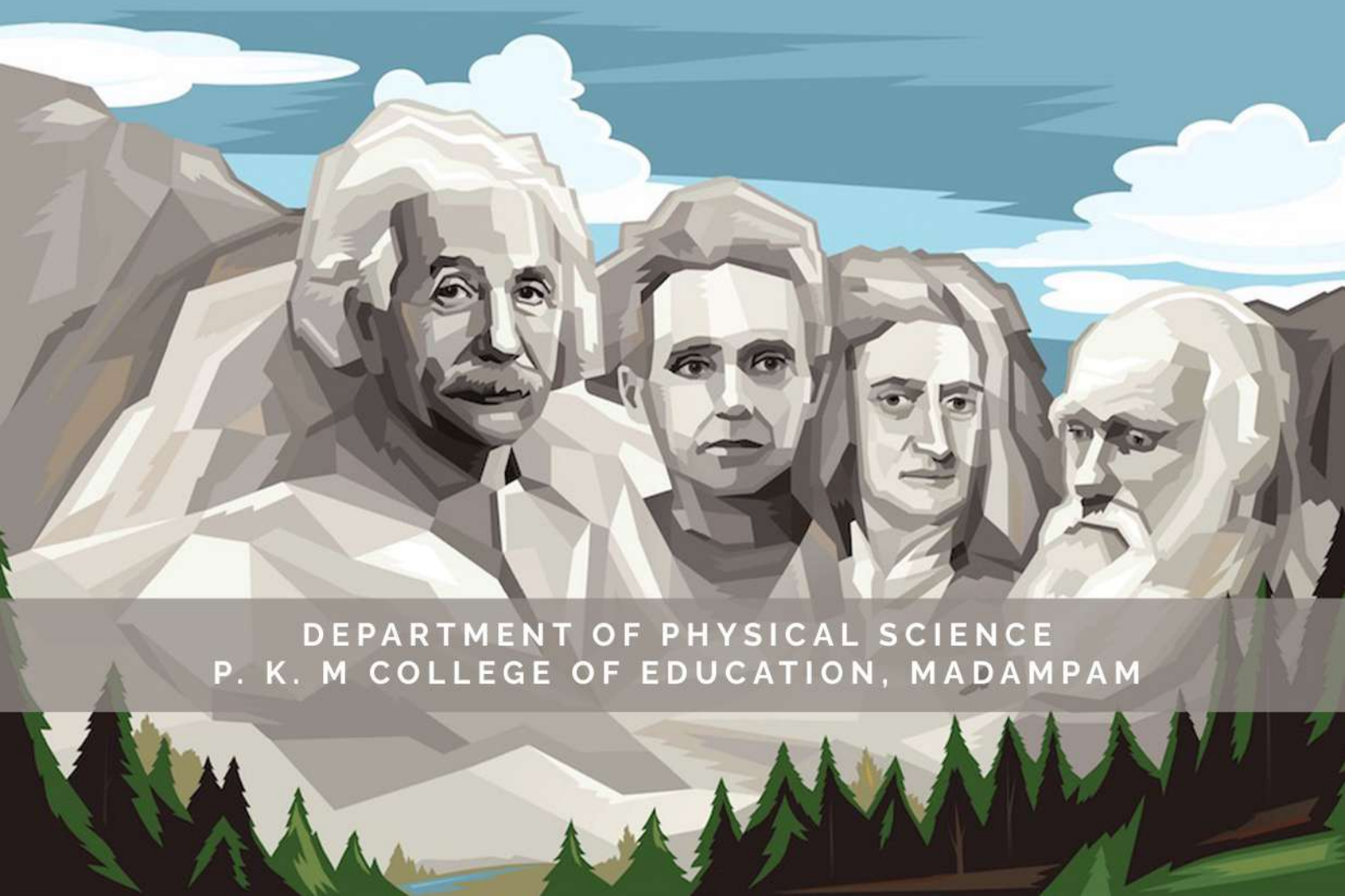
DESIDERIUM

LIFE STORY OF SCIENTISTS

Editor
Dr Prasanth Mathew



DEPARTMENT OF PHYSICAL SCIENCE
P. K. M COLLEGE OF EDUCATION, MADAMPAM

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Title	:	**DESIDERIUM** **Life Story of Scientist.**
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PREFACE

Science is a cumulative and endless series of empirical observations and systematic experimentations which result in the formation of fundamental scientific knowledge such as facts, concepts, principles, theories and laws about the physical world and phenomenon. And this scientific knowledge is subject to modification in the light of further empirical observations and experimentations, hence it is called a dynamic and expanding body of knowledge. However, science is not only a body of knowledge but also the process of acquiring it.

To understand how science developed and prospered, we have to go through the history of science. The history of science is the history of human evolution to the present day. It is the story of man's struggles to improve his living conditions and to overcome his physical limitations through scientific discoveries and inventions. The history of science is not easy to tell. We do not know much about its earliest days. We do not even know exactly who invented the fire and the wheel, or what country they belonged to. But one thing is for sure though, it is the contributions of many scientists who lived in different eras that brought science to where it is today. Therefore, the known and unknown scientists were paths to this tremendous growth of science. Telling the life story of these scientists would be a life-affirming history of science. This is a small attempt of Physical Science Department of P.K.M College of Education, Madampam, to select the top 63 scientists and depict the development of science through their life experiences.

