

Table 1: Historical Timeline of Linear Particle Accelerator Development

Year	Historical Events
1897	Discovery of electron by J. J. Thomson at Cavendish Laboratory, Cambridge University
1899	Discovery of beta decay by Ernest Rutherford (beta ray/particle was later identified as electrons in 1900). Discovery of alpha particles by Ernest Rutherford.
1904	Proposal of saturnian model of atom by Hantaro Nagaoka Proposal of plum pudding model of atomic structure by J. J. Thomson
1905	Proposal of photon by Einstein Proposal of the special theory of relativity by Einstein
1911	Discovery of atomic nucleus and the proposal of Rutherford model of atomic structure (planetary model) that calls for a compact positively charged atomic nucleus by Rutherford, Cavendish Laboratory, Cambridge University, UK. This superseded Nagaoka's Saturnian model.
ca 1911-1919	Early atomic model of Bohr (this initially was based on the observation of Rutherford model and then it was succeeded by quantum mechanical model later in the 1920's by the Schrodinger equation proposed in 1925)
1922	Compton scattering (scattering of photons when it collides with an electron) reported by Compton. This shows the particle nature of photon very well.
1924	Ising proposed 'resonant acceleration' using time-varying electro-magnetic fields.
1925	Proposal of Schoedinger equation by Schoedinger
1928	Proposal of relativistic wave equation by Dirac (addition of special theory of relativity to the Schoedinger equation) First linear accelerator by Rolf Widerøe at the RWTH Aachen University (using Ising's principle with a 1 MHz 25kV to create 50 KeV Potassium ions.
1929	Klein-Nishina formula that explains the behavior of photon scattering as seen in Compton scattering. It was derived using the relativistic wave equation of Dirac and the calculation was done by Oskar Klen and Yoshio Nishina
ca 1929-1930	Invention and construction of cyclotron at UC Berkeley by Ernest Lawrence
1930	Building of accelerator of proton at Cavendish Laboratory reported by Cockcroft and Walton Notion of neutrino was proposed by Wolfgang Pauli to explain Beta decay.
1931 Jan.	Discovery of deuterium (heavy hydrogen) that has one about twice the mass of ordinary hydrogen by Harold C. Urey, USA (Later it was explained that its nucleus has proton and one additional neutron. Note neutron was discovered next year.) Initial demonstration of cyclotron by Livingston to accelerate hydrogen ions to 80 keV.

1932	<p>Annus mirabilis ("miracle year") for nuclear physics There were three major discoveries in this year as follows (two of them were at Cavendish Lab.)</p> <ul style="list-style-type: none"> ◆ February Discovery of neutron by James Chadwick at Cavendish Laboratory, Cambridge University, UK. ◆ April The first artificial nuclear mutation by Cockcroft and Walton at Cavendish Laboratory, Cambridge University UK. This used the particle accelerator reported in 1930. Lithium nucleus was split, and at the same, the formula $E = mc^2$ derived by Einstein was verified. Lawrence's cyclotron produced 1.25 MeV protons and splits the atom a few weeks after Cockcroft and Walton. ◆ August Discovery of positron (anti-electron) by Anderson at Caltech, USA. It was found in photo plate record of cosmic rays. This was the first verification of the existence of anti-matter.
ca 1933- 1934	<p>Enrico Fermi completed the theory of Beta decay based on the existence of proposed neutrino.</p>
1934	<p>Positron emission (Beta Plus decay) was observed by Frédéric and Irène Joliot-Curie after they bombarded aluminum by alpha particle. Artificial isotopes of phosphor were created and they emit particles. They found that the particles emitted were identical to anti-electron discovered by Anderson in 1932.</p> <ul style="list-style-type: none"> • <i>July Linear Particle Accelerator in Taiwan (this application.) was completed (300 keV), and succeeded to reconfirm the artificial nuclear mutation by Cockcroft and Walton.</i> <p>... research of the other Japanese groups is detailed in [2].</p>
1938	<p>Nuclear fission reported by Otto Hahn and Fritz Strassmann</p>
1939	<p>Nuclear fission theoretically explained by Lise Metiner and Otto Robert Frisch</p>