Appendix A
Timetable

1054 Chinese astronomers observe a supernova explosion.
1521 Observation of the Magellanic Clouds.
1572 Brahe discovers the supernova SN 1572.
1604 Kepler discovers the supernova SN 1604.
1609 Galilei is the first to use optical instruments for astronomical observations.
Kepler publishes the fundamental laws of planetary movement.
1693 Newton notes the instability of a stable, infinitely extended universe.
1733 D'Ortous de Mairan suggests the solar origin of the polar lights.
1750 Wright discusses galaxies and the shape of the Milky Way.
1755 Kant publishes his *Allgemeine Naturgeschichte und Theorie des Himmels* (*Universal Natural History and Theory of the Heavens*).
1781 The final version of the *Messier Catalogue of Nebulae and Star Clusters* is published.
1785 Coulomb recognizes the loss of charge by isolated charged conductors.
1845 Discovery of a spiral nebula by Rosse.
1857 Geißler develops the electrical discharge tube.
1888 Dreyer publishes *The General Catalogue of Nebulae and Clusters of Stars*.
1895 Wilson develops a first version of the cloud chamber.
Röntgen discovers X-rays.
1896 Becquerel discovers radioactivity.
1897 Townsend localizes single charge carriers unsharply.
J.J. Thomson measures e/m for cathode rays and concludes that they consist of electrons.
1898 Presenting the results of their research Marie and Pierre Curie introduce the term *Radioactivity*.
1899 Villard discovers γ rays.
Hartmann observes calcium lines in the interstellar medium spectroscopically.
1900 As explanation for the ionisation of charged conductors, Wilson suggests small amounts of radioactive substances.
Julius Elster and Hans Geitel arrive at the same conclusion.
Planck suggests the quantization of the interaction between radiation and matter.

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1901 Wilson suggests to look for the source of the ionisation of charged conductors outside the atmosphere.

1902 Linke performs twelve balloon-flights in altitudes up to 5 500 meters with the result of increasing ionisation in height over 3 000 meters.
Kaufmann convincingly shows that β-rays are electrons.
Kennely and Heaviside suggest an electrically conducting layer in the upper atmosphere.

1903 Rutherford suggests terrestrial, radioactive substances to be the reason of the ionisation of charged conductors.

1905 Einstein publishes his light quantum hypothesis, the theory of Brownian motion and Special Relativity.

1906 Rutherford and his assistants carry out their scattering experiments.

1908 Perrin's measurements confirm Einstein's theory of Brownian motion.
Flemming and Bergwitz start a series of balloon-flights but due to problems with their measurement apparatus, they yield no convincing results.
Gockel uses the term *cosmic radiation*.

1909 In three balloon flights Gockel confirms that ionisation decreases only slowly with the altitude.
Under the direction of Rutherford, Geiger and Marsden measure unexpected backward scattering and suggest that atoms have a nucleus.

1910 Millikan performs his oil droplet experiment.
After designing and building the electrometer, Wulf conducts measurements on the Eiffel Tower. The results contradict the assumption that the radiation leading to the ionisation of charged conductors is terrestrial. The same conclusion is reached by Pacini, Simpson and Wright.

1911 Wilson uses the cloud chamber to visualize α- and β-rays.
Hertzsprung reveals the main sequence.

1912 Victor Hess recognizes an increase of radiation in altitudes of over 3 000 meters. As a reason he suggests the existence of *Höhenstrahlung*.
Leavitt discovers the correlation of brightness and period of Cepheid variable stars.

1913 Bohr develops his first quantum theory of atoms.

1914 Walter Kolörster confirms the results of Hess with further balloon flights.
Russell is able to obtain a diagram similar to the one of Hertzsprung.

1915 Einstein publishes the final version of his field equations of General Relativity.
Schweidler excludes several terrestrial and solar possibilities as origin of the cosmic rays.
Gockel and Hess give further confirmation of *Höhenstrahlung* with long term measurements.

1916 Einstein extends his light quantum hypothesis.
Schwarzschild shows the possibility of the existence of black holes.

1917 Einstein extends his field equations by introducing the cosmological constant.
Slipher finds first evidence for the expansion of the universe.

1919 Eddington gives, influenced by the work of de Sitter, evidence for the theory of General Relativity by observing the eclipse on May 29th.

Kolhörster proposes the possibility of a latitude dependence of the cosmic rays.
Rutherford finds first evidence for the proton.

