_{31\pm 1} = \frac{1}{81\sqrt{\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \left(6 - \frac{Zr}{a_0}\right) \frac{Zr}{a_0} e^{-Zr/3a_0} \sin \theta  e^{\pm i\varphi}$	
3	2	0	$\psi_{320} = \frac{1}{81\sqrt{6\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \frac{Z^2 r^2}{a_0^2} e^{-Zr/3a_0} (3\cos^2\theta - 1)$	$0.1 \begin{bmatrix} n = 3, l = 0 \end{bmatrix}$
3	2	±1	$\psi_{32\pm 1} = \frac{1}{81\sqrt{\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \frac{Z^2 r^2}{a_0^2} e^{-Zr/3a_0} \sin\theta\cos\theta  e^{\pm i\varphi}$	
3	2	±2	$\psi_{32\pm 2} = \frac{1}{162\sqrt{\pi}} \left(\frac{Z}{a_0}\right)^{3/2} \frac{Z^2 r^2}{a_0^2} e^{-Zr/3a_0} \sin^2 \theta  e^{\pm 2i\varphi}$	$0.1 \qquad n = 3, l = 1$
				0 5 10 15 20 25

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#### Polar Diagrams.

![](_page_4_Figure_1.jpeg)

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#### l = 3 polar diagrams.

![](_page_5_Figure_1.jpeg)

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#### $m = \pm l$ polar diagrams.

![](_page_6_Figure_1.jpeg)

#### 3D views of the probability density.

![](_page_7_Figure_1.jpeg)

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### 4 Minute 38 Second Intermission.

- Since paying attention for 1 hour and 15 minutes is hard when the topic is physics, let's take a 4 minute 38 second intermission.
- You can:
  - Stretch out.
  - Talk to your neighbors.
  - Ask me a quick question.
  - Enjoy the fantastic music.

![](_page_8_Picture_7.jpeg)

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#### Orientations of L.

![](_page_9_Figure_1.jpeg)

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# **ENOUGH FOR TODAY?**

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