

Physics 107

Lecture Demonstrations

Last update 2001-2

Here is a composite list of all demos that have been used for this course over the past five years and are grouped by class days. This list is only a reference guide and will differ from actual demos used in class depending on which faculty is teaching the course.

1. The Earliest Science: Seasons and the Moon:
 - Video A Private Universe
 - Small tilted globe
 - Black/white ball for moon
 - Bare lightbulb for sun
 - Small top
 - 3 small bright balls
 - Spherical mirror
 - Penny for eclipses
 - Mechanical sun/earth/moon model
 - Specialty Items
 - BD Smiley face balloon
 - BD Round paper moon face
 - BD Small paper plate
 - BD Aerobee
 - BD Pizza pan
 - BD Science if Fun button
2. Demystifying the Heavens: Tycho, Kepler, Galileo
 - Orerry from Astronomy
 - Screen at north side
 - Mechanized Earth-Moon-Sun-Venus
 - Conic sections
 - Ellipse whiteboard
 - Some balls
 - Football
3. Two Leaps of Logic: Galileo
 - Periodic table down
 - Ball on string
 - Marbles into glycerin and water
 - Vacuum tube with cotton and penny
 - Small inclined plane
 - 2 wood blocks
 - 2 pieces of paper
 - Specialty Items
 - BD cotton
 - BD penny
 - BD crisp \$ bills
4. Falling motion: Galileo's kinematics
 - Small beaker with water in it
 - Big aluminum inclined plane with ball bearing and metronome
 - Gravity demo with 24 Tapes to pass around
 - Zigzag red tape.
 - Specialty Items
 - BD crisp \$ bill

5. Three Great Principles: Galileo
 - Large Airtrack with big Gliders
 - Monkey/hunter (old)
 - Ballistic Cart with wood-block bridge
 - Basketball for a player to bounce
 - Flatbed Cart (large enough to bounce the basketball on, to pull her/him across the room)
 - 2 identical hand-sized balls
 - Add marbles into glycerin and water
 - Small board propped up as inclined plane
 - 2 wood blocks
 - 2 pieces of paper
 - Specialty Items
 - BD UW football
 - BD glow in the dark yo-yo
 - BD cotton
 - BD penny
 - BD crisp \$ bill
6. Conservation of Momentum: Descartes and Huygens
 - Airtrack with 2 large, 2 small carts, wax
 - Steel collision balls: 2 equal, 2 unequal, 5 equal
 - Arrow
 - Specialty Items
 - BD arrow
7. Three great laws of motion: Newton's Dynamics
 - Steel collision balls as in Lec 6
 - Water rocket
 - Aluminum and wood blocks to slide
 - "Muscle" strings on brick
 - Hooke's Law spring
 - 2 bar magnets
 - Nails
 - Balloon
 - Confetti
 - Plastic rod
 - Charging materials
 - Ball on string
8. The Universal Law of Gravitation: Newton
 - Cavendish experiment
 - Fake Cavendish
 - Flashlight
 - Ball on string
 - Ball on string to cut while whirling
 - Loose but not inflated white balloon with dots
 - Marker pen
 - Specialty Items
 - BD pincushion

9. Conservation of Energy
 - 2 arrows
 - Pendulum
 - Conservation of energy tracks – shallow V-shaped and U shaped
 - Wood block
 - Bowling ball pendulum
 - Meterstick
 - Bare 100-Watt lightbulb
 - Hammer
 - Specialty Items
 - BD barbell
 - BD power T-shirt
 - BD KE sweatshirt
 - BD belt
 - BD gloves
 - BD calculator
 - BD tattoos
10. Electric and Magnetic Forces and Fields: Coulomb, Ampere and Faraday
 - Balloon
 - Plastic rod
 - Charging materials
 - Confetti
 - Electroscope
 - 2 bar magnets
 - Nails
 - Pineapple magnets on post
 - Electromagnet
 - Balloon with dots
 - Viewgraph of magnet with iron filings
 - Compass needle
 - Magnet
 - Viewgraph of hairs with 2 electrodes
 - Handcranked electrostatic generator
 - Specialty Items
 - BD refrigerator magnets
 - BD wear wool
11. The First Unified Field Theory: Maxwell
 - 2 bar magnets
 - Electromagnet
 - Nails
 - Plastic rod
 - Wool blanket
 - Confetti
 - Magnet rings on peg
 - Induced emf
 - Meter to show current
 - Balloon with dots
 - 2 compass needles
 - 2 buckets (one beaker above the other, one beaker with spigot)
 - Electrostatic generator for spark
 - Specialty Items
 - BD 2 Maxwell's equation T-shirts