1920 The discussion about the nature of nebulae culminates in the Great Debate between Shapley and Curtis.
Eddington proposes that the energy of the sun might be produced by the fusion of hydrogen to helium.
Michelson and Pease perform the first measurements of stellar diameters.

1921 Nernst speculates about cosmic rays as by-products of the explosion of stars.
Chadwick and Bieler predict the strong force.

1922 Compton applies relativistic kinematics to the scattering of gamma radiation and electrons.
Friedman publishes his solutions to Einstein's field equations.
Wirtz formulates the idea of an expanding universe.

1923 Compton confirms Photons as particles.

1924 Bohr, Kramers and Slater develop the BKS-theory.
Bothe invents the coincidence method.
De Broglie proposes the wave–particle duality of matter.

1925 Bothe and Geiger validate the Compton-effect for single scattering processes.
Hubble measures the distance to the Andromeda Nebula and in doing so settles the Shapley–Curtis–Debate.
Wooster and Ellis try to solve the issue of monoenergetic electrons in β-decay calorimetrically.
Uhlenbeck and Goudsmit discover that the electron has spin $1/2$.
Pauli formulates the exclusion principle.
Heisenberg develops matrix mechanics.
Adams observes the redshift.

1926 Millikan finally reaches the same conclusion as Hess and Kolhörster and confirms the existence of the *Millikan Rays* – as he calls the cosmic rays.
Schrödinger develops his wave mechanics.
Born gives the probability interpretation of quantum mechanics.
The term *photon* is proposed by Lewis.

1927 Lemaître obtains the same solutions to Einstein's field equations as Friedman and in doing so gives evidence for the expansion of the universe. His work can be seen as the starting point for modern cosmology.
Dirac gives the basic equations of quantum electrodynamics.
First detection of cosmic rays in a cloud chamber by Skobeltzyn.
Heisenberg states his uncertainty principle.

1928 The Geiger–Müller counter is developed.
Gamow discovers the α-decay by quantum tunneling and applies.

1929 Hubble and Humason discover the proportionality between radial velocities and distances of galaxies; they introduce the Hubble constant.

1930 Rossi improves the coincidence method given by Bothe.
Dirac predicts the negative energy solutions of the Dirac equation.
Mott and Heisenberg show that Born's quantum mechanics of scattering predicts particle tracks with a classical shape.

Bethe develops the quantum theory of the passage of a charged particle through matter.
Bothe and collaborators detect the neutron, but fail to recognize it.
Jansky discovers extraterrestrial radio-noise.

1932 Regener confirms the results of Hess and Kolhörster with high accuracy measurements.
Chadwick discovers the neutron.
Using a cloud chamber, Anderson detects the positron in cosmic rays.
Blackett and Occhialini develop the method of triggering the cloud chamber by means of a coincidence counter.

1933 The Bothe–Kolhörster experiment confirms together with the results of Skobeltzyn, Clay and Compton that cosmic rays are charged particles.
Blackett and Occhialini detect e^+e^- pair-production as well as the first particle showers.
Fermi gives the correct theory for β-decay.
Rossi observes that the coincidence rate increases if an absorber is placed above the counter and thus measures the first particle showers.
Alvarez shows that cosmic radiation consists mainly of positively charged particles.

1934 Zwicky and Baade use the term *supernova* and are able to demonstrate that supernovae are sources of cosmic rays.
Bethe and Heitler lay down the key processes of cascade multiplication in extended air showers.
While examining galaxies in the Coma cluster, Zwicky points out the necessity of the existence of dark matter to hold together the clusters of stars.
The Cherenkov effect is discovered.
Pauli introduces the term *neutrino*.
Bethe and Peierls calculate the cross section for neutrinos interacting with a nucleus.

1935 Yukawa predicts the pion.
The Compton–Getting effect is predicted.
Goeppert-Mayer estimates the lifetime of double beta decay.

1936 The Breit–Wigner formula is stated.
Neddermeyer and Anderson detect a *meson*.
Hubble introduces the classification into spiral, elliptical, barrel spiral, and irregular galaxies.

1937 Blau develops nuclear emulsions.
Majorana proposes a two-component theory of the neutrino.

1938 Auger et al. can show the existence of air showers with coincidence measurement of two counters separated by some distance.
The Bhabha–Heitler theory gives further insights into extended air showers; Carlson and Oppenheimer complete the theory and prove that it qualitatively agrees with the experimental results of Regener and Pfotzer.
Bethe and Weizsäcker propose the CNO-cycle as a source of energy generation in the sun.

