



Interactive Simulations

<http://phet.colorado.edu>

Exploring Easy and Effective Ways to Use PhET's Web-Based Interactive Simulations

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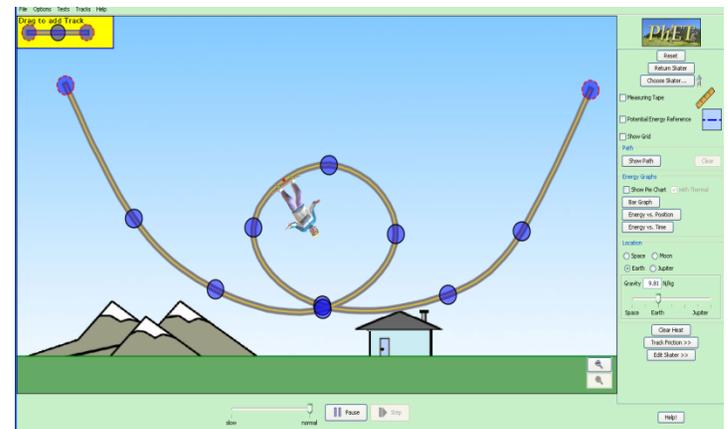


*TIE Conference
Copper Mountain, CO
June 24, 2009*



Workshop Goals

- What are PhET simulations and who creates them?
- How can PhET simulations help students learn?
- Explore the simulations and activities
- Plan for use in your school



Who are we?

**University Faculty, Post-docs, HS Teachers,
Computer Developers**



What we do: Build and study new tools (simulations) and approaches for helping students and teachers improve science learning.

PhET Funding and Collaborations



Collaborative agreement
with King Saud University



NSF



Kavli Foundation



Hewlett Foundation



University of Colorado



Carl Wieman and
Sarah Gilbert

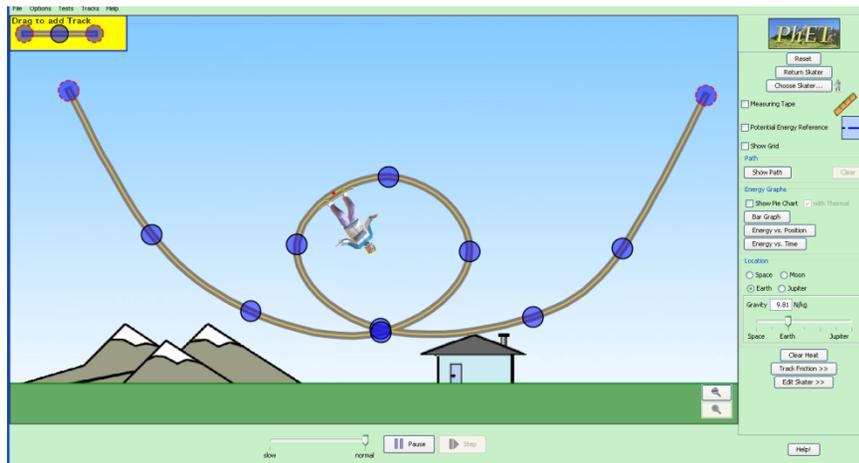


Interactive Simulations Demonstration

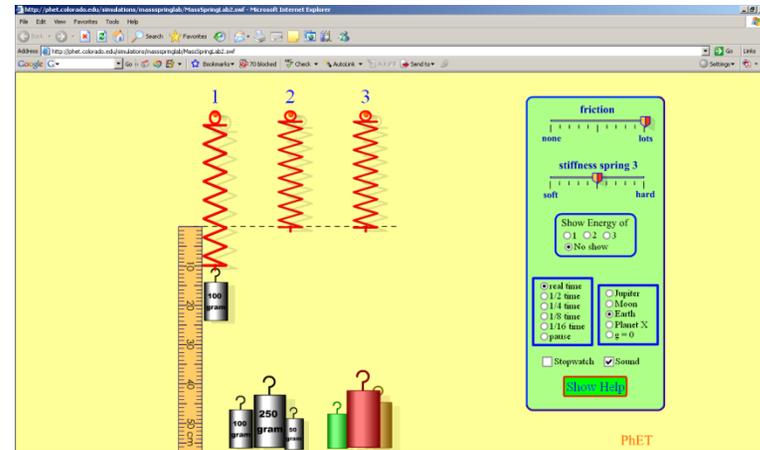
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PhET Design

