Quantum numbers

BIOPHYSICS 1 LECTURE

2018. SEPT. 18.

László Grama
QUANTUM MECHANICAL MODEL OF THE ATOM

Schrödinger
wave function - $\Psi$ (psi)

$\Psi^2$ - probability of finding an e\textsuperscript{-} in a point

\[ \Psi^2 \]

Bohr

Schrödinger

Bohr radius

distance from nucleus

\[ 0 \]

\begin{align*}
\Psi_1 \\
\Psi_2
\end{align*}

pattern of e\textsuperscript{-}
QUANTUM NUMBERS - they define (quantize) quantities

1. principal \( (n) \)

\[ E_n = \frac{E_1}{n^2} \]

Angular momentum

- magnitude

\[ L = mvr \]

2 types

1. ORBITAL rotation around nucleus
2. SPIN rotation around itself
<table>
<thead>
<tr>
<th>Quantum number</th>
<th>Quantity it defines</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 orbital</td>
<td>magnitude of ( L )</td>
</tr>
<tr>
<td>3 magnetic</td>
<td>direction of ( L )</td>
</tr>
<tr>
<td>spin</td>
<td>magnitude of ( S )</td>
</tr>
<tr>
<td>spin magnetic</td>
<td>direction of ( S )</td>
</tr>
</tbody>
</table>
**WHY MAGNETIC?**

- **magnetic field**

- **e-**

---

**Spins in a magnetic field**

- **external magnetic field**

- **+ 1/2 → lower E**
  - **E ↓ no magn. field**
  - **magn. field**
  - **-1/2 → higher E**

- **not exactly**

---

**ground state**