1940 Williams and Roberts present the first photograph of a decaying muon.
Bethe and Critchfield propose the pp-chain.
Reber discovers the radio source Cygnus A.
1941 Rasetti is the first to measure the lifetime of a meson.
The term *nucleon* is introduced.
1944 Walter Baade distinguishes between two different stellar populations and in doing so can correct the Hubble constant by a factor 2.7. Further corrections follow.
Discovery of the Seyfert galaxies.
1947 Blackett predicts that relativistic particles passing the atmosphere produce Cherenkov light.
The Feynman diagrams are introduced.
1948 Alpher and Gamow formulate their theory of the origin of the elements.
Hoyle, Bondi and Gold support the steady-state model of the universe.
The first artificial pions are produced in the synchotron cyclotron.
1949 Hoyle is the first to use the term *Big Bang*.
Gamow and collaborators predict the cosmic microwave background.
Fermi is the first to describe a power law distribution of cosmic rays.
Discovery of the extragalactic radio sources NGC 4486 (M87) and NGC 5128 (Centaurus A).
The K^+ is detected.
1950 The Π^0 is detected at the cyclotron at the university of California.
1951 The detector *El Monstro* ist designed and built.
Biermann predicts the solar winds.
The λ° and the K° are detected in cosmic rays.
1952 Glaser invents the bubble chamber.
Discovery of the Δ.
1953 Bassi, Clark and Rossi show that the disk of air showers is quite thin.
Galbraith and Jelley prove that air showers generate Cherenkov light.
First measurements of *Project Poltergeist*.
1954 Baade and Minkowsky identify the optical counterpart of Cygnus A.
Yang and Mills develop the gauge theories, providing the theoretical foundations for the later standard model.
1956 Kulikov and Khristiansen discover the *knee* of the cosmic ray spectrum.
First detection of neutrinos by Cowan and Reines near a nuclear reactor.
1957 Hoyle works on the synthesis of the elements in stars with impressive results.
Sputnik is launched.
Schwinger proposes the unification of the weak and electromagnetic interactions.
1958 Porter is the first to succeed in preventing bacterial growth in unfiltered water long enough to realise a stable detector.
Morrison puts forward strong arguments for observing very high energy gamma rays from the Crab nebula.
The Bolivian Air Shower Joint Experiment (BASJE) at Mount Chacaltaya is established.

Discovery of the Van Allen Belt.

1959 The work to build the Volcano Ranch Array begins.
Like Morrison earlier, Guiseppe Cocconi presents strong arguments for having observed very high energy gamma rays from the Crab nebula.

1960 Sandage discovers an unusual blue quasi stellar object by optically observing 3C48.

1961 Ryle and Clarke publish the results of their survey of radio galaxies which contradict the steady-state model.
Linsley discovers the first ultra-high energy cosmic ray event.

1962 The Schrödinger Prize of the Australian Academy of Science is awarded to Blau.
Giacconi discovers the first X-ray sources outside the Solar System.
The fluorescence technique is first discussed at an international forum in La Paz.
Maki, Nakagawa and Sakata introduce neutrino flavour mixing and flavour oscillations.
Muon neutrinos are discovered and distinguished from electron neutrinos.
Hazard, Mackey and Shimmins determine the precise position for 3C273 and state that it is a double source.

1963 First detection of quasars by Schmidt and identifying its Balmer lines.

1964 Zweig and Gell-Mann predict quarks.

1965 Penzias and Wilson discover the cosmic micro wave background and in doing so finally disprove the steady-state model.
Dicke gives a proper explanation of the microwave background.
Reines and colleagues set first astrophysical limits for the energy of neutrinos.

1966 Gould and Schréder make the first prediction of the opacity of the universe.
The Greisen–Zatsepin–Kuzmin cutoff is stated.

1967 Sachs and Wolfe calculate the temperature fluctuations in the cosmic microwave background.
First detection of a gamma ray burst by the Vela satellite.
First detection of solar neutrinos by the Davis experiment.
Wheeler uses the term *black hole*.

1968 The concept of Silk damping is formulated.
Hewish is the first to detect a pulsar.
First measurements at the Sydney University Giant Air Shower Recorder (SUGAR) and Haverah Park.
Confirmation of the quark-parton model at SLAC.
First measurement of solar neutrinos and statement of the *solar neutrino problem*.

1970 The Sunyaev–Zeldovich effect is stated.
The Yakutsk Array begins taking data.
The Uhuru satellite is launched.

1972 Bolton confirms the existence of black holes by detection of Cygnus X-1.

1973 Ostriker and Peebles discover that the amount of visible matter in the disks of typical spiral galaxies is not sufficient for keeping it from flying apart.