Skate Park

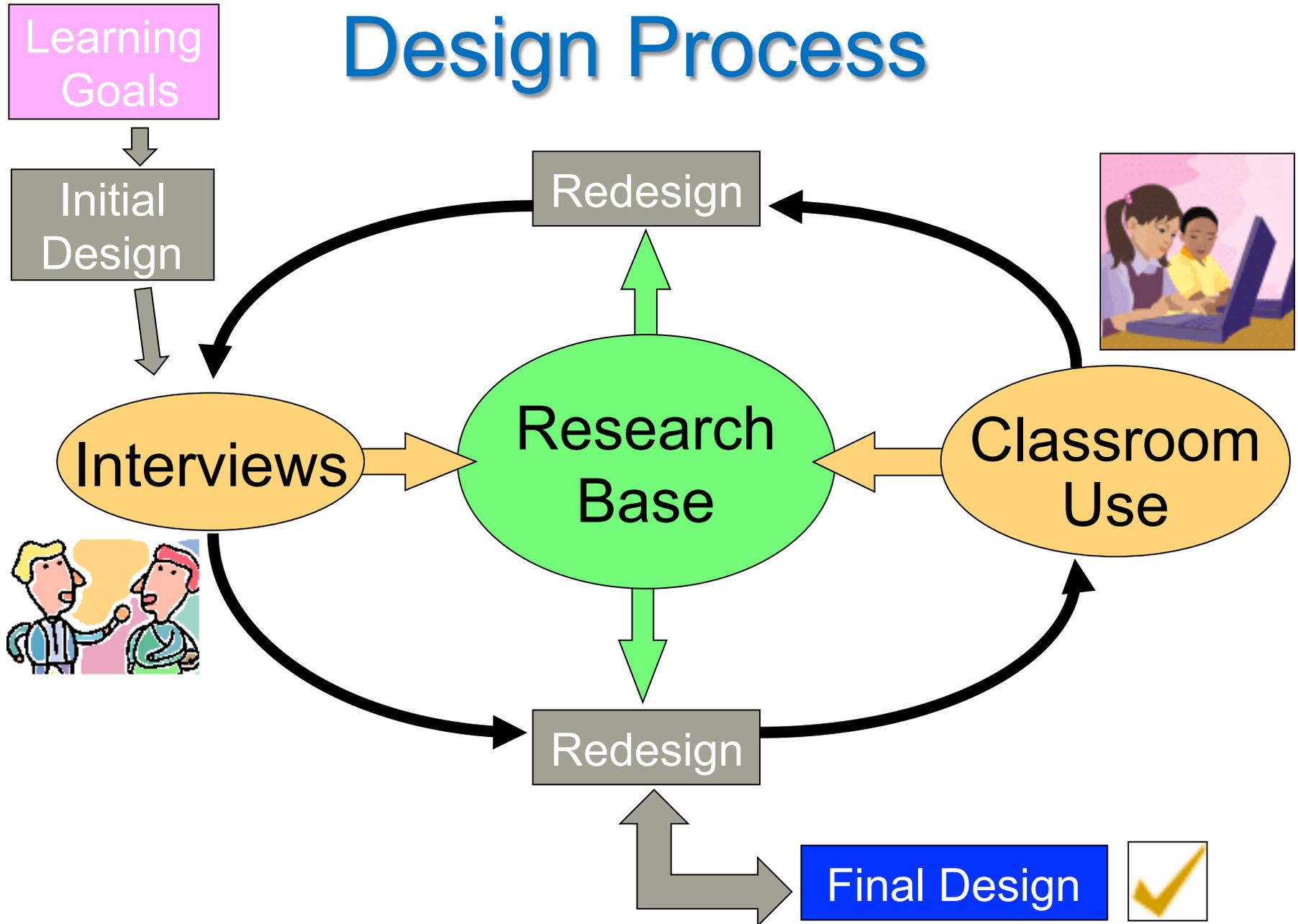


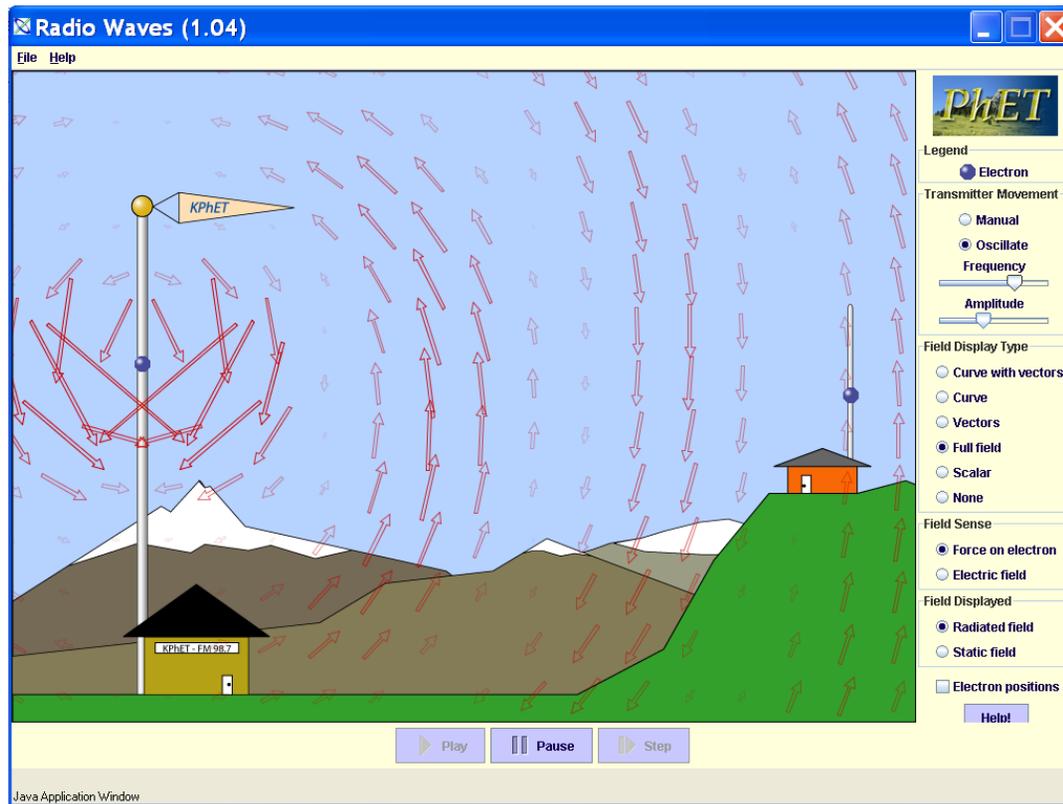
Masses and Springs:



What makes these PhET sims particularly effective educational tools?