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NOBLE PRIZE WINNERS

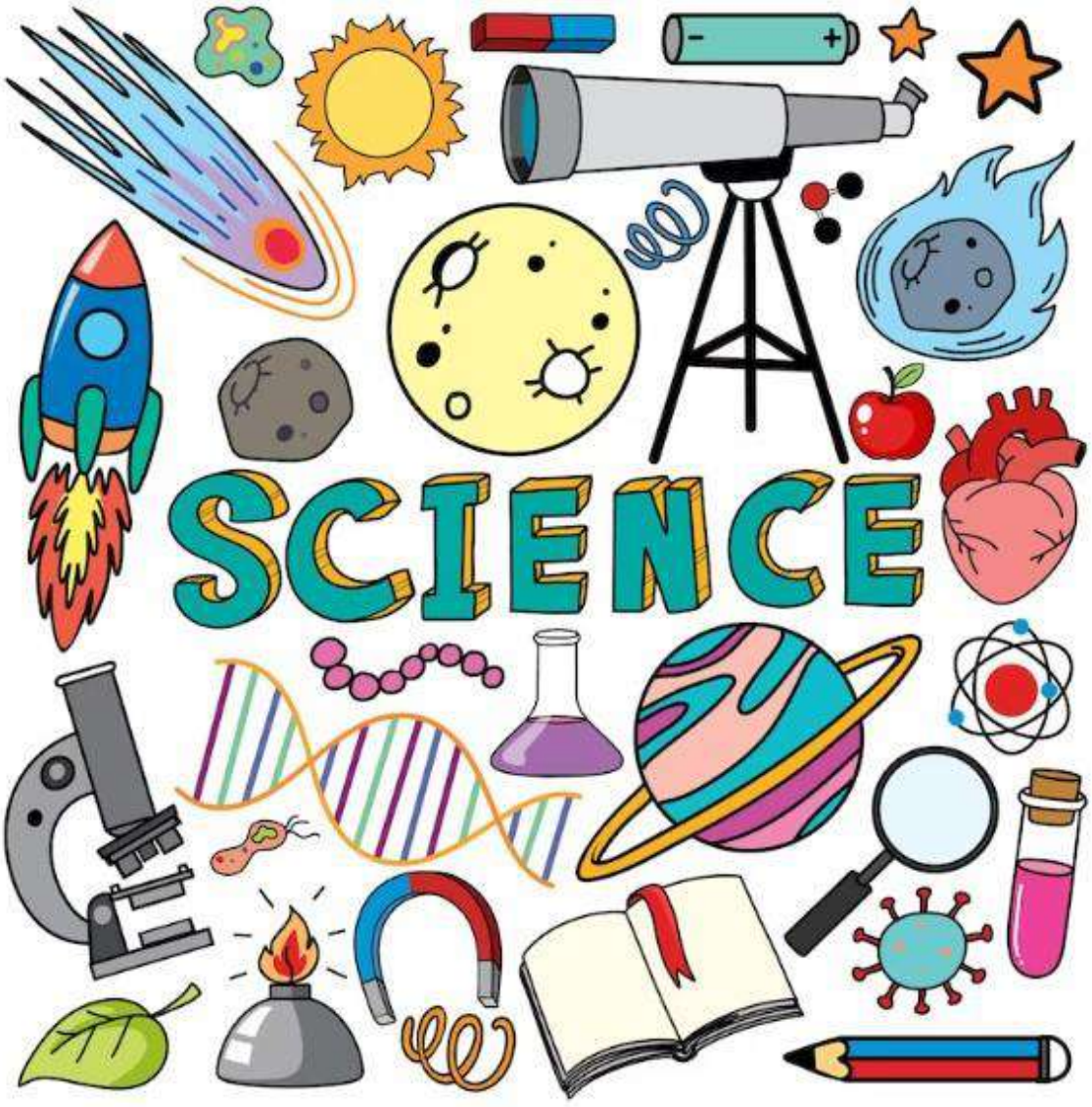
Sl No	Name of Scientist
1.	Lord Rayligh (1904)
2.	Erwin Schrodinger (1933)
3.	Werner Heisenberg (1932)
4.	Klaus hasselman (2021)

INDIAN SCIENTIST

Sl No	Name of Scientist
1.	C V Raman
2.	A.P.J. Abdul Kalam
3.	Venkatraman Ramakrishnan
4.	D S Kothari
5.	M K Vainu Bappu
6.	P K Iyengar
7.	Dr. Vikram Sarabhai
8.	Thanu Padmanabhan
9.	Meghnad Saha
10.	E C G Sudharshan
11.	Prafulla Chandra Ray
12	Raja Ramanna

WOMEN SCIENTIST

Sl No	Name of Scientist
1.	Marie Curie
2.	Asima Chatterjee
3.	Dorothy Hodgkin
4.	Irene Joliot- Curie
5.	Lise Meitner
6	Vera Rubin
7.	Anna Mani
8.	Kalpana Chawla
9.	Tessy Thomas
10.	Ritu Karidhal


SCIENCE

1. C V RAMAN

Chandrasekhara Venkata Raman, (born November 7, 1888, Trichinopoly, India—died November 21, 1970, Bangalore), Indian physicist whose work was influential in the growth of science in India.

After earning a master's degree in physics at Presidency College, University of Madras, in 1907, scientific career did not appear to present the best possibilities, so Raman joined the Indian Finance Department in 1907; Raman found opportunities for carrying on experimental research in the laboratory of the Indian Association for the Cultivation of Science at Calcutta (of which he became Honorary Secretary in 1919). In 1917 he was offered the newly endowed Palit Chair of Physics at Calcutta University, and decided to accept it. After 15 years at Calcutta he became Professor at the Indian Institute of Science at Bangalore (1933-1948), and since 1948 he is Director of the Raman Institute of Research at Bangalore, established and endowed by himself.

When he was working as a professor at Calcutta he spent time in studying the scattering of light in various substances, in 1928 he found that when a transparent substance is illuminated by a beam of light of one frequency, a small portion of the light emerges at right angles to the original direction, and some of this light is of different frequencies than that of the incident light. These so-called Raman frequencies are the energies associated with transitions between different rotational and vibrational states in the scattering material. For this he received Nobel Prize in the year 1930.

He received Matteucci medal (1928), Hughes medal (1930), Bharat Ratna (1954), Lenin Peace prize (1957). He contributed to the building up of nearly every Indian research institution in his time, founded the Indian Journal of Physics (1926), Raman research institute, and the Indian Academy of Sciences, and trained hundreds of students who found important posts in universities and government in India.

2. ENRICO FERMI

Enrico fermi was an Italian American physicist and the creator of the world's first nuclear reactor. He made significant contributions to the development of statistical mechanics, quantum theory and nuclear and particle physics.

Fermi was born in Rome on 29th September 1901 as the third child of albert fermi and lda de Gattis. During his school days he found a physics book Elementron Physicae Mathematicae helped him to start some projects such as building gyroscopes and measuring the acceleration of earth's gravity. Fermi cleared all the difficult entrance exam with first rank. He completed his graduation in physics and won a Rockefeller Fellowship in 1923 and spent several months with renowned physicist Max Born in Germany.

Fermi was the first to pint out the Einstein's equation ($E = mc^2$) was an enormous amount of nuclear potential energy to be exploited. In 1925 Fermi published a paper 'On the quantisation of the perfect monoatomic gas' in which he applied the exclusion principle to an ideal gas. It is now known as Fermi-Dirac statistics. The particles which obey exclusion principle are called Fermions. Fermi was appointed as a professor of physics at Columbia University. His experiments on Uranium neutrons led to the first controlled nuclear chain reaction in Chicago in Dec 2 1942. During World War 11, Fermi became the principal leader on the Manhattan project which focused on the development of Atom Bomb.

In 1923 Fermi Received Nobel Prize in physics at the age of 37 for his demonstration of the existence of new radioactive elements produced by neutron irradiation and for his related discovery of nuclear reactions brought about by slow neutrons. He also received awards such as Medal for merit, Matteucci medal (1926), Barnard medal for his meritorious service to science (1950), Rumford prize (1953) and Max Planck medal (1954). He died in his sleep on Nov. 28, 1954 due to stomach cancer at his home in Chicago.

3. GEORG SIMON OHM

(Born March 16, 1789, Erlangen, Bavaria, Germany-Died July 6, 1854, Munich) Georg Simon Ohm was a German physicist who clarified the fundamental relationships between electric current, voltage, and resistance. This integration of the three properties into a single formula, which became known as Ohm's law, served as a huge stepping stone for all the subsequent advances involving electrical circuits, ranging from electric lights to radios and computers.

In his first paper published in 1825, Ohm examines the decrease in the electromagnetic force produced by a wire as the length of the wire increased. The paper deduced mathematical relationships based purely on the experimental evidence that Ohm had tabulated. In two important papers in 1826, Ohm gave a mathematical description of conduction in electrical circuits modelled on Joseph Fourier's study of heat conduction. Ohm's law appeared in the famous book “Die galvanische Kette, mathematisch bearbeitet” (“The Galvanic Circuit Investigated Mathematically” 1827) in which he gave his complete theory of electricity. The book begins with the mathematical background necessary for an understanding of the rest of the work. While his work later greatly influenced the theory and applications of current electricity. His other contribution was Ohm's acoustic law, sometimes called the acoustic phase law states that a musical sound is perceived by the ear as a set of a number of constituent pure harmonic tone. Finally, in 1852 he was appointed professor of physics at Berlin University.

