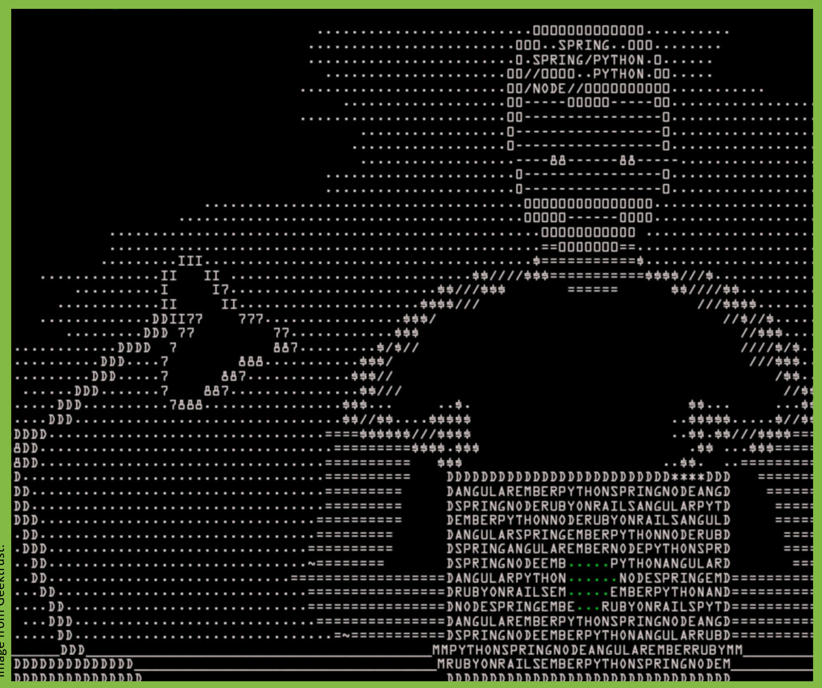

VPython coding challenges for calculus-based physics

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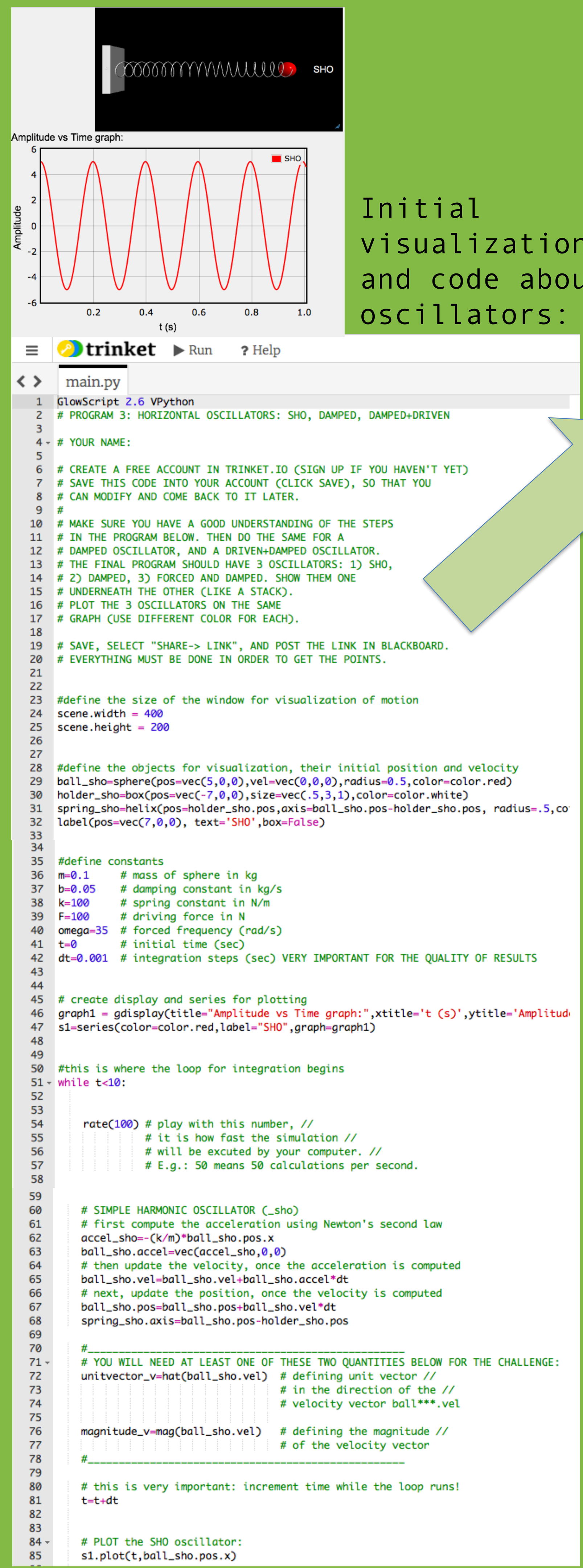
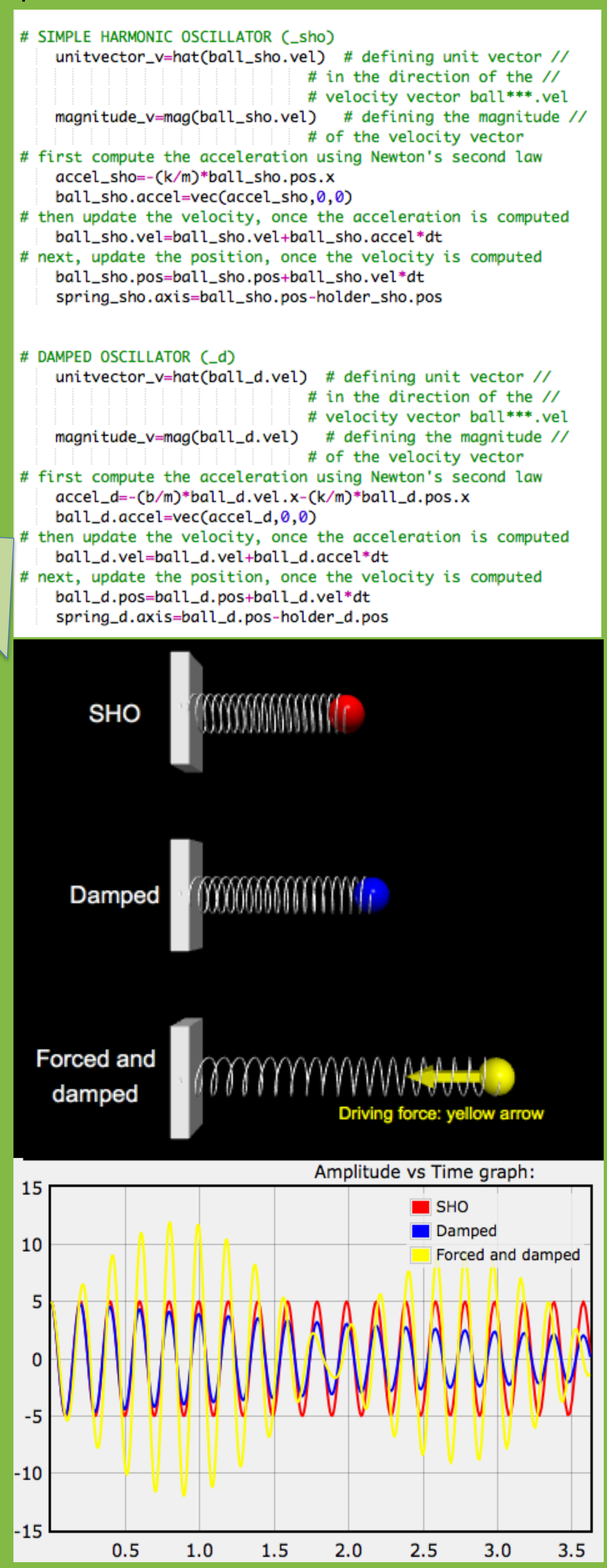
- The VPython coding challenges I use in my calculus-based physics classes are available for public use.
- Codes are minimal working examples mostly written by me, but some are modified from Tom O'kuma, Dwain Desbien, Ruth Chabay, and Bruce Sherwood.
- The codes are deployed with trinket.io (no installation requirements), and are offered for extra credit. Little time is spent in class for instruction to these coding challenges, as they are designed to be self-explanatory. Selected online resources and documentation about VPython and Glowscript are provided to students.
- Sometimes only a few changes to the initial code are necessary. When more is required, students are guided by comments contained in the codes, which also have questions to be answered.
- Videos are provided to show a possible solution to each challenge.
- The topics are mostly in mechanics and include, so far:
  - one-dimensional motion
  - projectile motion at complementary angles
  - Newton's second law with air drag
  - examining elliptical versus circular orbits
  - energy and momentum of a bouncing ball
  - two-dimensional collision
  - center of mass motion in a collision
  - angular momentum conservation in orbital motion
  - simple harmonic oscillator
  - damped and driven oscillators
  - superposition of waves
- The coding challenges are available at: http://gdenicolo.net/vpython.html