1974 Perl discovers the τ-lepton.
Fanaroff and Riley distinguish between FR I and FR II radio sources.
1976 The Faber–Jackson relation is discovered.
1977 The Tully–Fisher relation is discovered.
1978 Gregory and Thompson describe the Coma supercluster.
1981 The Fly's Eye array starts taking data.
1983 Samorski and Stamm report the observation of ultra-high-energy gamma-ray emission from Cygnus X-3.
The Kamiokande Nucleon Decay Experiment (KamiokaNDE) starts taking data.
CERN discovers the $W^{\pm}$- and the Z°-bosons.
1985 IMB and Kamiokande discover the *atmospheric neutrino anomaly*.
1986 The Kamiokande-II experiment starts taking data and confirms the deficit of solar neutrinos.
1987 Discovery of supernova 1987A.
Detection of solar neutrinos by the Kamiokande detector in real time.
The First International School of Astroparticle Physics takes place.
1989 Cosmic Background Explorer (COBE) is launched and can confirm the cosmic microwave background as the thermal afterglow of the hot early universe as well as giving support of the theory of existence of cold dark matter.
The CASE-MIA array starts its work as does the EAS-TOP-array.
The Whipple collaboration detects TeV gamma rays from the Crab nebula.
Kiel physicists start to build an improved scintillation counter array, the High Energy Gamma Ray Astronomy (HEGRA) experiment.
The LEP accelerator experiments and the SLAC state the existence of only three light neutrino species.
1990 First data are taken at the Akeno Giant Air Shower Array (AGASA).
1991 The *ankle* is detected at Haverah Park, Akeno and Fly's Eye.
The Gallium Experiment (GALLEX) starts taking data.
SAGE and GALLEX confirm the solar neutrino deficit.
1992 Fleury and Vacanti invite the community to a conference at Palaiseau with the aim of forming a project of a major imaging Cherenkov telescope – no consensus can be achieved.
First detection of pp-neutrinos.
The Large Volume Detector (LVD) starts taking data.
Perl discovers the τ.
1996 KArlsruhe Shower Core and Array DEtector (KASCADE) starts taking data.
Super-Kamiokande begins searching for neutrinos.
1997 The High-Resolution Fly's Eye (HiRes) becomes the successor of Fly's Eye.
The HEGRA-collaboration confirms the very high energy γ-emission of Mkn 501.
1998 The Balloon Observation Of Millimetric Extragalactic Radiation ANd Geophysics (BOOMERanG) starts and finds further support for the existence of dark matter.
Riess and others publish measurements based on several supernovae.

Turner introduces the term *Dark Energy* to explain the acceleration of the expansion of the universe.
The Gallium Neutrino Observatory (GNO) succeeds GALLEX.
The Sudbury Neutrino Observatory (SNO) starts taking data.
The Super-Kamiokande collaboration confirms the existence of neutrino-oscillations and thus the existence of non-zero neutrino mass.

1999 Perlmutter and others publish the cosmological results from the investigations of several supernovae.
The Collaboration of Australia and Nippon for Gamma-Ray Observation in the Outback (Cangoroo III) starts taking data.

2000 The DONUT experiment detects the first tau neutrino; it is stated as oscillating partner to the muon neutrino.

2001 AMANDA II is completed.
SNO announces the observation of neutral currents from solar neutrinos and finally solves the problem of missing solar neutrinos.

2002 The High Energy Stereoscopic System (HESS) starts taking data as well as the first really successful tail-catcher detector Milargo.
Kamioka Liquid-scintillator Anti-Neutrino Detector (KamLAND) begins data taking.
Using neutrinos from an accelerator, KamLAND confirms the results of the observations of the results of the observations of solar neutrinos.

2003 The KASKADE array is expanded to KASKADE-Grande.

2004 MAGIC starts taking data.
Physics data collecting begins at the Pierre Auger Observatory.

2006 The Very Energetic Radiation Imaging Telescope System (VERITAS) Starts taking data.

2007 Data taking starts at the BOREXINO experiment.
A first real-time detection of monoenergetic ^{7}Be neutrinos is announced.

2008 The Telescope Array (TA) near Utah starts taking data.
HiRes and Auger discover the suppression at the GZK threshold.

2010 The neutrino detector IceCube is completed.

Appendix B
Nobel Prizes

All quotes taken from: http://www.nobelprize.org/nobel_prizes/physics/laureates.