Design Process





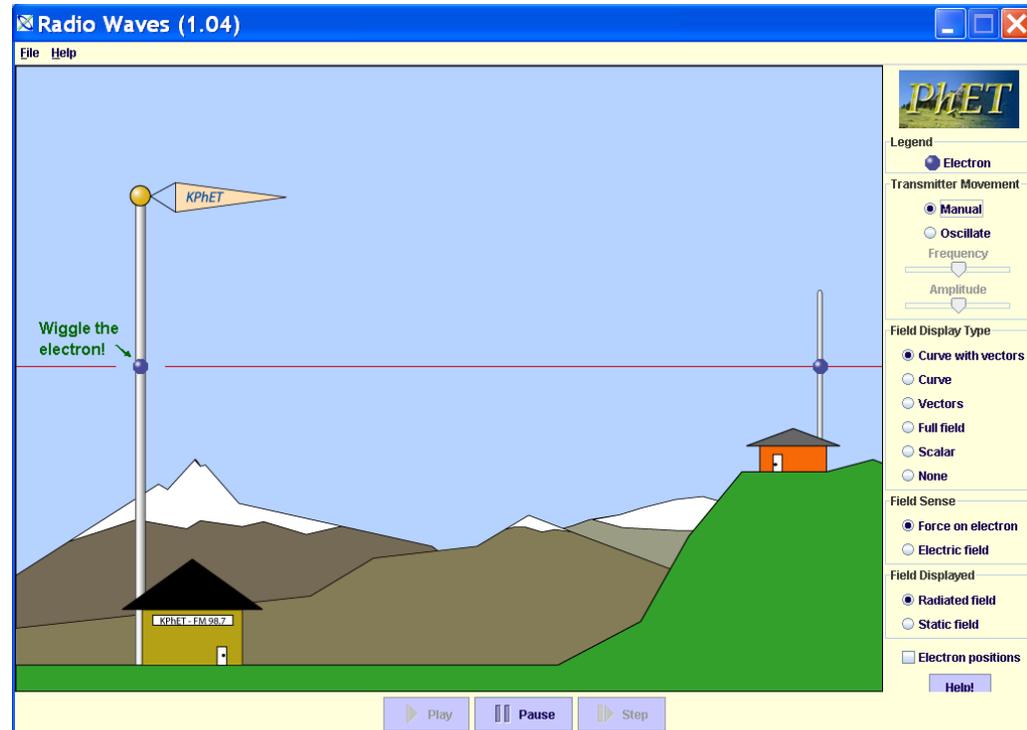
What is revealed
by interview
studies?

Radio waves.
Initial startup.

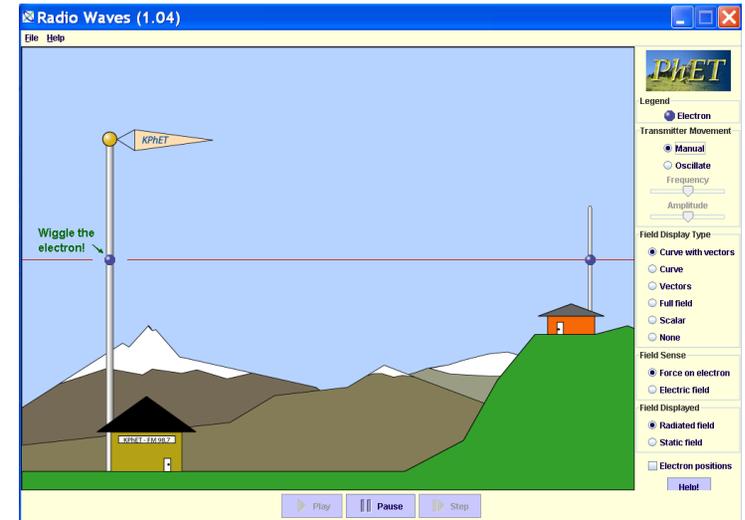
Experts- - really like.
Students--Watch without interacting.
Don't like. Misinterpret

Start with curve view. Students manually move electron, then later move to full field view.

Results:
The students manipulate, like, and correctly interpret.