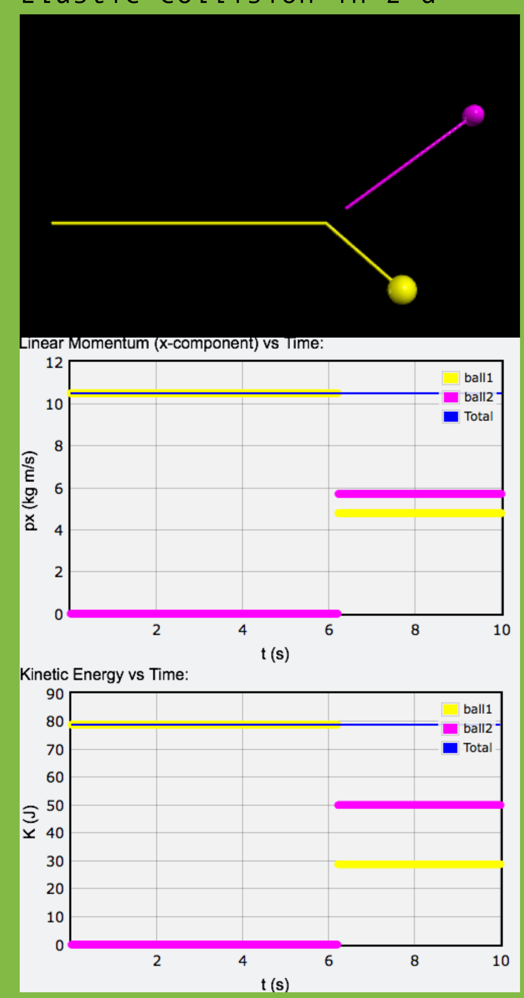
Initial visualization and code about oscillators:



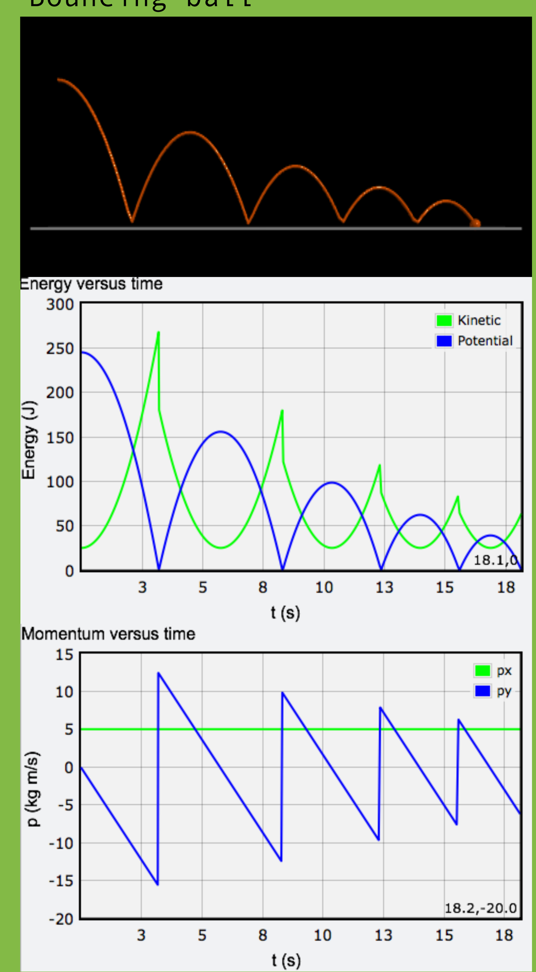
Example of final desired plot and visualization, and part of final code:



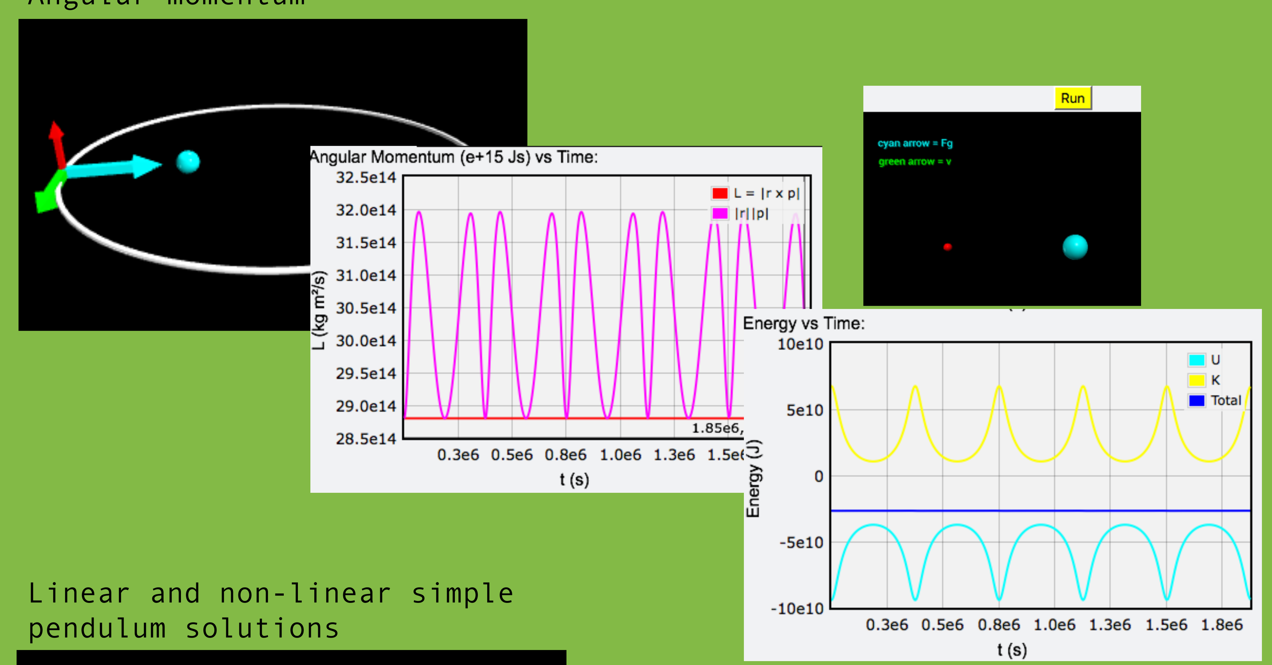
Elastic collision in 2-d



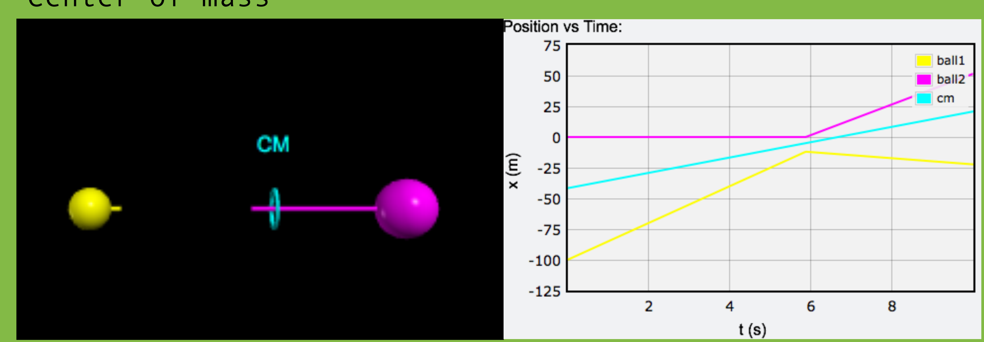
Bouncing ball



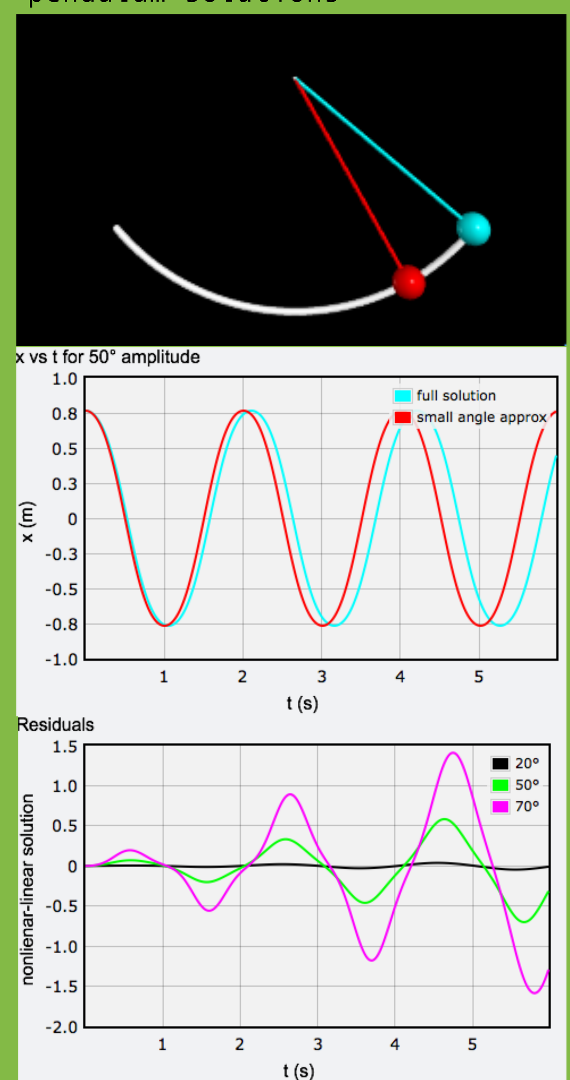
