Flash Animations for Physics

We have been increasingly using *Flash* animations for illustrating Physics content. This page provides access to those animations which may be of general interest. The animations will appear in a separate window.

The animations are sorted by category, and the file size of each animation is included in the listing. Also included is the minimum version of the Flash player that is required; the player is available free from http://www.macromedia.com/. The categories are:

There are 64 animations listed below. The most recent animations added to the list are identified.

Category	Title	Description/Comment	
Chaos	Logistic Map	The logistic map, which demonstrates the bifurcations of the population levels preceding the transition to chaos. Requires Flash 6; file size is 15k.	View
Chaos	Lorenz Attractor	Looking at the Lorenz Attractor in a chaotic regime, allowing the attractor to be rotated. Requires Flash 6; file size is **550k**.	View
Chaos	Three-body Gravitational Interaction	2 fixed suns and 1 planet. Initial conditions are controllable, and up to 4 different independent planets may be displayed. Requires Flash 6 and a computer with reasonable power; file size is 50k.	View
Classical Mechanics	Constant Acceleration	1-dimensional kinematics of a body undergoing constant acceleration. Includes visually integrating the acceleration and velocity graphs, and visually differentiating the position and velocity graphs. Requires Flash 6; file size is 30k.	View
Classical Mechanics	Motion Animation	A car with a non-zero initial speed has a constant acceleration whose value can be controlled by the user. Requires Flash 6; file size is 27k.	View
Classical Mechanics	Dropping Two Balls Near the Earth's Surface	Two balls falling near the Earth's surface under the influence of gravity. The initial horizontal speed of one of the balls may be varied. Requires Flash 6; file size is 11k.	View
Classical Mechanics	Galilean Relativity	Illustrating Galilean relativity using his example of dropping a ball from the top of the mast of a sailboat. Requires Flash 6; file size is 22k.	View
Classical Mechanics	Projectile Motion	Firing a projectile when air resistance is negligible. The initial height and angle may be adjusted. Requires Flash 6; file size is 36k.	View

Classical Mechanics	NEW The Monkey and the Hunter	An animation of the classic lecture demonstration. The actual demonstration is preferable if possible; then this animation can be given to the students for later review. Requires Flash 6; file size is 21k.	View
Classical Mechanics	NEW Racing Balls	Two balls roll down two different low-friction tracks near the Earth's surface. The user is invited to predict which ball will reach the end of the track first. This problem is difficult for many beginning Physics students. Requires Flash 6 Release 79; file size is 140k.	View
Classical Mechanics	NEW Racing Skiers	The "Racing Balls" animation which is accessed via the above line sometimes triggers cognitive dissonance and rejection in beginning students. For some of these, changing the balls to skiers helps to clarify the situation, and that is what this animation does. The "Racing Balls" one should be used with students first. Requires Flash 6 Release 79; file size is 145k.	View
Classical Mechanics	Air Track Collusion	Elastic and inelastic collisions on an air track, with different masses for the target cart. Requires Flash 6; file size is 70k.	View
Classical Mechanics	Rolling Disc	A simple animation that traces the motion of a point on a rolling disc. Requires Flash 6; file size is 31k.	View
Classical Mechanics	Simple Harmonic Motion I	Demonstrating that one component of uniform circular motion is simple harmonic motion. Requires Flash 6; file size is 10k.	View
Classical Mechanics	Simple Harmonic Motion II	Illustrating and comparing Simple Harmonic Motion for a spring-mass system and for a oscillating hollow cylinder. Requires Flash 5; file size is 20k.	View
Classical Mechanics	Damped Simple Harmonic Motion	The damping factor may be controlled with a slider. The maximum available damping factor of *100* corresponds to critical damping. Requires Flash 6; file size is 12k.	View
Classical Mechanics	Coupled Harmonic Oscillators	Two simple pendulums connected by a spring. The mass of one of the pendulums may be varied. Within mathematical rounding errors, the resolution on the screen of one pixel, and a frame rate of 12 frames per second the animation is correct, not an approximation. Requires Flash 6; file size is 47k.	View
Electricity and Magnetism	Comparing a DC circuit to the flow of water.	A simple DC circuit has a DC voltage source lighting a light bulb.Also shown is a hydraulic system in which water drives a turbine. The two systems are shown to be similar. Requires Flash 6; file size is 51k.	View
Electricity and Magnetism	Electric Field of an Oscillating Charge	An electric charge is executing simple harmonic motion, and the animation shows the electric field lines around it. Requires Flash 6 and a computer with reasonable power; file size is 40k.	View
Micrometer Caliper	Measuring with a Micrometer	A simple animation of using a micrometer to measure the width of a pencil. Requires Flash 5; file size is 13k.	View
Micrometer Caliper	An Exercise in Reading a Micrometer	Provides controls to position the micrometer, and when a button is clicked displays the reading. Requires Flash 5; file size is 30k	View
Miscellaneous	A Simple Piston and Boyle's Law	A small animation showing a piston compressing a sample of gas. As the volume of the gas goes down, the density and therefore the pressure goes up. Requires Flash 5; file size is 3.9k.	View