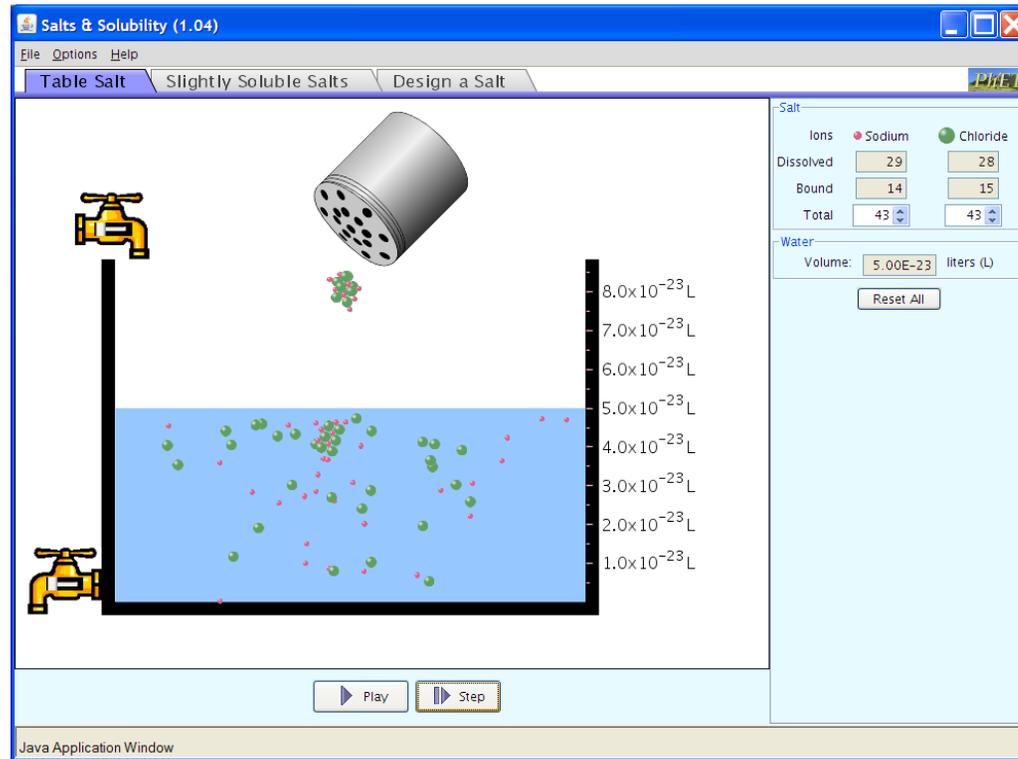
Why starting this way works so much better?



Matches research on learning:

- Cognitive demand.
- Construction of understanding
- Interactivity
- Shows expert models

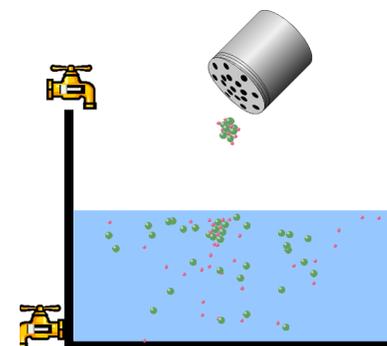
Soluble Salts: Group Input



*What learning goals does this sim support?
How could you use this sim or similar sims
in a course?*

What might students learn in each activity?

What will students be doing in each activity?



Add 100 silver bromide pairs to the water. How many silver and bromide ions dissolve in the water? Repeat this for all salts.

Investigate different salts. What features do salts have in common, and how do salts differ from each other?

PhET Inquiry Guidelines

Research Based

- ✓ Specific learning goals
- ✓ Students reason and make sense
- ✓ Connect to students' knowledge
- ✓ Connects to students' experiences
- ✓ Collaborative activities
- ✓ Minimal directions
- ✓ Students self-check understanding

Practice Using the PhET Inquiry Guidelines

Variety of Uses

Pre-class or pre-lab Activity

Lecture/classroom

Visual Aids, Interactive Lecture Demos, &
Concept tests

Labs/Recitations

Group activities

Homework

Time to Play with Sims

- **What sim do you think would be useful in your course?**
- **Why do you think it would be an effective learning tool?**

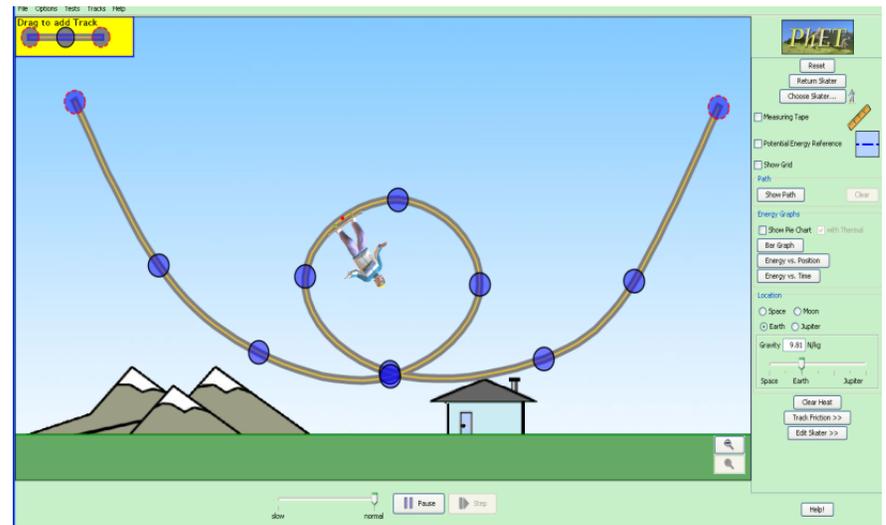
Teacher Ideas & Activities

- Over 90 activities posted by PhET team
- Search by sim, keyword, level, type of activity
- Look for “GOLD STAR” activities that are inquiry
- Share your activities with other teachers

Omit? Examples are available for this workshop on the electronic PhET folder on conference computers, the PhET USB drives, or the TIE wiki

Time to Work with Activities

- Explore activities
- Plan for use in your school by writing or adapting



Pairs Report Out

Tell us about one simulation that you plan to use.

How do you plan to use the sim?