In 1841, he received the Copley Medal of the Royal Society of London. The “ohm”, the physical unit measuring electrical resistance was also named for him. He was elected as foreign member of the Royal Society in 1842.

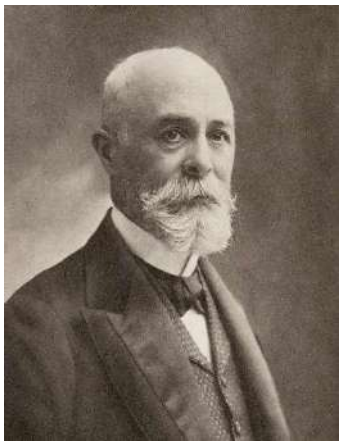
4. HEINRICH HERTZ

(Born February 22, 1857, Hamburg, Germany-Died January 1, 1894, Bonn, Germany) Heinrich Hertz was a brilliant German physicist and experimentalist who demonstrated that the electromagnetic waves predicted by James Clerk Maxwell actually exist. The unit of frequency, cycle per second, was named the "hertz" in his honour.

Hertz mainly focused on Electromagnetism, Electrical engineering and Contact mechanics. In 1883 he began his studies of Maxwell's electromagnetic theory. Between 1885 and 1889, while he was professor of physics at the Karlsruhe Polytechnic, he produced electromagnetic waves in the laboratory and measured their length and velocity. He showed that the nature of their vibration and their susceptibility to reflection and refraction were the same as those of light and heat waves. As a result, he established beyond any doubt that light and heat are electromagnetic radiations. The electromagnetic waves were called Hertzian and, later radio waves. In 1889 Hertz was appointed professor of physics at the University of Bonn, where he continued his research on the discharge of electricity in rarefied gases. In 1892, Hertz began experimenting and demonstrated that cathode rays could penetrate very thin metal foil. His scientific papers were translated into English and published in three volumes: Electric Waves (1893), Miscellaneous Papers (1896), and Principles of Mechanics (1899).

He won the Italian award for physicists, Matteucci Medal in 1888. In 1890 he was awarded Rumford Medal for his work in electromagnetic radiation. He was honoured by Japan with a membership in the Order of the Sacred Treasure.

5. HENRI BECQUEREL



(Born December 15, 1852, Paris, France-Died August 25, 1908, Le Croisic) Henri Becquerel was a French Physicist, engineer, Nobel laureate, who discovered radioactivity through his investigations on Uranium and other substances.

He was a member of a scientific family extending through several generations, the most notable being his grandfather Antoine-César Becquerel, his father Alexandre-Edmond Becquerel, and his son Jean Becquerel. After his early schooling at the Lycee Louis-le-Grand, Henri received his formal scientific education at the Ecole Polytechnique (1872–74) and engineering training at the Ecole des Ponts et Chaussées. In addition to his teaching and research posts, Becquerel was for many years an engineer in the Department of Bridges and Highways, being appointed chief engineer in 1894. Henri then concerned himself with infrared radiation, the spectra of different phosphorescent crystals under infrared stimulation. Of particular significance, he extended the work of his father by studying the relation between absorption of light and emission of phosphorescence in some uranium compounds. Through these experiments, he discovered radioactivity and published seven papers on radioactivity in 1896. Becquerel found that the X rays issued from the area of a glass vacuum tube made fluorescent when struck by a beam of cathode rays. His other contribution was to measure the deflection of beta particles, which are a constituent of the radiation in both electric and magnetic fields. From the charge to mass value thus obtained, he showed that the beta particle was the same as J J Thomson identified electron. Another discovery was the circumstance that the allegedly active substance in uranium, uranium X. It lost its radiating ability in time. While the uranium is inactive when freshly prepared, eventually regained its lost radioactivity. When Ernest Rutherford and Frederick Soddy found similar decay and regeneration in thorium X and thorium, they were led to the transformation theory of radioactivity. His last major achievement concerned the physiological effect of the radiation.

For his discovery of radioactivity, he shared the 1903 Nobel Prize for Physics with Pierre Curie and Marie Curie. In 1900, he won the Rumford Medal for his discovery of the radioactivity of uranium and he was made an Officer of the Legion of Honour. The Berlin Brandenburg Academy of Sciences and Humanities awarded him the Helmholtz Medal in 1901.

6. JAGADISH CHANDRA BOSE

Jagadish Chandra Bose, (born November 30, 1858, Mymensingh, Bengal, India (now in Bangladesh)—died November 23, 1937, Giridih, Bihar), Indian plant physiologist and physicist who made significant contributions to many areas of science. After earning a degree from the University of Cambridge in 1884 he served as professor of physical science at presidency college Calcutta which he left to found and direct the Bose Research Institute (Bose institute) in Calcutta during 1917 to 1937. To facilitate his research, he constructed an automatic recorder called Crescograph that could detect very small motion of plant tissues. These instruments produced some striking result such as changes in membrane potentials of plant cells in response to various stimuli like microwaves, chemical inhibitors, and temperature among other things. He showed that plants could feel pain, and that certain signals within plant tissues were electrical in nature, and not chemical, as previously believed. Bose demonstration of an apartment power of failing in plants.

Bose experiments on quasi optical properties of very short radio waves in 1895 led him to make improvements on the coherer. And early form of radio detector which have contributed to the development of solid-state physics. He's well known for his work on the wireless transmission of information using microwaves.

Sir J. C. Bose has several accolades to his credit. He was the Companion of the order of the Indian Empire in 1903, Companion of the order of the star of India in 1911 and in 1917 he was knighted. He was a founding Fellow of the Indian National Science Academy, and an avid writer, often regarded as the father of Bengali science fiction, a crater on the moon has been named in his honour. His book includes 'Response in the living and non-living' in 1902 and 'The nervous mechanism of plants' in 1926.

7. JAMES WATT

James Watt was born in Greenock in 1736. He was not a healthy child and was educated at home for most of his early years. His father was a carpenter and shipwright who set himself up in business as a merchant and ship-owner. Watt liked to make models and repair nautical instruments in his father's workshop. Engineering work in Scotland. In 1755 Watt went to London to be an apprentice scientific instrument maker. He was a quick learner and mastered his craft in one year. Aged 19 he returned to Glasgow, where he set up his own business. Before long he was recognized as a high-quality engineer, and employed on the Forth and Clyde Canal and the Caledonian Canal. He was also involved in the improvement of harbors' and in the deepening of Scottish rivers, including the Forth and the Clyde. Improving steam engines. In the late 1750s, Watt met Joseph Black's , who then was Professor of Chemistry at Glasgow University. The men became friends, and Watt provided model engines for Black to use in his lectures on the properties of heat. One Sunday in 1765, Watt was struck by the idea that was to spark the Industrial Revolution. Walking in a park near the Clyde, he suddenly he realised how he could make the standard Newcomen steam engine more efficient. He could use a separate chamber to condense steam without cooling the rest of the engine. He patented his steam engine condensing chamber in 1769.Boulton & Watt and the Industrial Revolution. In 1774, Watt started a business in Birmingham with investor Matthew Boulton to manufacture his improved steam engine. The Boulton & Watt Company produced steam engines that could be used anywhere, and demand for them was high. Watt and Boulton became leading figures in the Industrial Revolution. Watt continued to make improvements to steam engines, and patented other important inventions, such as the rotary engine and a steam locomotive. His achievements were recognized by fellow scientists. He was a fellow of the Royal Society of Edinburgh and the Royal Society of London, and became a Foreign Associate of the French Academy of Sciences. Family and later life Watt's first wife, Margaret, died in childbirth in 1773, leaving him with two young children. He married Ann in 1776 and had a son and a daughter, who died of consumption before their father's death. James Watt died in 1819 in Heathfield, near Birmingham, aged 83.