Miscellaneous	Derivative of the Sine Function	An animation illustrating that the derivative of a sine function is a cosine. Requires Flash 6, file size is 20k.	View
Miscellaneous	NEW Area of a Circle As a Limit	Illustrating that the area of a circle is a limit of the sum of the areas of interior triangles as the number of triangles goes to infinity. Requires Flash 5; file size is 12k.	View
Miscellaneous	NEW Integration	Illustrating the meaning of the integral sign, including an example. Requires Flash 5; file size is 124k.	View
Nuclear	Scattering	Simulating nuclear scattering experiments by scattering ball bearings off targets. This is based on an experiment in the First Year Physics Laboratory at the University of Toronto. Requires Flash 6 Release 79; file size is 182k.	View
Nuclear	Nuclear Decays	The decay of 500 atoms of the fictional element Balonium. Uses a proper Monte Carlo engine to simulate real decays. Requires Flash 6, file size is 27k.	View
Nuclear	Pair Production	A simple illustration of electron-positron production and annihilation. Requires Flash 5, file size is 21k.	View
Nuclear	The Interaction of X-rays With Matter	Illustrating the 3 principle modes by which X-rays interact with matter. Requires Flash 6; file size is 47k.	View
Optics	Rotating a Mirror and the Reflected Ray	Illustrating that when a mirror is rotated by an angle, the reflected ray is rotated by twice that angle. Requires Flash 6; file size is 20k.	View
Optics	NEW Reflection and Refraction	Illustrating reflection and refraction, including total internal reflection. Requires Flash 6; file size is 25k.	View
Optics	Object-Image Relationships	Ray tracing for a thin lens showing the formation of a real image of an object. Requires Flash 5; file size is 17k.	View
Optics	Using an Optical Bench	A simulation of an optical bench with a light source, object, thin lens and an image. The screen that displays the image is moved. Requires Flash 5, file size is 14k.	View
Oscilloscope	The Time Base Control 1	Shows the effect of changing the time base control on the display of an oscilloscope. There is no input voltage. Requires Flash 5; file size is 10k.	View
Oscilloscope	The Time Base Control 2	Shows the effect of changing the time base control on the display when there is an input voltage varying in time. Requires Flash 5; file size is 12k.	View
Oscilloscope	The Time Base Control 3	Shows the effect of changing the time base control on the display when there is an input voltage varying in time when the frequency of the voltage is high. Requires Flash 5; file size is 17k.	View
Oscilloscope	The Voltage Control	Shows the effect of changing the voltage control on the display. Requires Flash 5; file size is 10k.	View
Oscilloscope	The Trigger	Shows the effect of changing the trigger level on the display. Requires Flash 5; file size is 5.9k	View
Quantum Mechanics	The Bohr Model	The photon excitation and photon emission of the electron in a Hydrogen atom as described by the Bohr model. Requires Flash 6: file size is 77k.	View
Quantum	Complementarity	Here we visualise a hydrogen atom, which consists of an electron in	View