Thanks for Participating

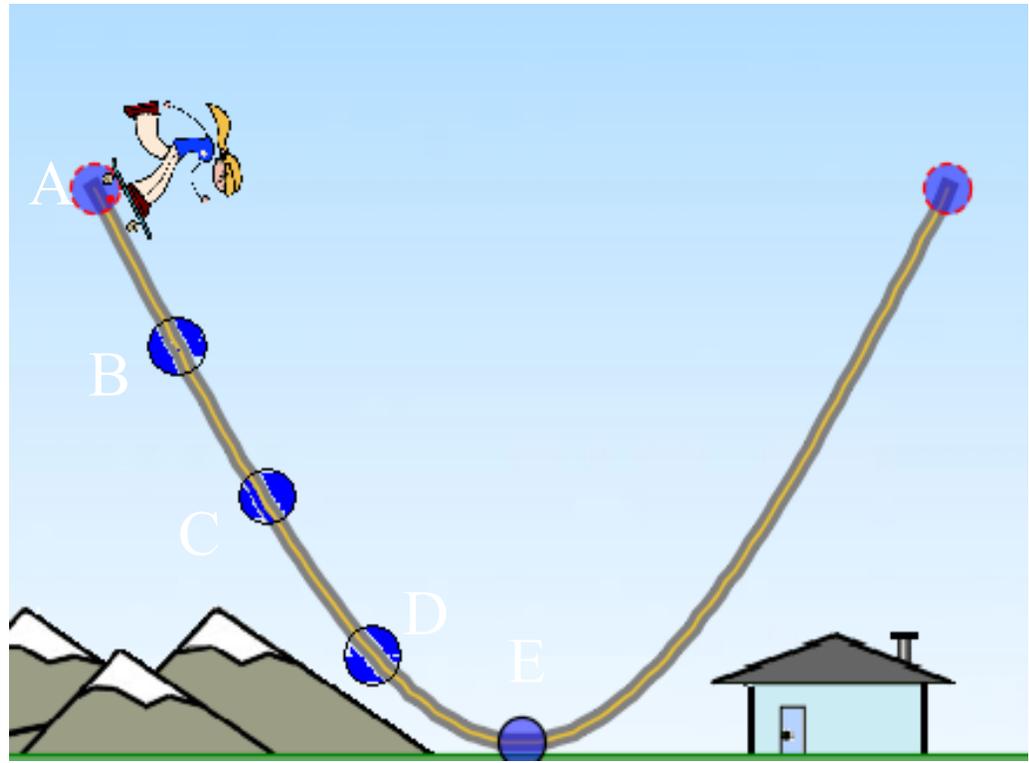
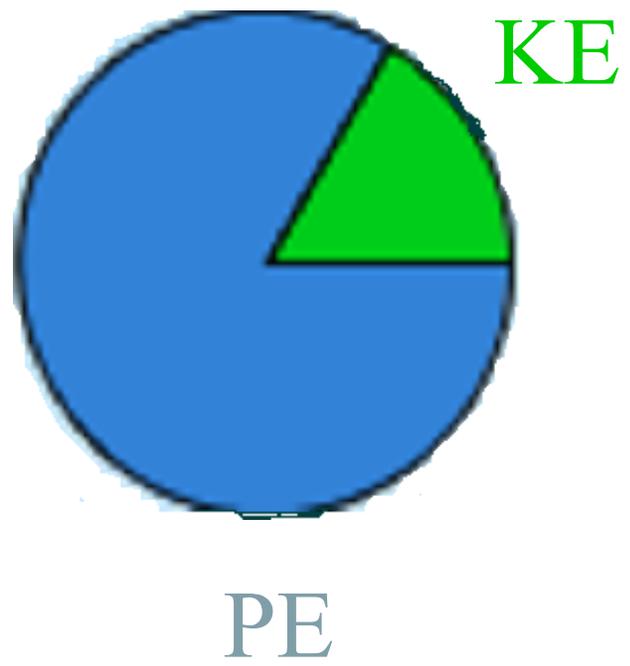
For questions or to submit ideas
Email: phethelp.colorado.edu



The slides that follow are ideas for using the sims in different ways.

Concept tests

The pie graph shows the energy of the Skater, where could she be on the track?