8. JOSEPH JOHN THOMSON

J.J. Thomson (born December 18, 1856, Cheetham Hill, near Manchester, England—died August 30, 1940, Cambridge, Cambridgeshire), English physicist who helped revolutionize the knowledge of atomic structure by his discovery of the electron (1897). He enrolled at Owens College, Manchester, in 1870, and in 1876 entered Trinity College, Cambridge as a minor scholar. He became a Fellow of Trinity College in 1880. Thomson's early interest in atomic structure was reflected in his 'Treatise on the Motion of Vortex Rings' which won him the Adams Prize in 1884. His Application of Dynamics to Physics and Chemistry appeared in 1886, and in 1892 he had his 'Notes on Recent Researches in Electricity and Magnetism' published.

Thomson may be described as "the man who split the atom" for the first time. Thomson's most important line of work, interrupted only for lectures at Princeton University in 1896, was that which led him in 1897 to the conclusion that all matter, whatever its source, contains particles of the same kind that are much less massive than the atoms of which they form a part. They are now called electrons, although he originally called them corpuscles. His discovery was the result of an attempt to solve a long-standing controversy regarding the nature of cathode rays, he was able to put forward a convincing argument that these rays were composed of particles , or corpuscles, regardless of what kind of gas carried the electric discharge or what kinds of metals were used as conductors. Thomson was an outstanding teacher.

In 1906 he received the Nobel Prize for Physics for his researches into the electrical conductivity of gases; in 1908 he was knighted; in 1909 he was made president of the British Association for the Advancement of Science; in 1912 he received the Order of Merit; the Franklin Medal and Scott Medal in 1923; in 1927 the Mascart Medal; the Dalton Medal in1931; and the Faraday Medal in 1938.

9. NIELS BOHR

Niels Henrik David Bohr, (born October 7, 1885, Copenhagen, Denmark—died November 18, 1962, Copenhagen), Danish physicist who is generally regarded as one of the foremost physicists of the 20th century. After matriculation at the Gammelholm Grammar School in 1903, he entered Copenhagen University where he came under the guidance of Professor C. Christiansen, a profoundly original and highly endowed physicist, and took his Master's degree in Physics in 1909 and his Doctor's degree in 1911.

Niels's doctor's disputation with Ernest Rutherford at university of Manchester being a purely theoretical piece of work on the explanation of the properties of the metals with the aid of the electron theory, which remains to this day a classic on the subject. It was in this work that Bohr was first confronted with the implications of Planck's quantum theory of radiation. Rutherford and his collaborators had established experimentally that the atom consists of a heavy positively charged nucleus with substantially lighter negatively charged electrons circling around it at considerable distance. Bohr published an article in The Philosophical Magazine in 1913, that electrons could only occupy particular orbits determined by the quantum of action and that electromagnetic radiation from an atom occurred only when an electron jumped to a lower-energy orbit. Although radical and unacceptable to most physicists at the time, the Bohr atomic model was able to account for an ever-increasing number of experimental data, famously starting with the spectral line series emitted by hydrogen. Bohr, Heisenberg, and a few others developed Copenhagen interpretation of quantum mechanics, a central element of this is Bohr's complementarity principle.

Bohr was the first to use quantum concepts for which he received Nobel Prize for physics in 1922. He also received Matteucci media (1923), Franklin medal (1926), Max Planck medal (1930), Faraday Lectureship prize (1930), and Atoms for peace award (1957).

10. JOHANNES KEPLER

Johannes Kepler(born December 27, 1571, Weil der Stadt, Württemberg [Germany]—died November 15, 1630, Regensburg), German astronomer who discovered three major laws of planetary motion, conventionally designated as follows: (1) the planets move in elliptical orbits with the Sun at one focus; (2) the time necessary to traverse any arc of a planetary orbit is proportional to the area of the sector between the central body and that arc (the "area law"); and (3) there is an exact relationship between the squares of the planets' periodic times and the cubes of the radii of their orbits (the "harmonic law").

. At Tübingen, where he received a solid education in languages and in science, he met Michael Maestlin, who introduced him to the new world system of Copernicus. In 1594 Kepler accepted an offer to teach mathematics as the successor to Georg Stadius at the Protestant school in Graz (in Styria, Austria). During this period (1594–1600), he composed many official calendars and prognostications and published his first significant work, the 'Mysterium Cosmographicum. He moved to Prague in 1600, to work under the supervision of the great Danish astronomer Tycho Brahe (1546–1601). After Tycho's unexpected death on October 1601, Kepler succeeded him as Imperial Mathematician. During the time in Prague, he completed his most important optical works, 'Astronomiae pars optica' and 'Dioptrice. Also published several treatises on astrology (De fundamentis astrologiae certioribus, Antwort auf Roeslini Diskurs; Tertius interveniens), Discussed about Galileo's telescopic discoveries in 'Dissertatio cum nuncio sidereo', and composed his most significant astronomical work, the 'Astronomia nova', which contains his first two laws of planetary motion. In 1612 he moved to Linz, in Upper Austria, and became a professor at the Landschaftsschule. In 1615, he completed the mathematical works 'Stereometria doliorum *and* Messekunst Archimedis'. In 1619 he published his principal philosophical work, the 'Harmonice mundi', and wrote, partially at the same time, the 'Epitome astronomiae copernicanae' . In 1624 Kepler continued his investigations on mathematics, publishing his work on logarithms. He died on November 15, 1630 at Regensburg.

11. EDMUND HALLEY

Edmond Halley (born Nov. 8, 1656, Haggerston, Shoreditch, near London—died Jan. 14, 1742, Greenwich, near London), English astronomer and mathematician who was the first to calculate the orbit of a comet later named after him. He is also noted for his role in the publication of Isaac Newton's 'Philosophiae Naturalis Principia Mathematica'.

His father was a prosperous soapmaker and property owner.Halley was tutored privately at home before entering St. Paul's School, where he excelled in mathematics and astronomy. Halley entered Queen's College, Oxford, in 1673, when he was 17 years old. Halley made important observations at Oxford, including an occultation of Mars by the moon, and published papers on the solar system and on sunspots. The young astronomer gave up his studies in 1676 and sailed to St. Helena in the South Atlantic. Halley published his star catalog in 1678. King Charles II decreed that Oxford grant Halley a Master of Arts degree. Halley was also elected a fellow of the Royal Society. He observed a comet in Paris in 1680 and worked with Giovanni Cassini to determine its orbit. In 1684, Halley, with fellow Royal Society members Christopher Wren and Robert Hooke, visited Isaac Newton to discuss theories of planetary motion. In 1704, Halley was appointed the Savilian professor of geometry at Oxford. Halley published "A Synopsis of the Astronomy of Comets" in 1705. In this work, he showed that comet sightings of 1456, 1531, 1607 and 1682 were so similar that they must have been the same comet returning. He predicted that it would return in 1758. In 1716, Halley devised a method for observing transits of Venus across the disk of the sun in order to determine the distance of Earth from the sun. He also proposed two types of diving bells for exploring underwater. In 1718, by comparing star positions with data recorded by the Greek philosopher Ptolemy, he deduced the motion of stars.

