Timeline in Modern Physics

The period of modern physics (18XX-1925) ≈ The transition period from classical to quantum physics

- The idea of quantization was born
- The mathematical language were not fully developed (i.e. Application of functional analysis)
- Explanations / Ways of thinking still tended to be based on classical theories
- *A LOT of discoveries happened around the same time*

Reference: https://en.wikipedia.org/wiki/Timeline_of_fundamental_physics_discoveries
https://en.wikipedia.org/wiki/History_of_quantum_mechanics#Founding_experiments

Classical theory of light

1621 - Willebrord Snellius: Snell's law
1676 - Ole Rømer: Determination of the speed of light traveling from the moons of Jupiter
1678 - Christiaan Huygens: Mathematical wave theory of light
1801 - Thomas Young: Wave theory of light by interference
1814 - Augustin-Jean Fresnel: Wave theory of light, optical interference
…
1864 - James Clerk Maxwell: Theory of Electromagnetism (EM waves)
1887 - Heinrich Rudolf Hertz: Experimental confirmation to light as EM waves

Light speed needs to be constant

★ Highlighted = Possible to be found in syllabus
Otherwise = Either no math or too difficult

Relativity

1887 - Michelson–Morley experiment
1889, 1892 - Lorentz-FitzGerald contraction
1905 - Albert Einstein: Special relativity
1908 - Hermann Minkowski: Minkowski space
1915 - Albert Einstein: General relativity

Cosmology & Astrophysics

1916 - Schwarzschild metric modeling gravity outside a sphere
1922 - Alexander Friedmann: Propose expanding universe
1922-37 - FLRW metric as the modern cosmological model
1927 - Georges Lemaître: Big Bang model
1929 - Edwin Hubble: Confirm expansion of the universe
1935 - Subrahmanyan Chandrasekhar: Chandrasekhar limit for black hole collapse
…
1965 - Arno Penzias and Robert Wilson: Discover Cosmic Microwave Background (CMB)
…

Discoveries ongoing at the same time

Quantization of Light

1861 - Gustav Kirchhoff: Idea of black body
1884 - Boltzmann derives Stefan radiation law
1887 - Heinrich Rudolf Hertz: Observe photoelectric effect
1893 - Wilhelm Wien: Wien's displacement law for black-body radiation
1900 - Lord Rayleigh: Rayleigh–Jeans law - explain radiation spectrum in IR regime
1900 - Max Planck: Black-body radiation formula - the quanta solution to radiation UV catastrophe
1902 - Philipp Lenard: photo-emitted electrons' energy prop. to light frequency, not intensity
1905 - Albert Einstein: propose the photon to explain the photoelectric effect
1923 - Arthur Compton: Particle nature of photons confirmed by observing of photon momentum

1900: Mark the start of the old quantum theory

Quantization of Atomic Structure

1803 - John Dalton: Atomic theory of matter
...
1888 - Johannes Rydberg: Rydberg formula
1895 - Wilhelm Röntgen: Discovery of X-rays
1896 - Henri Becquerel: Discovery of Radioactivity
1897 - J. J. Thomson: Electron discovered
1904 - J. J. Thomson's plum pudding model of the atom
1909 - Robert Millikan: Oil-drop experiment showing electric charge are quantized
1911 - Ernest Rutherford: Discovery of the atomic nucleus (Rutherford model)
1917 - Ernest Rutherford: Show that proton exists in every atom's nucleus
1913 - Niels Bohr: Bohr model of atom
1913 - Lawrence Bragg: Bragg diffraction
1923 - Stern–Gerlach experiment (Discovery of spin)
1924 - Louis de Broglie: Hypothesis of matter waves + derive De Broglie wavelength

Birth of Modern Quantum Mechanics

1925 - Werner Heisenberg: Matrix mechanics for QM
1926 - Erwin Schrödinger: Schrödinger Equation for QM
1925-27 - Copenhagen interpretation - the philosophy of QM
1927 - Werner Heisenberg: Uncertainty principle
1927 - Max Born: Born rule
1927 - Paul Dirac: Dirac equation

Particle Physics / Nuclear Physics (The "experiments")

1928 - Paul Dirac: Propose antiparticle
1932 - C. D. Anderson: Antimatter discovered
1932 - James Chadwick: Neutron discovered
1937 - C. D. Anderson and S. Neddermeyer: Muon discovered
1938 - O. Hahn, L. Meitner and F.Strassmann: Nuclear fission discovered
...
1947 - C.F. Powell, G. Occhialini, C. Lattes: Pion discovered
1955 - Clyde L. Cowan, Frederick Reines: Confirm neutrino exists
1961 - Claus Jönsson: Double-slit experiment with electrons
...
1970 - 73 - Standard Model of elementary particles invented
...

Quantum Field Theory (The "theories")

1941 - Feynman path integral
1948 - R. Feynman, S. Tomonaga, J. Schwinger, F. Dyson: Quantum electrodynamics
1948 - Feynman diagrams
...
1962-63 - Theory of strong interaction, prediction of quarks
1964 - Bell's Theorem on quantum entanglement
1967 - Unification of weak interaction and electromagnetism (electroweak theory)
...