12. Waves: Simple behavior of a simple system
 - 2 film loops: non-recurring wavefronts, Tacoma Narrows Bridge
 - Pendulum
 - Hooke's Law
 - Big slinky on stand
 - Waveboard with damping
 - 2 ropes between walls with cards
 - torsion wave on wall
 - Specialty Items
 - BD bring football to throw across room
13. Sound: Mechanical Waves in a Medium
 - Film loop: Doppler, shockwave, drumhead
 - Flute
 - Violin
 - Computer with Fourier analyzer
 - Standing waves on a string with strobes.
 - 2 speakers with signal generator (sound interference)
 - Helium
 - Sulfur hexafluoride
 - Balloon
 - 2 sources viewgraph
 - meter stick
 - Specialty Items
 - BD bring book to read from
14. Electromagnetic Waves in a Field
 - Film loops: Doppler, shockwave
 - Flashbulb
 - Flashlight
 - Prism- rainbow
 - Pencil in small beaker of water
 - Lens they can see my face distorted through
 - 2 sources viewgraph
 - Young's double slit
 - Radio
 - Meter stick
15. Chaos: Complex Behavior of a Simple System
 - Computer: binary star, driven pendulum, 2 fractals
 - Moving table with water tank, dye, white backdrop
 - Stick pendulum
 - Silly putty
 - String
 - 2 pieces of paper
 - Air hose whipping
 - Geiger counter
 - Overhead projector for phase space viewgraph
 - Water dripping into pie tin with microphone
 - Ball and piece of paper to drop
 - Ball on string to swing
 - 2 colored transparencies of Sprott,
 - 3 books: Sprott, Gell-Mann, Glieck
16. Light waves are different: the famous missing gamma factor
 - 2 posts with 2 rubber tubes
 - Michelson interferometer
 - Prism with rainbow

17. The two postulates of special relativity: Einstein
 - Flashlight
 - Small mirror
 - Specialty Items
 - BD football
18. Gedanken experiments on simultaneity and length
 - 2 flashlights
 - Flashbulb
 - 2 tubes on posts
 - 2 bigger mirrors
 - Eraser
 - Meter stick
 - Albert/Henry video
 - Specialty Items
 - BD 2 kerchiefs
19. Gedanken experiments on clocks and time
 - 3 clocks that run at the same rate, forward not backward!
 - 2 mirrors
 - 2 pieces of (8.5x11 OK) cardboard for “garage doors” with stand-alone clamps
 - Meter stick
 - Flashbulb
 - 2 flashlight
 - 2 kerchiefs
 - The part of the Albert/Henry video with buzzers and bells, and on to hourglass
 - Specialty Items
 - BD Bucky dolls and tractor
20. Spacetime: Gamma factor effects and the time as the fourth dimension
 - 2 mirrors
 - 2 metersticks
 - 2 rubber tubes with 2 posts
 - String
 - Disk (Frisbee or pizza pan)
 - Round ball
 - Balloon
 - Repeat garage with 2 pieces of cardboard on clamps with Bucky doll
 - Repeat video through hourglass
 - Specialty Items
 - BD pieces of paper for Flatland story
21. Spacetime diagrams
 - short version of Albert and Henry
 - 2 metersticks (for coordinate system)
 - String
 - Balloon
 - Ball
22. Mass and energy are equivalent
 - 2 black and white balls
 - 2 metersticks
 - 2 cardboards
23. $E=mc^2$: Bombs, stars and reactors
 - Periodic table
 - Feynman “Pleasure of Finding Things Out”
24. Relativity in action: Big gamma factors
 - Video
 - Overhead (Einstein)
 - 4 slides of Fermilab