In 1720, Halley succeeded Flamsteed as Astronomer Royal. He continued to make observations, such as timing the transits of the moon across the meridian, which he hoped would eventually be useful in determining longitude at sea. Halley died Jan. 14, 1742, in Greenwich, England.

12. GALILEO GALILEI

Galileo Galilei (born February 15, 1564, Pisa [Italy]—died January 8, 1642, Arcetri, near Florence), Italian natural philosopher, astronomer, and mathematician who made fundamental contributions to the sciences of motion, astronomy, and strength of materials and to the development of the scientific method.

He was the oldest son of Vincenzo Galilei, a musician who made important contributions to the theory and practice of music. Although Galileo seriously considered the priesthood as a young man, at his father's urging he instead enrolled in 1580 at the University of Pisa for a medical degree. However, after accidentally attending a lecture on geometry, he talked his reluctant father for letting him to study mathematics and natural philosophy instead of medicine. He created a thermoscope, a forerunner of the thermometer, and, in 1586, published a small book on the design of a hydrostatic balance he had invented. Galileo also studied disegno, a term encompassing fine art, and, in 1588, obtained the position of instructor in the Accademia delle Arti del Disegno in Florence. In 1589, he was appointed to the chair of mathematics in Pisa. In 1592, he moved to the University of Padua where he taught geometry, mechanics and astronomy until 1610.Galileo studied speed and velocity, gravity and free fall, the principle of relativity, inertia, projectile motion and also worked in applied science and technology, describing the properties of pendulums and "hydrostatic balances". He invented the thermoscope and various military compasses, and used the telescope for scientific observations of celestial objects..

Galileo's championing of Copernican heliocentrism was met with opposition from within the Catholic Church and from some astronomers. The matter was investigated by the Roman Inquisition in 1615, which concluded that heliocentrism was foolish, absurd, and heretical since it contradicted Holy Scripture. Galileo later defended his views in ‘Dialogue Concerning the Two Chief World Systems’ (1632), which appeared to attack Pope Urban VIII and thus alienated both the Pope and the Jesuits, who had both supported Galileo up until this point. He wrote ‘Two New Sciences’ (1638), primarily concerning kinematics and the strength of materials, summarizing work he had done around forty years earlier. Galileo continued to receive visitors until 1642, when, after suffering fever and heart palpitations, he died on 8 January 1642, aged 77.

13. TYCHO BRAHE

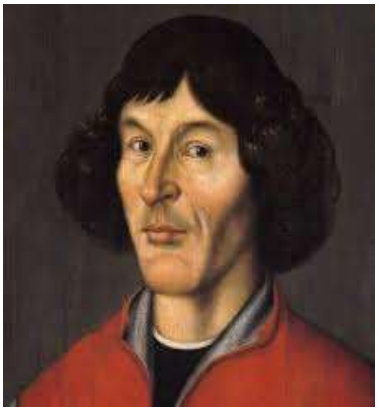
Tycho Brahe, (born December 14, 1546, Knudstrup, Scania, Denmark—died October 24, 1601, Prague), Danish astronomer whose work in developing astronomical instruments and in measuring and fixing the positions of stars paved the way for future discoveries. His observations included a comprehensive study of the solar system and accurate positions of more than 777 fixed stars.

Tycho Brahe was born to a noble family. He was the nephew of Jorges Brahe, a sailor who gave his life in an effort to save the life of King Fredrik II of Denmark. Tycho Brahe benefited greatly from King Fredrik's generous support. Brahe received an island called Hven from the king. He turned this island into his own little country. Brahe built a castle on Hven and named it Uraniborg after Urania, the goddess of the sky. He also built an observatory on the island.

For over 20 years, Brahe used the island as his base from which to make astronomical observations. In 1597, Tycho Brahe lost the Danish king's support, so he went to Wandsbech in what is today known as Germany. He eventually settled in Prag where he continued his astronomical observations. Over a 20year period of time, Tycho Brahe made consistent observations which supported the heliocentric theory proposed earlier by Copernicus. These observations were made using only a compass and a sextant. Brahe catalogued over 1000 stars. He also proved that comets were not just components of Earth's atmosphere, but actual objects traveling through space. Brahe showed irregularities in the Moon's orbit and discovered a new star in the Cassiopeia formation.

Brahe invented many instruments such as the Tyconian Quadrant which were widely copied and led to the invention of improved observational equipment. In 1600, Tyco Brahe hired Johannes Kepler as his assistant. In later years, Kepler would use Brahe's work as the basis for the laws of planetary movement which he developed. Tyco Brahe, though of noble decent, married a commoner. Within a few years of his death, the castle and observatory he built on his beloved island Hven were destroyed

14. NICOLAUS COPERNICUS

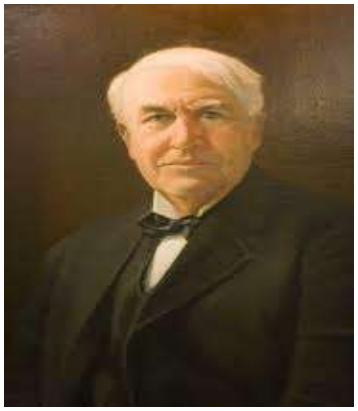


Nicolaus Copernicus (Born February 19, 1473, Thorn, Royal Prussia, Poland - Died May 24, 1543, Frauenburg, Royal Prussia, Poland),Polish astronomer, who proposed that the planets have sun as the fixed point, to which their motions are to be referred; that Earth is a planet which, besides orbiting the Sun annually, also turns once daily on its own axis; and that very slow long-term changes in the direction of this axis account for the precession of the equinoxes. This representation of the heavens is usually called the heliocentric, or "Sun-centred," system.

De revolutionibus orbium coelestium libri vi ("Six Books Concerning the Revolutions of the Heavenly Orbs"), is his main work that contain the final version of this theory. Nicolaus was the youngest of four children. His father, Nicolaus, was a well-to-do merchant, and his mother, Barbara Watzenrode, also came from a leading merchant family. Between 1491 and about 1494 Copernicus studied liberal arts, including astronomy and astrology at the University of Kraków. He left before completing his degree and resumed his studies in Italy at the University of Bologna(1496–1500). He was the principal astronomer at the university, Domenico Maria de Novara. He pursued medical studies from the University of Padua, between 1501 and 1503. In May 1503 Copernicus received a doctorate in canon law, from an Italian university where he had not studied: The University of Ferrara. In De revolutionibus, Copernicus reported that he had seen the Moon eclipse "the brightest star in the eye of the Bull," Alpha Tauri (Aldebaran). By the time he published this observation in 1543, he had made it the basis of a theoretical claim: that it confirmed exactly the size of the apparent lunar diameter. But in 1497 he was probably using it to assist in checking the new- and full-moon tables derived from the commonly used Alfonsine Tables and employed in Novara's forecast for the year 1498. In 1517 he derived a quantity theory of money, a key concept in economics and in 1519 he formulated an economic principle that later came to be called Gresham's law.

