

Discovering Physics: The Universe and Humanity's Place In It

Timeline

2000-500 BCE.....	Babylonian Civilization
6 th century BCE.....	Pythagorean School founded
388 BCE	Plato founds the Academy
384 BCE.....	Aristotle born
~340 BCE.....	Eudoxus dies
335 BCE	Aristotle founds the Lyceum
310-230 BCE.....	Aristarchus considers the earth moving around a central fire
195 BCE.....	Eratosthenes (calculated circumference of the earth) dies
190 BCE.....	Appollonius of Perga dies (originator of epicycles)
55 BCE.....	Lucretius dies - concluded extraterrestrial life likely
150 AD.....	Claudius Ptolemy flourishes
570 AD.....	John Philoponus dies - suggested "impetus" moves flying arrow
1138 AD.....	Avempace (Ibn Bajja) dies - critic of Aristotelian idea of planetary motion
1198 AD.....	Averroes (Ibn Roschd), critic of Aristotlelian motion, dies
1271-1295	Marco Polo's journey to China
1274	Thomas Aquinas dies – his embrace of Aristotle led to rebuke re extraterrestrial life
1330s	Merton School flourishes
~1360	Jean Buridan, impetus only lessens if there is resistance, considered motion of earth, dies
1382	Nicole Oresme dies - studied uniformly accelerated motion and considered earth's rotation
1464	Nicholas of Cusa dies - considered motion of earth from theological reasoning
1487	Bartholomeu Dias travels to the Cape of Good Hope

1492.....Columbus's first voyage to the New World
1497Vasco da Gamma sails around the Africa to India
1518Protestant Reformation begins with Luther's 95 Theses
1519-1522Voyage of Fedinand Magellan's ship Victoria around the world
1543Nicholas Copernicus dies, his famous *On the Revolutions* appears
1545-1563Council of Trent ignores Copernicus's book
1572A new star (supernova) leads Tycho Brahe to conclude change is possible in heavens
1577Lack of parallax for a comet leads Tycho (a decade later) to abandon crystalline spheres
1588Tychonic system published at the end of Tycho's book on the comet of 1577
1597Johannes Kepler's *Cosmographic Mystery* contains his 5-solid theory
1600Kepler goes to Tycho in Prague a year before Tycho's death
1609Kepler's *New Astronomy* shows planetary orbits to be ellipses
1610Galileo's *Starry Message* astounds Europe with its telescopic observations
1616Galileo goes to Rome and is forbidden to "hold and defend" Copernican theory
1618Kepler *Harmonies of the World* contains his Third Law of planetary motion
1624Galileo has 6 conversations with Pope Urban VIII in Rome
1632Galileo's *Dialogues of the Two Chief Systems of the World* published
1633Trial of Galileo
1642Galileo dies, Isaac Newton born
1642.....English Civil War
1644.....Descartes's *Principles of Philosophy*, containing quantity of motions as mv
1666..... Newton's *Annus Mirabilis*, solution to problem of the Moon
1686.....Leibniz's introduction of *vis viva* as measure of quantity of motion
1687.....Newton's *Principia Mathematica*, containing his 3 laws of motion and universal gravitation

1704.....Newton's *Opticks*, the 1717 edition of which contained his notions of an ether by which gravity was transmitted

1720'sGravesand's experimental proof of vis viva ($1/2 mv^2$) as quantity of motion

1727.....Newton dies

1733.....Voltaire's *Philosophical Letters* makes Newton's system more known in France

1736.....Maupertuis goes to Lapland to determine the shape of the earth

1738.....Madame du Chatelet's *Elements of the Philosophy of Newton* increases knowledge of Newton in France

1747.....Clairaut's reformulation of Newton's inverse square law, later retracted

1755.....Kant's nebular hypothesis published

1758.....Clairaut's successful prediction of the return of Halley's comet for spring 1759

1776.....Declaration of American Independence

1776.....Laplace explains the Moon's secular acceleration

1799f.....Laplace's *Mechanique celeste*, containing his deterministic vision for a perfect intelligence

1786.....Galvani discovers animal electricity

1789.....French Revolution begins

1800.....Volta invents the battery, allowing a continuous flow (current) of electrical charge