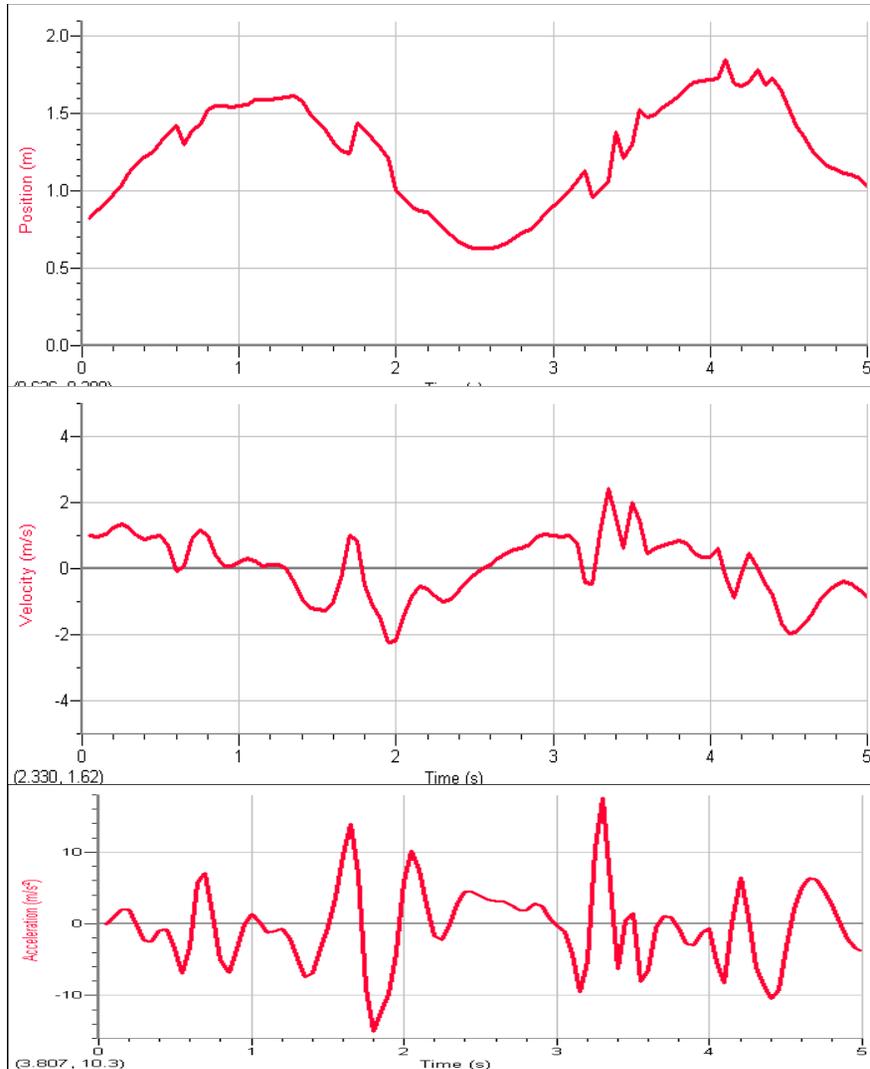
Simulation Extends Lab Concepts

Qualitative lab: Use the motion probe to graph position and velocity of some motion, also make motions to fit given graphs

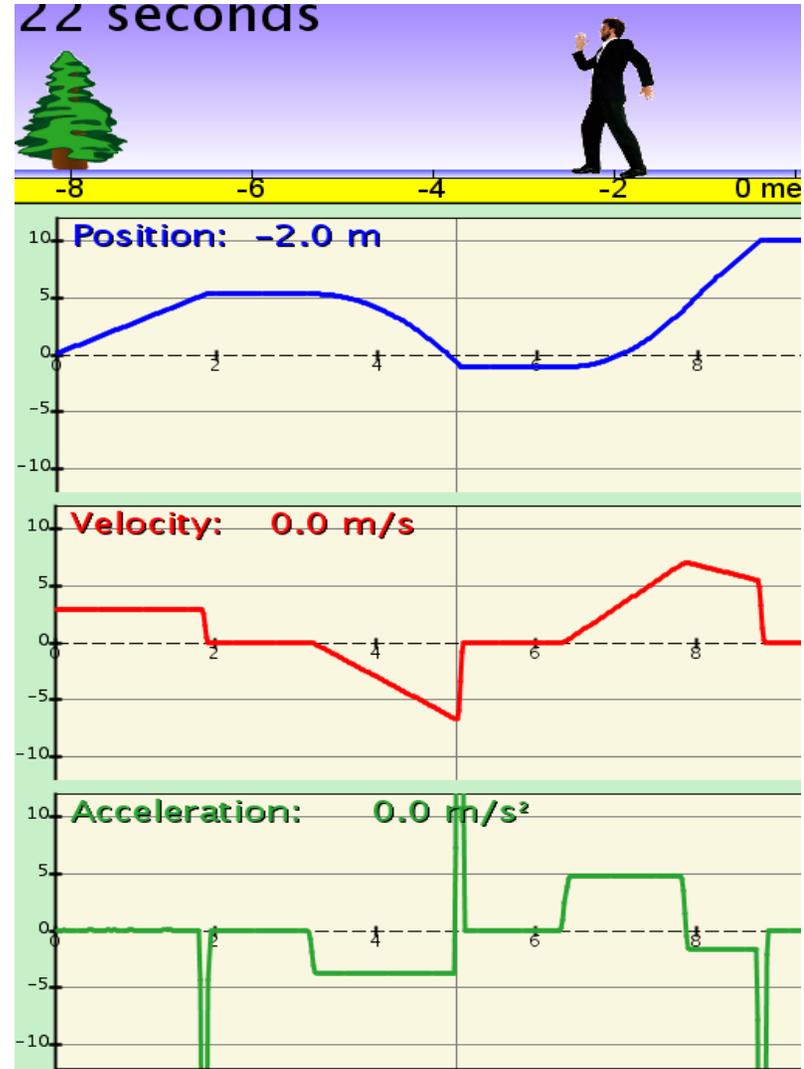
Quantitative lab: Use Moving man to accurately interpret and draw position, velocity and acceleration graphs for common situations and explain reasoning.