Toward the close of 1542, Copernicus was seized with apoplexy and paralysis, and he died at age 70 on 24 May 1543.

15. THOMAS ALVA EDISON

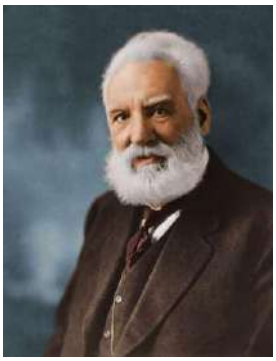


(Born February 11, 1847, Milan, Ohio, U.S. -Died October 18, 1931, West Orange, New Jersey) Thomas Alva Edison was an American inventor who, singly or jointly, held a world-record 1,093 patents. In addition, he created the world's first industrial research laboratory. Aside from being an inventor, Edison also managed to become a successful manufacturer and businessman, marketing his inventions to the public.

He was the seventh and last child of Samuel Ogden Edison Jr. and Nancy Matthews Elliott born in Chenango County, New York State. When a schoolmaster called Edison "addled," his furious mother took him out of the school and proceeded to teach him at home. In 1859, Edison took a job selling newspapers and candy on the Grand Trunk Railroad to Detroit. In the baggage car, he set up a laboratory for his chemistry experiments and a printing press, where he started the Grand Trunk Herald, the first newspaper published on a train. An accidental fire forced him to stop his experiments on board. Edison took advantage of the opportunity to learn telegraphy and in 1863 became an apprentice telegrapher. In January 1869 Edison resigned his job, intending to devote himself fulltime to inventing things. His first invention to receive a patent was the electric vote recorder, in June 1869. During the next period of his life, Edison became involved in multiple projects and partnerships dealing with the telegraph. Edison received several patents for improvements to the telegraph. In 1877, Edison worked on a telephone transmitter that greatly improved on Alexander Graham Bell's work with the telephone. Edison's experiments with the telephone and the telegraph led to his invention of the phonograph in 1877. Edison focused on the electric light system in 1878, setting aside the phonograph for almost a decade. He invented filament of carbonized thread proved to be the key to the long-lasting light bulb, the incandescent bulb. He developed many devices in fields such as electric power generation, mass communication, sound recording and motion pictures.

In 1887, Edison won the Matteucci Medal. The Philadelphia City Council named Edison the recipient of the John Scott Medal in 1889. In 1899, he was awarded the Edward Longstreth Medal of The Franklin Institute. He received the American Association of Engineering Societies John Fritz Medal in 1908. He was honoured with a Technical Grammy Award in 2010.

16. ALEXANDER GRAHAM BELL



Alexander Graham Bell, (born March 3, 1847, Edinburgh, Scotland—died August 2, 1922, Beinn Bhreagh, Cape Breton Island, Nova Scotia, Canada), Scottish-born American inventor, scientist, and teacher of the deaf whose foremost accomplishments were the invention of the telephone (1876) and the refinement of the phonograph (1886). He also co-founded the American Telephone and Telegraph Company (AT&T) in 1885.

He enrolled in the University of London to study anatomy and physiology, but his college time was cut short when his family moved to Canada in 1870. When he was eleven, Bell invented a machine that could clean wheat.

He first became interested in the science of sound because both his mother and wife were deaf. His experiments in sound eventually let him to want to send voice signals down a telegraph wire. While trying to perfect a method for carrying multiple messages on a single wire, he heard the sound of a plucked spring along 60 feet of wire in a Boston electrical shop. Thomas A. Watson, one of Bell's assistants, was trying to reactivate a telegraph transmitter. Hearing the sound, Bell believed that he could solve the problem of sending a human voice over a wire. He figured out how to transmit a simple current first, and received a patent for that invention on March 7, 1876. Five days later, he transmitted actual speech. Sitting in one room, he spoke into the phone to his assistant in another room, saying the now famous words: "Mr. Watson, come here. I need you." The telephone patent is one of the most valuable patents ever issued. Bell had other inventions as well - his own home had a precursor to modern day air conditioning, he contributed to aviation technology, and his last patent, at the age of 75, was for the fastest hydrofoil yet invented.

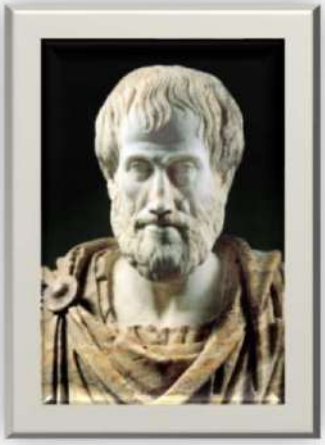
Bell died on August 2, 1922. On the day of his burial, all telephone service in the US was stopped for one minute in his honor.

17. ARCHIMEDES

Archimedes (Born around 287 B.C. in the Greek city-states of Syracuse on the island of Sicily – Died around 212 B.C. at the age of 75) is a Greek mathematician, engineer, inventor, physicist, and astronomer. He was the sun of Phidias, an astronomer. Although few details of his life are known, he is regarded as one of the leading scientists in classical antiquity. Considered to be the greatest mathematician of ancient history, and one of the greatest of all time, Archimedes anticipated modern calculus and analysis by applying the concept of the infinitely small and the method of exhaustion to derive and rigorously prove a range of geometrical theorems, including: the area of a circle; the surface area and volume of a sphere; area of an ellipse; the area under a parabola; the volume of a segment of a paraboloid of revolution; the volume of a segment of a hyperboloid of revolution; and the area of a spiral. Archimedes is especially important for his discovery of the relation between the surface and volume of a sphere and its circumscribing cylinder. He is known for his formulation of a hydrostatic principle (known as Archimedes' principle) and a device for raising water, still used, known as the Archimedes screw.

In antiquity Archimedes was also known as an outstanding astronomer: his observations of solstices were used by Hipparchus (flourished c. 140 BCE), the foremost ancient astronomer. Given the magnitude and originality of Archimedes' achievement, the influence of his mathematics in antiquity was rather small. Those of his results that could be simply expressed—such as the formulas for the surface area and volume of a sphere—became mathematical commonplaces, and one of the bounds he established for π, 22/7, was adopted as the usual approximation to it in antiquity and the Middle Ages. Nevertheless, his mathematical work was not continued or developed, as far as is known, in any important way in ancient times, despite his hope expressed in Method that its publication would enable others to make new discoveries. However, when some of his treatises were translated into Arabic in the late 8th or 9th century, several mathematicians of medieval Islam were inspired to equal or improve on his achievements**.**

18. ARISTOTLE



Aristotle (Born 384 BC, Stagira, Chalcidice- Died 322 BC (aged 61–62) Euboea, Macedonian Empire) was a Greek philosopher and polymath during the Classical period in Ancient Greece. Taught by Plato, he was the founder of the Lyceum, the Peripatetic school of philosophy, and the Aristotelian tradition. His writings cover many subjects including physics, biology, zoology, metaphysics, logic, ethics, aesthetics, poetry, theatre, music, rhetoric, psychology, linguistics, economics, politics, meteorology, geology and government. Aristotle provided a complex synthesis of the various philosophies existing prior to him. It was above all from his teachings that the West inherited its intellectual lexicon, as well as problems and methods of inquiry. As a result, his philosophy has exerted a unique influence on almost every form of knowledge in the West and it continues to be a subject of contemporary philosophical discussion.