1901 Wilhelm Conrad Röntgen "in recognition of the extraordinary services he has rendered by the discovery of the remarkable rays subsequently named after him".

1903 Antoine Henri Becquerel, Pierre Curie and Marie Curie, née Sklodowska. The Nobel Prize in Physics 1903 was divided, one half awarded to Antoine Henri Becquerel "in recognition of the extraordinary services he has rendered by his discovery of spontaneous radioactivity", the other half jointly to Pierre Curie and Marie Curie, née Sklodowska "in recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor Henri Becquerel".

1905 Philipp Eduard Anton von Lenard "for his work on cathode rays".

1906 Joseph John Thomson "in recognition of the great merits of his theoretical and experimental investigations on the conduction of electricity by gases".

1907 Albert Abraham Michelson "for his optical precision instruments and the spectroscopic and metrological investigations carried out with their aid".

1918 Max Karl Ernst Ludwig Planck "in recognition of the services he rendered to the advancement of Physics by his discovery of energy quanta".

1921 Albert Einstein "for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect".

1922 Niels Henrik David Bohr "for his services in the investigation of the structure of atoms and of the radiation emanating from them".

1923 Robert Andrews Millikan "for his work on the elementary charge of electricity and on the photoelectric effect".

1925 James Franck and Gustav Ludwig Hertz "for their discovery of the laws governing the impact of an electron upon an atom".

1927 Arthur Holly Compton "for his discovery of the effect named after him "and Charles Thomson Rees Wilson "for his method of making the paths of electrically charged particles visible by condensation of vapour".

1929 Prince Louis-Victor Pierre Raymond de Broglie "for his discovery of the wave nature of electrons".

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1932 Werner Karl Heisenberg "for the creation of quantum mechanics, the application of which has, inter alia, led to the discovery of the allotropic forms of hydrogen".
1933 Erwin Schrödinger and Paul Adrien Maurice Dirac "for the discovery of new productive forms of atomic theory".
1935 James Chadwick "for the discovery of the neutron".
1936 Victor Franz Hess "for his discovery of cosmic radiation" and Carl David Anderson "for his discovery of the positron".
1938 Enrico Fermi "for his demonstrations of the existence of new radioactive elements produced by neutron irradiation, and for his related discovery of nuclear reactions brought about by slow neutrons".
1939 Ernest Orlando Lawrence "for the invention and development of the cyclotron and for results obtained with it, especially with regard to artificial radioactive elements".
1945 Wolfgang Pauli "for the discovery of the Exclusion Principle, also called the Pauli Principle".
1948 Patrick Maynard Stuart Blackett "for his development of the Wilson cloud chamber method, and his discoveries therewith in the fields of nuclear physics and cosmic radiation".
1949 Hideki Yukawa "for his prediction of the existence of mesons on the basis of theoretical work on nuclear forces".
1950 Cecil Frank Powell "for his development of the photographic method of studying nuclear processes and his discoveries regarding mesons made with this method".
1951 Sir John Douglas Cockcroft and Ernest Thomas Sinton Walton "for their pioneer work on the transmutation of atomic nuclei by artificially accelerated atomic particles".
1954 Max Born "for his fundamental research in quantum mechanics, especially for his statistical interpretation of the wavefunction" and Walther Bothe "for the coincidence method and his discoveries made therewith".
1955 Divided equally between Willis Eugene Lamb "for his discoveries concerning the fine structure of the hydrogen spectrum" and Polykarp Kusch "for his precision determination of the magnetic moment of the electron".
1957 Chen Ning Yang and Tsung-Dao (T.D.) Lee "for their penetrating investigation of the so-called parity laws which has led to important discoveries regarding the elementary particles".
1958 Pavel Alekseyevich Cherenkov, Il'ja Mikhailovich Frank and Igor Yevgenyevich Tamm "for the discovery and the interpretation of the Cherenkov effect".
1959 Emilio Gino Segré and Owen Chamberlain "for their discovery of the antiproton".
1960 Donald A. Glaser "for the invention of the bubble chamber".
1961 Divided equally between Robert Hofstadter "for his pioneering studies of electron scattering in atomic nuclei and for his thereby achieved discoveries concerning the structure of the nucleons" and Rudolf Ludwig Mössbauer "for his researches concerning the resonance absorption of gamma radiation and his discovery in this connection of the effect which bears his name".