Simulation Extends Lab Concepts

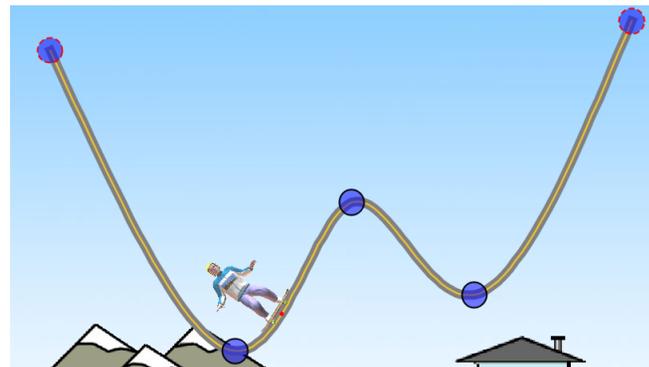
Vernier Labpro



Moving Man



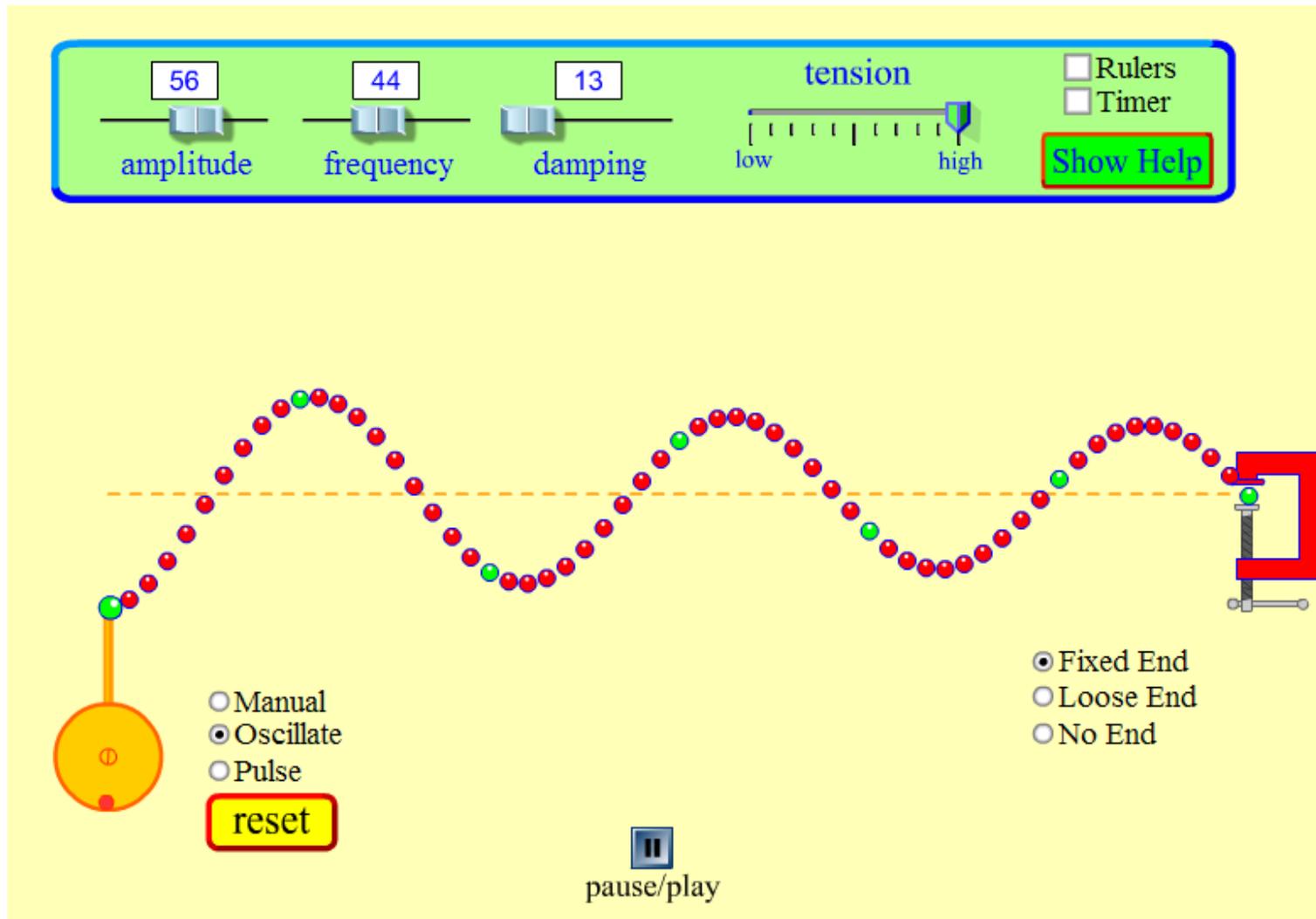
Enables Inquiry Labs



Energy Skate Park

- Multiple variables, but easily isolated
- Easy to repeat experiments
- Variables beyond classroom
- Multiple representations
- Relates to students experiences