Angular momentum



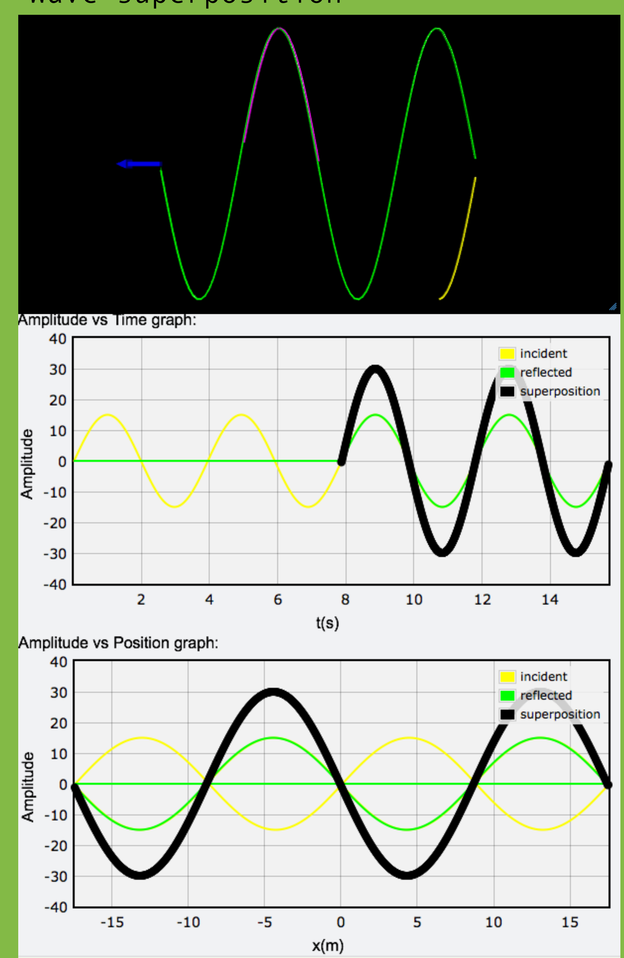
Center of mass



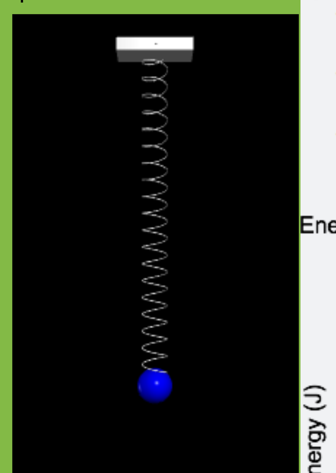
Linear and non-linear simple pendulum solutions

