BY: Amanda Gunning and Ram Avni
North Rockland High School
Middle College High School

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SMART Science and Mechatronics Aided Research for Teachers 2003—2005
What is Mechatronics?

- Combines various fields of engineering to build "smart" machines
Need for New Instructional Tools

- Modern Physics is abstract
- A plethora of demonstrations for other physics topics
- Hands-on activities engage students
Project Goals

- To address three skills that students learn
- To make the topic interesting and engaging
- To actively involve students
New York Standards

- STANDARD 1—Analysis, Inquiry, and Design. Mathematical Analysis
- STANDARD 4—The Physical Setting
- STANDARD 6—Interconnectedness: Common Themes
- STANDARD 7—Interdisciplinary Problem Solving
Theory

- Bohr model

- Absorption and emission spectra

Examples of emission and absorption spectra

Examples of energy levels proposed by Neils Bohr
Quantum Leap

Allows Students to:
- Move the “electron”
- Determine the energy emitted or absorbed
- Determine the related frequency of light
- See the emission or absorption “spectra”
Project Design

- **Sensors**: photoresistors detect electron location

- **Microcontroller**: Interpret sensors’ output and determines spectra and energy value

- **Actuators**: LEDs and servo motor receive information from BS2 and display output
Parts and Components

- LEDs
- Transistors
- Fiber Optics
- Servo Motor
- Electron Wand
- BOE with BS2
- Photoresistors
- 2 Layers of Plexiglass
Program Logic

A. Electron Location Detection
B. Calculating Spectra Lines
C. Energy Level Detection
Lesson Plans/Class Activities

- The most stable condition of an electron is called the _______ state.

- Predict whether you would see absorption or emission spectra when an electron moves from $n = 2$ to $n = 4$. 
Conclusions and Next Steps

- SMART project – extraordinary training tool
- Empowering science teachers and students
- Grants to expand/develop/implement more programs
- Continuous feedback starting October 2004
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