Aristotle divided the theoretical sciences into three groups: physics, mathematics, and theology. Physics as he understood it was equivalent to what would now be called "natural philosophy," or the study of nature (physics); in this sense it encompasses not only the modern field of physics but also biology, chemistry, geology, psychology, and even he never uses the word, which first appears in the posthumous catalog of his writings as a name for the works listed after the Physics. He does, however, recognize the branch of philosophy now called metaphysics: he calls it "first philosophy" and defines it as the discipline that studies "being as being." He was the first author whose surviving works contain detailed and extensive observations of natural phenomena, and he was the first philosopher to achieve a sound grasp of the relationship between observation and theory in scientific method. He identified the various scientific disciplines and explored their relationships to each other. He was the first professor to organize his lectures into courses and to assign them a place in a syllabus. His Lyceum was the first research institute in which a number of scholars and investigators joined in collaborative inquiry and documentation. Finally, and not least important, he was the first person in history to build up a research library, a systematic collection of works to be used by his colleagues and to be handed on to posterity.

19. BENJAMIN FRANKLIN

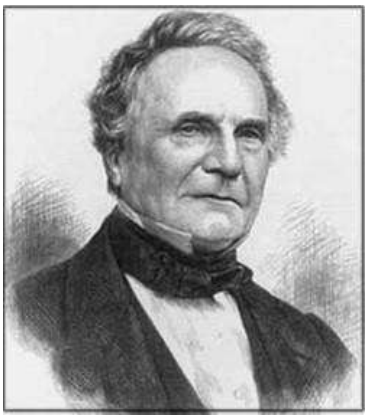
Benjamin Franklin was an American polymath who was active as a writer, scientist, inventor, statesman, diplomat, printer, publisher and political philosopher. He was born on Milk Street in Boston, Massachusetts on January 17, 1706. He attended Boston Latin School but did not graduate; he continued his education through voracious reading. As a scientist, he was a major figure in the American Enlightenment and the history of physics for his discoveries and theories regarding electricity. As an inventor, he is known for the lightning rod, bifocals, Franklin stove and the flexible urinary catheter among other inventions.

Benjamin Franklin left an important legacy in electrical science and its useful application to mankind. The experiments published in "*Experiments and Observations on Electricity Made at Philadelphia in America"* proved the existence of positive and negative charges as well as the concepts of insulators and conductors. He is mainly known for his Kite Experiment. By 1749, he had turned his attention to the possibility of protecting buildings and the people inside from lightning strikes. His work led to the invention of the lightning rod which saved buildings from being struck by lightning.

Franklin invented Bifocals which are eyeglasses with an upper and lower half, the upper for distance, and the lower for reading. Bifocals are commonly prescribed to people with presbyopia, a condition that Franklin suffered. The Franklin stove invented in 1742, is a metal-lined fireplace that stands in the middle of a room. It has rear baffles for improved airflow. It provides more heat and less smokes than an open fireplace and uses less wood. This cast-iron furnace would radiate heat from the middle of the room in all directions, and the iron walls even absorbed heat, providing warmth to the room long after the fire went out.

For his work with electricity, Benjamin Franklin was awarded the Copley Medal, the second person to ever receive that honor. Benjamin Franklin died from pleuritic attack at his home in Philadelphia on April 17, 1790.

20. CHARLES BABBAGE



Charles Babbage, (born December 26, 1791, London, England — died October 18, 1871, London), is an English mathematician mechanical engineer, inventor and philosopher. He contributed to many different scientific fields but his most famous work is designing a programmable computing device. Charles Babbage is considered the "father of the computer" and is given credit for devising the first ever mechanical computer. His design served as the blue print for other, more complex machines.

In his twenties Babbage worked as a mathematician, principally in the calculus of functions. He was elected a Fellow of the Royal Society in 1816 and played a prominent part in the foundation of the Astronomical Society (later Royal Astronomical Society) in 1820. It was about this time that Babbage first acquired the interest in calculating machinery that became his consuming passion for the remainder of his life. In 1821 Babbage invented the Difference Engine to compute values of polynomial functions. It was created to calculate a series of values automatically. By using the method of finite differences, it was possible to avoid the need for multiplication and division. On completing it in 1832, he conceived the idea of a better machine that could perform not just one mathematical task but any kind of calculation. This was the Analytical Engine (1856), which was intended as a general symbol manipulator, and had some of the characteristics of today's computers. The machine was also intended to employ several features subsequently used in modern computers, including sequential control, branching and looping. The Engine was not a single physical machine, but rather a succession of designs that Babbage tinkered with until his death in 1871.

In 1838, Babbage invented the pilot (also called a cow-catcher), which is the metal frame attached to the front of locomotives that clears the tracks of obstacles. Babbage also invented an ophthalmoscope, which is used in eye examinations. Throughout his life Babbage worked in many intellectual fields typical of his day, and made contributions that would have assured his fame irrespective of the Difference and Analytical Engines.

21. CHARLES – AUGUSTIN DE COULOMB

Charles-Augustin de Coulomb (14 June 1736 – 23 August 1806) was a French officer, engineer, and physicist. He is best known as the eponymous discoverer of what is now called Coulomb's law, the description of the electrostatic force of attraction and repulsion. He also did important work on friction. The SI unit of electric charge, the coulomb, was named in his honor in 1880. His studies included philosophy, language and literature. He also received a good education in mathematics, astronomy, chemistry and botany. He graduated in 1761 and joined the French army as an engineer in the rank of lieutenant. Over the next twenty years, he was posted to a variety of locations where he was involved in engineering: structural, fortifications, soil mechanics, as well as other fields of engineering. His first posting was to Brest but in February 1764 he was sent to Martinique, in the West Indies, where he was put in charge of building the new Fort Bourbon and this task occupied him until June 1772. His health suffered setbacks during the three years he spent in Martinique that would affect him for the rest of his life.

Coulomb published a series of important papers on electricity and magnetism in the late 1780s. One was a thorough discussion of Coulomb's experiments with electrostatic forces and a description of the inverse square law that they led Coulomb to posit. Similar to Isaac Newton's inverse square law of gravitational force, Coulomb's law states that the electric force between charged objects inversely depends upon the distance between the objects. That is, like gravity, the electric force acts in a line between two objects and decreases with the square of the distance between them. The primary difference between the law for gravity and that for electric force is that gravitation is influenced by the mass of the objects, whereas Coulomb's law depends upon the charge of the objects involved. When the objects in question are both positively or both negatively charged, the forces between them are repulsive, but attractive forces arise between objects carrying opposing charges.