1963 Divided, one half awarded to Eugene Paul Wigner "for his contributions to the theory of the atomic nucleus and the elementary particles, particularly through the discovery and application of fundamental symmetry principles", the other half jointly to Maria Goeppert Mayer and J. Hans D. Jensen "for their discoveries concerning nuclear shell structure".

1965 Jointly to Sin-Itiro Tomonaga, Julian Schwinger and Richard P. Feynman "for their fundamental work in quantum electrodynamics, with deep-ploughing consequences for the physics of elementary particles".

1967 Hans Bethe "for his contributions to the theory of nuclear reactions, especially his discoveries concerning the energy production in stars".

1969 Murray Gell-Mann "for his contributions and discoveries concerning the classification of elementary particles and their interactions".

1970 Divided equally between Hannes Olof Gösta Alfvén "for fundamental work and discoveries in magnetohydro-dynamics with fruitful applications in different parts of plasma physics" and Louis Eugéne Félix Néel "for fundamental work and discoveries concerning antiferromagnetism and ferrimagnetism which have led to important applications in solid state physics".

1974 Martin Ryle and Antony Hewish "for their pioneering research in radio astrophysics: Ryle for his observations and inventions, in particular of the aperture synthesis technique, and Hewish for his decisive role in the discovery of pulsars".

1977 Jointly to Philip Warren Anderson, Sir Nevill Francis Mott and John Hasbrouck van Vleck "for their fundamental theoretical investigations of the electronic structure of magnetic and disordered systems".

1978 Divided, one half awarded to Pyotr Leonidovich Kapitsa "for his basic inventions and discoveries in the area of low-temperature physics", the other half jointly to Arno Allan Penzias and Robert Woodrow Wilson "for their discovery of cosmic microwave background radiation".

1979 Jointly to Sheldon Lee Glashow, Abdus Salam and Steven Weinberg "for their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles, including, inter alia, the prediction of the weak neutral current".

1980 Jointly to James Watson Cronin and Val Logsdon Fitch "for the discovery of violations of fundamental symmetry principles in the decay of neutral K-mesons".

1981 Divided, one half jointly to Nicolaas Bloembergen and Arthur Leonard Schawlow "for their contribution to the development of laser spectroscopy" and the other half to Kai M. Siegbahn "for his contribution to the development of high-resolution electron spectroscopy".

1983 Divided equally between Subramanyan Chandrasekhar "for his theoretical studies of the physical processes of importance to the structure and evolution of the stars" and William Alfred Fowler "for his theoretical and experimental studies of the nuclear reactions of importance in the formation of the chemical elements in the universe".

1984 Jointly to Carlo Rubbia and Simon van der Meer "for their decisive contributions to the large project, which led to the discovery of the field particles W and Z, communicators of weak interaction".

1986 Divided, one half awarded to Ernst Ruska "for his fundamental work in electron optics, and for the design of the first electron microscope", the other half jointly to Gerd Binnig and Heinrich Rohrer "for their design of the scanning tunneling microscope".

1988 Jointly to Leon M. Lederman, Melvin Schwartz and Jack Steinberger "for the neutrino beam method and the demonstration of the doublet structure of the leptons through the discovery of the muon neutrino".

1990 Jointly to Jerome I. Friedman, Henry W. Kendall and Richard E. Taylor "for their pioneering investigations concerning deep inelastic scattering of electrons on protons and bound neutrons, which have been of essential importance for the development of the quark model in particle physics".

1992 Georges Charpak "for his invention and development of particle detectors, in particular the multiwire proportional chamber".

1993 Jointly to Russell A. Hulse and Joseph H. Taylor Jr. "for the discovery of a new type of pulsar, a discovery that has opened up new possibilities for the study of gravitation".

1995 Awarded "for pioneering experimental contributions to lepton physics" jointly with one half to Martin L. Perl "for the discovery of the tau lepton" and with one half to Frederick Reines "for the detection of the neutrino".

1996 Jointly to David M. Lee, Douglas D. Osheroff and Robert C. Richardson "for their discovery of superfluidity in helium-3".

2002 One half jointly to Raymond Davis Jr. and Masatoshi Koshiba "for pioneering contributions to astrophysics, in particular for the detection of cosmic neutrinos" and the other half to Riccardo Giacconi "for pioneering contributions to astrophysics, which have led to the discovery of cosmic X-ray sources".

2006 Jointly to John C. Mather and George F. Smoot "for their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation".

2011 Divided, one half awarded to Saul Perlmutter, the other half jointly to Brian P. Schmidt and Adam G. Riess "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae".

Appendix C
Textbooks

C.1 Textbooks 1987–2012

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