Mechanics		orbit around a proton. In one view the electron is a *particle* and in the other view it is a *probability distribution*. The reality is neither view by itself, but a composite of the two. Requires Flash 5; file size is 15k.	
Quantum Mechanics	The Double Slit Experiment 1	The famous "Feynman Double Slit Experiment" for electrons. Here we fire one electron at a time from the electron gun, and observe the build-up of electron positions on the screen. Requires Flash 5; file size is 15k.	View
Quantum Mechanics	The Double Slit Experiment 2	Here we illustrate *Complementarity* using the double slit experiment. We view the path of the electron from the gun to the observing screen as a particle and as a wave. Requires Flash 5; file size is 33k.	View
Relativity	Time Dilation	A demonstration that the phenomenon of time dilation from the special theory of relativity necessarily follows from the idea that the speed of light is the same value for all observers. Requires Flash 6; file size is 55k.	View
Relativity	Deriving Length Contraction	A tutorial that shows how relativistic length contraction must follow from the existence of time dilation. Requires Flash 5; file size is 37k.	View
Relativity	Length Contraction is Invisible	This series of animations demonstrates that the relativistic length contraction is invisible. Requires Flash 5; file size is 90k.	View
Relativity	Deriving the Relativity of Simultaneity	A tutorial that shows how the relative nature of the simultaneity of two events must follow from the existence of length contraction. Requires Flash 5; file size is 39k.	View
Relativity	Twin Paradox	There are many ways of approaching this classic "paradox". Here we discuss it as an example of the relativistic Doppler effect. Requires Flash 6; file size is 116k.	View
Sound Waves	NEW Beats	Illustrating beats between 2 oscillators of nearly identical frequencies. Requires Flash 6; file size is 215k.	View
Sound Waves	Doppler Effect	Illustrating the classical Doppler Effect for sound waves. Requires Flash 6; file size is 43k.	View
Sound Waves	Tuning Fork	A small animation of a vibrating tuning fork producing a sound wave. Requires Flash 5; file size is 2.7k.	View
Sound Waves	Pressure and Displacement Waves	This animation shows air molecules vibrating, with each molecule "driving" its neighbour to the right. It is used to illustrate that when the displacement wave is at a maximum then the density of the molecules, and thus the pressure wave, is at a minimum and vice versa. Requires Flash 5; file size is 30k	View
Sound Waves	Temperament	A very brief introduction to the physics and psychophysics of music, with an emphasis on temperament, the relationship between notes. Requires Flash 6 and sound; file size is 151k.	View
Vectors	Adding 2 Vectors	A simple demonstration of adding 2 vectors graphically. Also demonstrates that vector addition is commutative. Requires Flash 5; file size is 7k.	View
Vectors	Adding 3 Vectors	A simple demonstration of adding 3 vectors graphically. Also demonstrates that vector addition is associative. Requires Flash 5; file size is 10k.	View
Vectors	Subtracting 2	A simple demonstration that subtracting 2 vectors graphically is the	View

	Vectors	same as adding the first one to the negative of the second one. Requires Flash 5; file size is 4.5k.	
Vectors	Component Addition	A simple demonstration that to add 2 vectors numerically, just add the cartesian components. Requires Flash 5; file size is 16k.	View
Vectors	Unit Vectors	A simple animation of unit vectors and vector addition. Requires Flash 6; file size is 12k.	View
Vectors	Dot Product	A simple demonstration of the relation between the dot product of 2 vectors and the angle between them. Requires Flash 6; file size is 8k.	View
Vectors	Cross Product	Illustrating the direction of the cross product of 2 vectors with a right-hand "screw" rule. Requires Flash 6; file size is 17k.	View
Waves	Traveling Waves	Illustrating the sign of the time term for traveling waves moving from left to right or right to left. Requires Flash 6; file size is 42k.	View
Waves	Reflections From a Barrier	A wave is reflected from a barrier with a phase reversal. This is the behaviour for transverse waves and the *displacement* aspect of a longitudinal wave. Requires Flash 5; file size is 42k.	View
Waves	Reflections From Two Barriers	A wave is reflected back and forth between two barriers, setting up a standing wave. Requires Flash 5; file size is 41k.	View
Waves	Standing Waves With a Node on Both Ends	The first three standing waves for nodes at both ends. The frequencies of the waves are proportional to one over the wavelength. Requires Flash 5; file size is 11k.	View
Waves	Standing Waves With a Node on One End	The first three standing waves for a node at one end and an antinode at the other. The frequencies are proportional to one over the wavelength. Requires Flash 5; file size is 18k.	View

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If you wish to put a copy of an animation on your own web server, you may wish to know that in all cases the name of the animation file is the same as the name of the html file that accesses it, except that the filename extension is `.swf` instead of `.html`. Thus from Netscape or Mozilla you may use `Save As ...` to save the html file. Then you may manually change the URL so that it ends in `.swf` instead of `.html`, press Enter and use `Save As ...` to save the swf file. Internet Explorer users will need to erase the entire file name, so that the URL ends with the directory name: then after pressing Enter the names of the files in the directory will be displayed and you may right-click on the desired `swf` file name and choose `Save Target As ...`.

I will be interested to know if you have downloaded one or more of my animations; if you are so inclined send me an email.

If you wish to have a copy of the `.fla` file for an animation, send me an email and I will be pleased to send it to you. Please do not ask me for a copy of the `.fla` files for all the animations: there are too many located in too many different directories on my computer. Most of the above animations were written with Flash MX; more recent ones were written with Flash MX2004, whose format is not compatible with Flash MX.

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