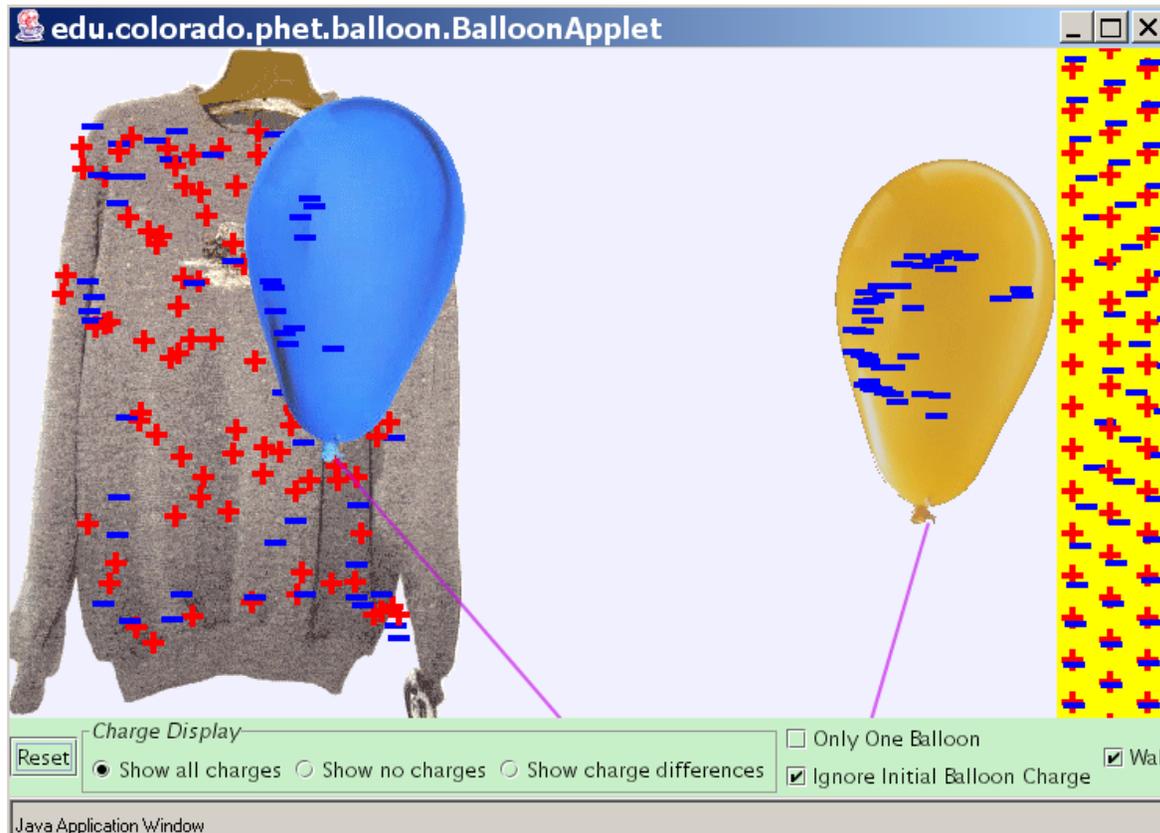
Demonstration in Slow Motion



Demo Scientific Model

Electrostatics – Traditional balloon demos

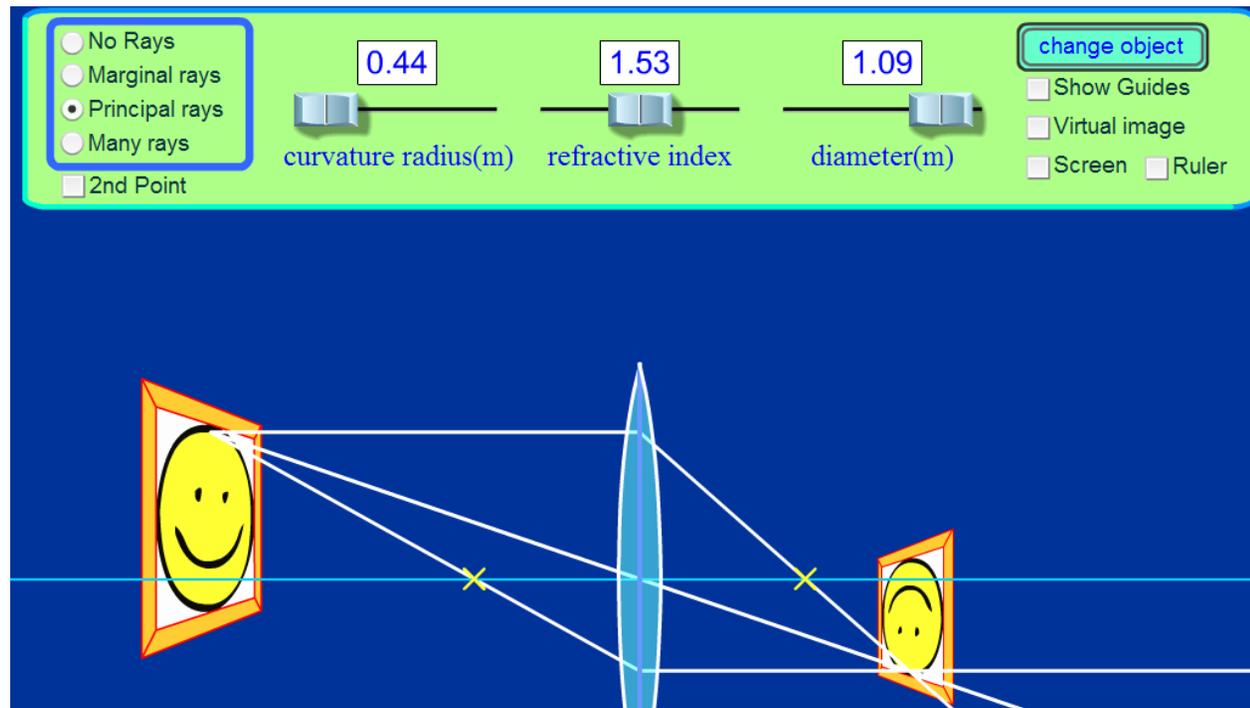
- Charge transfer, Coulomb attraction, Polarization



Simple,
but effective

Recitation or homework

Challenge: Use the simulation to see how the design of a lens effects how it works.



No lab equipment required!!