25. The Equivalence Principle
 - Cardboard tube with spiral pen mark
 - Big globe
 - Small globe
 - Tissue paper
 - Marker pad
 - String: one short, fat piece, 2 regular size, long enough to go around the equator of the big globe
26. Curved spacetime: Physics is math
 - Rubber membrane
 - Heavy ball
 - Marble
 - Small barbell
 - Small wheel handles
 - Conic sections
 - Overhead
27. Big Bang cosmology: "Seeing" the very large
 - Curved track with ball
 - White balloon
 - Marker pen
 - Conic sections
 - Tungsten lightbulb
 - Specialty Items
 - BD round rubber band
 - BD Straight rubber band
28. Black holes and dark matter in the universe
 - 2 slides of galaxies
 - conic sections
 - balloon
29. Atoms, electrons, nuclei: "seeing" the very small
 - E/M experiment
 - Periodic table
 - Brownian motion
 - Balloon in liquid nitrogen
 - Geiger counter
 - Cathode ray tube with green beam
 - Magnet to deflect beam
 - Foil
 - 2 small balls of different sizes
 - 2 slides of Fermilab- overview and tunnel
 - 1 bubble chamber
 - Meterstick
 - Aspirin for cm sizes
 - Specialty Items
 - BD tissue paper
 - BD ruler
 - BD sesame seed for mm
 - BD 3 STM slides
30. The quantum physics of light: Planck, spectra of solids
 - Plastic grating by door
 - Spectra with gratings: H, Ne, He, Tungsten
 - Prism onto screen
 - Periodic table

31. Waves are particles: Einstein, the photoelectric effect
 - Electroscope with mercury UV lamp and glass plate (photoelectric effect)
 - 2 black and white balls
 - Small ball on string
 - Specialty Items
 - BD red 107 sweatshirt or T-shirt
 - BD get two students purple and red, tall and short
32. The quantum physics of matter: Bohr, the Hydrogen atom
 - Spectra tubes and gratings
 - Photoelectric effect
 - X-ray tube
33. Particles are waves: DeBroglie, Schrodinger and Born
 - Electron diffraction
 - Specialty Items
 - BD bring coins and pieces of string units of length 1', 2', 3', 4', 1', 4', 9', 16'
 - BD Electron microscope slide of gross needle tip
34. The Uncertainty Principle: Heisenberg
 - Slide projector
 - Tuning fork and drum
 - Scope
 - Microphone
 - TV camera
 - Monitor
 - Squishy balloon
 - Ball
 - Specialty Items
 - BD coins
 - BD slide of STM picture of surface
35. Quantum physics in action: Superconductivity
 - 3 or maybe only 1 setup of superconductors
 - Camera
 - Balloon
 - Tongs
 - Bring something to freeze
 - LN2
36. Quantum physics in the sky: sunsets, ozone, the greenhouse effect
 - "Atmosphere" with overhead
 - Beaker
 - Paper with hole
 - Water
 - Milk
 - Sciences on ozone
 - Specialty Items
 - BD milk
37. Quantized energy levels: lasers and atomic clocks
 - Diode laser in CD
 - 9 electron microscope slides from Grayson Scott
 - STM overhead
 - Laser with side off
 - Diode laser
 - Light pen
 - Hologram
 - Light pipe
 - Fiber optics: fat, thin, thin frayed

38. Quantum electronic and computer chips
 - Computer: hard drive, CPU, memory?
 - Specialty Items
 - BD chips poster
39. Quantum field theory: Feynman's dynamics
 - Stack of Physics Today's Feynman articles
40. Nature's building blocks: particles, quarks, leptons
41. The Four Forces: Gauge bosons Inner space/outer space: Particle physics meets cosmology
 - Specialty Items
 - BD innerspace/outerspace Tshirt
 - BD sesame seeds again
 - BD bring games
42. The Nobel Prize: tracing the ideas of Modern Physics