Quantum Mechanic Basics

Experiments

Electron Diffraction
Matter Waves
It Was Probably Heisenberg
Spreading Wave Packets
Exploring Quantum Tunneling
Wave Functions and Their Interpretations
The Shape of the Wave Function
Sketching Wave Functions 1
Sketching Wave Functions 2
Sketching Wave Functions 3
Wave Functions and Their Energies in Atoms
Bound States and Their Binding Energies
Discrete Energy Levels in Bound States: Numerical Solutions

Equipment List

Electron Diffraction

For each group:

1 - laser
1 - double slit
1 - screen or blank paper for viewing diffraction patterns

For the class:
1 - electron diffraction apparatus.

The preferred arrangement would be one electron apparatus per group. However, because of the expense we recommend that each group do the experiment when the apparatus is available.

If you do not have the apparatus, you can use the video on Physics: Cinema Classics, Side F (Ztek, Lexington, KY) or the QuickTime VR movie available from Jürgen Kerstein (http://bifrost.physik.tu-berlin.de/ibe/index.html)

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Wave Functions and Their Energies in Atoms

Bound States and Their Binding Energies

Oscillator
String

See Figures 1 and 2.

Discrete Energy Levels in Bound States: Numerical Solutions

References

Electron Diffraction

Beiser, 1995 - Chapter 3.5
Blatt, 1992 - Chapter 6.2
Harris, 1998 - Chapter 3.1
Krane, 1996 - Chapter 4.1
More, 1998 - Q5.6
Rohlf, 1994 - Chapter 5.2
Sandin, 1989 -
Serway et al., 1997 - Chapter 4.2, 4.7
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 - Chapter 5.2

Matter Waves

Beiser, 1995 -
Blatt, 1992 -
Harris, 1998 - Chapter 4
Krane, 1996 - Chapter 4
More, 1998 -
Rohlf, 1994 -
Sandin, 1989 -
Serway et al., 1997 -
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 -

It Was Probably Heisenberg

Beiser, 1995 - Chapter 3.7 - 3.9
Blatt, 1992 - Chapter 6.4
Harris, 1998 - Chapter 3.4 - 3.6
Krane, 1996 - Chapter 4.2, 4.3
More, 1998 - Q7.6
Rohlf, 1994 - Chapter 5.4, 5.5
Sandin, 1989 - 10.3, 10.4
Serway et al., 1997 - Chapter 4.4, 4.5
Thornton & Rex, 2000 - Chapter 5.7
Tipler & Llewellyn, 1999 - Chapter 5.5, 5.6

Spreading Wave Packets

Beiser, 1995 -
Blatt, 1992 -
Harris, 1998 - Chapter 4
Krane, 1996 - Chapter 4
More, 1998 -
Rohlf, 1994 -
Sandin, 1989 -
Serway et al., 1997 -
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 -

Exploring Quantum Tunneling

Beiser, 1995 -
Blatt, 1992 -
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Wave Functions and Their Interpretations

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The Shape of the Wave Function

Beiser, 1995 -
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More, 1998 -
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Sandin, 1989 -
Serway et al., 1997 -
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 -

Sketching Wave Functions 1

Beiser, 1995 -
Blatt, 1992 -
Harris, 1998 -
Krane, 1996 -
More, 1998 -
Rohlf, 1994 -
Sandin, 1989 -
Serway et al., 1997 -
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 -

Sketching Wave Functions 2

Beiser, 1995 -
Blatt, 1992 -
Harris, 1998 -
Krane, 1996 -
More, 1998 -
Rohlf, 1994 -
Sandin, 1989 -
Serway et al., 1997 -
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 -

Sketching Wave Functions 3

Beiser, 1995 -
Blatt, 1992 -
Harris, 1998 -
Krane, 1996 -
More, 1998 -
Rohlf, 1994 -
Sandin, 1989 -
Serway et al., 1997 -
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 -

Wave Functions and Their Energies in Atoms

Beiser, 1995 -
Blatt, 1992 -
Harris, 1998 -
Krane, 1996 -
More, 1998 -
Rohlf, 1994 -
Sandin, 1989 -
Serway et al., 1997 -
Thornton & Rex, 2000 -
Tipler & Llewellyn, 1999 -