1800.....Herschel discovers infrared "light"

1801.....Ritter discovers ultra-violet "light"

1801.....Young's double slit interference patterns suggests light is a wave

1804.....Napoleon crowned Emperor of France

1815.....Napoleon's final defeat

1820.....Oersted's discovery of electromagnetism

1821.....Faraday invents the electric motor (producing mechanical motion from electricity)

1823.....Ampère uses a electrical circuit to create a magnet in an iron bar

1824.....Carnot's *Reflections on the Motive Power of Heat* declares that heat reservoirs at different temperatures required to obtain mechanical motion from heat

1831.....Faraday discovers how to induce a current by changing a magnetic field

1834.....Babbage invents the analytical machine, precursor of the computer

1839.....Daguerre invents photography

1848.....Revolutions of 1848 on the European continent

1845.....Joule determines a mechanical equivalent of heat

1847.....Helmholtz's paper "On the Conservation of Energy"

1850.....Courbet's painting, *The Stonebreakers*, depicts the hard reality of life

1852.....Kelvin's anticipates the Second Law in his paper "On a Universal Tendency in Nature to the Dissipation of Mechanical Energy"

1857.....Flaubert's novel, *Madame Bovary*, chronicles the unfulfilled life of a mid-century woman

1859.....Darwin's *Origin of Species* explains the development of life naturalistically

1865.....Clausius uses the word entropy to describe the measure of unavailable energy

1866.....Reliable submarine Atlantic telegraph cable finally laid

1869.....Mendeleev's periodic table of elements

1870.....Bismarck unifies the German states through a series of manufactured wars

1873.....Maxwell links electricity and magnetism and uncover that light is an electromagnetic wave

1875.....Crookes discovers cathode rays

1876.....Bell invents the telephone

1877.....Edison invents the phonograph

1887.....Hertz discovers that electromagnetic (radio) waves travel through space

1887.....Second Michelson/Morley experiment unable to detect an ether wind

1895.....Röntgen discovers x-rays

1896.....Becquerel discovers radioactivity

1897.....Thomson discovers the electron

1900.....Planck quantizes energy to solve black body radiation, introduces $E=hf$

1905.....Einstein announces Special Relativity, $E=mc^2$, and Photoelectric effect

1911.....Rutherford reveals his model of the atom, with concentrated nucleus

1912.....Leavitt confirms the relationship between the period of variable stars and their
brightness, providing a means to determine distance of far away stars

1913.....Bohr rescues Rutherford's model of the atom with the help of Planck's quantized energy

1914.....World War I begins

1915.....Einstein announces General Relativity

1917.....Einstein introduces his cosmological constant to keep universe in steady state

1918.....World War I ends

1923.....Beer Hall Putsch in Munich puts Hitler in prison, where he writes *Mein Kampf*

1924.....De Broglie's wave model of the electron

1924.....Hubble quantifies the expansion of the universe. Rate increases with distance, $v=Hd$

1925.....Heisenberg and Schrödinger introduce, respectively, matrix and wave
mechanical systems to explain atomic structure

1925.....Payne argues that the composition of the Sun is mostly H and He, against conventional wisdom

1926.....Heisenberg's Uncertainty Principle

1927.....LeMaître suggests expanding universe means there was a creation event

1932.....Chadwick discovers the neutron

1933.....Nazi's come to power in Germany

1938.....Hahn reveals the splitting of the atom

1939.....Bethe identifies atomic fusion as the source of the energy in stars

1939.....World War II begins

1942.....Manhattan Project to build an atomic bomb begun

1945.....Atomic bombs dropped on Hiroshima and Nagasaki, World War II ends

1948.....Gamow suggests the universe began in a hot big bang

1949.....Soviets build atomic bomb

1952.....Fusion (thermonuclear) bomb tested in Marshall Islands

1955.....Soviets test their fusion bomb

1965.....Penzias and Wilson discover background microwave radiation from the Big Bang

1970s.....Rubin and Ford revive the term “dark matter,” first used in the 1930s
by Fritz Zwicky, to account for the unexplained rotation rate of galaxies

2008.....Large Hadron Collider, world’s most powerful particle accelerator, starts up