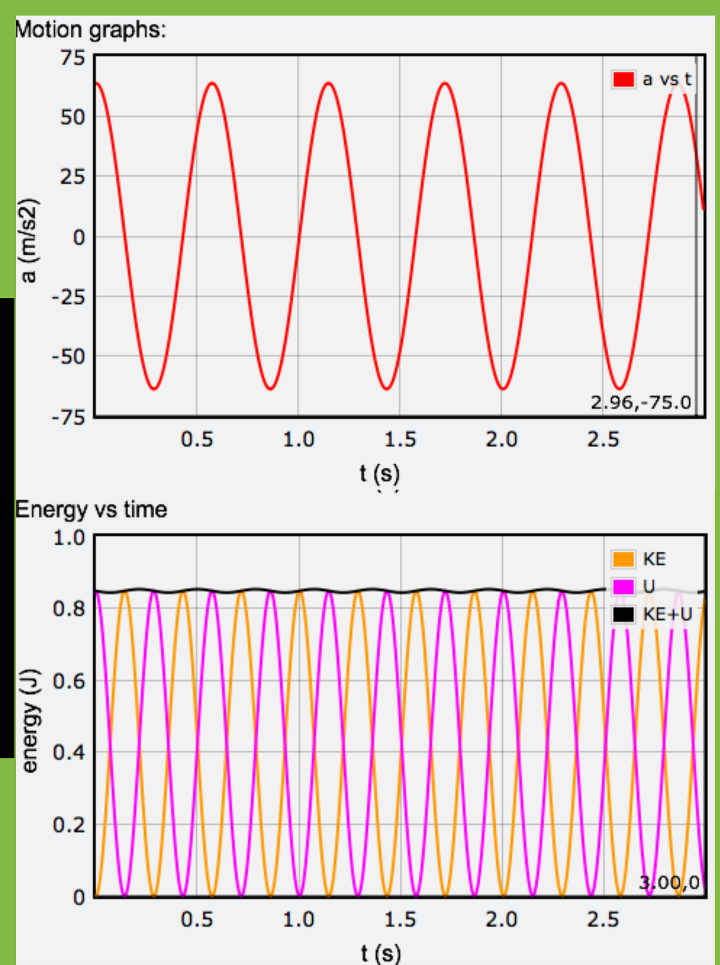


Wave superposition

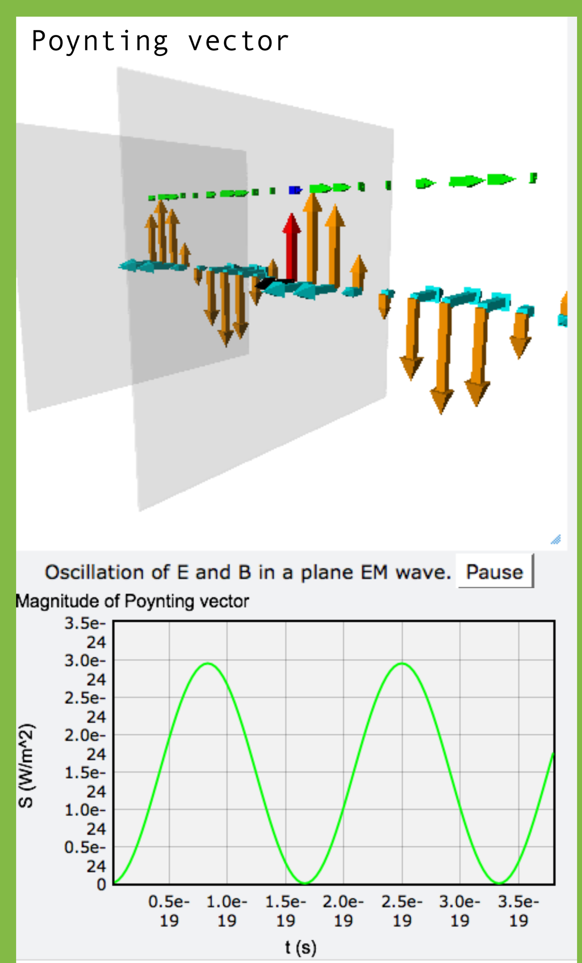


Simple linear pendulum





Poynting vector



Reflection and refraction