22. DMITRI MENDELEEV

Dmitri Mendeleev, in full Dmitri Ivanovich Mendeleev, (born February 8, 1834, Tobolsk, Siberia, Russian Empire—died February 2, 1907, St. Petersburg, Russia), is a Russian chemist who developed the periodic classification of the elements. In the same year that Dmitri was born, his father went blind. To provide her son with an education, Dmitri's mother brought him to St. Petersburg and enrolled him in the Main Pedagogical Institute. Dmitri graduated from the Institute in 1855 and then went on to earn a master degree in education. He received a fellowship from the government to continue his studies and moved to the University of Heidelberg in Germany. In 1861, Dmitri went back to St. Petersburg to earn his PhD. He then became a chemistry professor at the University of St. Petersburg.

Dmitri found it hard to find a good chemistry textbook for his classes, so he wrote his own. While writing his textbook, Principles of Chemistry, Mendeleev found that if you arrange the elements in order of increasing atomic mass, their chemical properties demonstrated definite trends. He called this discovery the Periodic Law, and stated it in this way: "When the elements are arranged in order of increasing atomic mass, certain sets of properties recur periodically." Drawing on his understanding of element characteristics, Mendeleev arranged the known elements in an eight-column grid. Each column represented a set of elements with similar qualities. He called the grid the Periodic Table of Elements. In his version of the periodic table of 1871, he left gaps in places where he believed unknown elements would find their place. The subsequent proof of many of his predictions within his lifetime brought fame to Mendeleev as the founder of the periodic law. The only real difference between his table and the one we use today is that Mendeleev's table ordered elements by increasing atomic weight, while the present table is ordered by increasing atomic number.

Mendeleev also made major contributions to other areas of chemistry, metrology (the study of measurements), agriculture, and industry. Mendeleev never won a Nobel Prize in Chemistry. He was, however, awarded the prestigious Davy Medal (1882) and ForMemRS (1892).

23. HOMI JEHANGIR BHABHA

Homi Jehangir Bhabha was an Indian born nuclear physicist who made important contributions to quantum theory and cosmic radiation. He is known as the "father of Indian nuclear program." He was the first Chairman of The Atomic Energy Commission of India.

H. J. Bhabha was born on 30 October, 1909 to a wealthy Parisi family in Mumbai that was very influential in the west of India. His father was Jehangir Hormusji Bhabha, a lawyer. Initially Bhabha attended Cathedral School and he then enrolled for studies at Elphinstone College at the age of fifteen. This was followed by further studies at the Royal Institute of Science in Bombay. In 1927, Bhabha began his studies at Cambridge University, studying mechanical engineering according to his family's wishes. Soon, however, Bhabha became more interested in theoretical physics, being influenced by physicist Paul Dirac. After passing the Mechanical Engineering Tripos with first class Bhabha remained at Cambridge and with his family's approval began studying theoretical physics. In 1932 he passed the Mathematics Tripos, again with first class and he received his doctorate degree in nuclear physics from the University of Cambridge in 1934.

Bhabha's first paper "The Absorption of Cosmic radiation" in 1933 earned him a three-year Isaac Newton Studentship in 1934. He worked alongside Neil Bohr in Copenhagen in addition to his research work at Cambridge. Bhabha published a paper in 1935, performing the first calculation to determine the cross section of electron-positron scattering. Bhabha conducted research with Walter Heitler and in 1936 they made a breakthrough in the cosmic radiation's understanding by working on the cascade theory of electron showers. Their theory described how primary cosmic rays from outer space interact with the upper atmosphere producing observable particles at the ground level, making estimations of the number of electrons in the cascade process at different altitudes for different electron initiation energies.

In 1937, Bhabha was awarded the Senior Studentship of the 1851 exhibition. With the outbreak of the Second World War in 1939, Bhabha returned to India accepting a position of reader of physics and establishing the Cosmic Ray Research Institute at the Indian Institute of Science in Bangalore. In 1941, Bhabha was elected Fellow of the Royal Society. He also established the Tata Institute of

Fundamental Research in Mumbai, becoming their director in 1945. He was a skillful manager and it was due to his prominence, devotion, wealth and comradeship with Jawaharlal Nehru, Prime Minister of India that he gained a leading position for allocating the scientific resources of India. Bhabha become the first chairperson of India's Atomic Energy Commission in 1948. It was under his direction that the scientists of India made their way into making an atomic bomb ant the first atomic reactant was operated in Mumbai in 1956. Bhabha also led the first UN Conference held for the purpose of Peaceful Uses of Atomic Energy in Geneva, 1955.

Bhabha received many rewards and award from Indian as well as foreign universities and was an associate of various societies of science including the American National Academy of Sciences. He was awarded Padma Bhushan in 1954, the third-highest civilian award in India. Bhabha remained a bachelor during his life. His hobbies included painting, classical music and opera, and botany. He was killed in mysterious circumstances, aged 56, when Air India Flight 101 crashed on January 24, 1966 near Mont Blanc in Switzerland. In quantum physics, the cross section of electron-positron scattering was renamed "Bhabha scattering" in his honour.

24. WERNER HEISENBERG

Werner Heisenberg was a German physicist and philosopher who is noted for his crucial contributions to quantum mechanics. He devised a method to formulate quantum mechanics in terms of matrices, for which he was awarded the 1932 Nobel Prize for Physics. Heisenberg is widely considered as one of the most influential figures in nuclear physics, particle physics and quantum field theory.

Born in Würzburg, Germany on 5 December in 1901, Werner Heisenberg's father was a prominent secondary school teacher. Heisenberg went to the Ludwig-Maximilians-Universität München and the Georg-August-Universität Göttingen, where he studied physics and mathematics from 1920 to 1923. He earned his doctorate in 1923.

Werner Heisenberg ranks alongside Niels Bohr, Paul Dirac and Richard Feynman as far as his influence on contemporary physics is concerned. He was one of the most important figures in the development of quantum mechanics, and its modern interpretation. Heisenberg formulated the quantum theory of ferromagnetism, the neutron-proton model of the nucleus, the S-matrix theory in particle scattering, and various other significant breakthroughs in quantum field theory and high-energy particle physics are associated with him. As a prolific author, Heisenberg wrote more than 600 original research papers, philosophical essays and explanations for general audiences. His work is still available in the nine volumes of the "Gesammelte Werke" (Collected Works).

Heisenberg is synonymous with the so-called uncertainty, or indeterminacy, principle of 1927, for one of the earliest breakthroughs to quantum mechanics in 1925, and for his suggestion of a unified field theory, the so-called "world formula". He won the Nobel Prize for Physics in 1932 at the young age of 31. Heisenberg stayed firmly in Germany during the worst years of the Hitler regime, heading Germany's research effort on the applications of nuclear fission during World War II. He also played a vital role in the reconstruction of West German science after the war. Heisenberg's role was crucial in the success of West Germany's nuclear and high-energy physics research programs.

In his later years, Werner Heisenberg assumed various influential positions in Germany and abroad, giving important lectures on theoretical physics and other subjects. He died of cancer of the kidneys and gall bladder on February 1, 1976. Heisenberg was 74 years old.

25. HENRY CAVENDISH

Henry Cavendish (born October 10, 1731, Nice, France—died February 24, 1810, London, England) was a British philosopher, scientist, chemist, and physicist. He is well known for discovering hydrogen, also known as "inflammable air," as well as the density of air and the mass of the Earth.

He completed his schooling from Dr. Newcomb's Academy in Hackney, England and went to Cambridge University in 1749 for his higher studies. Around 1766 to 1788, Henry made notable discoveries in chemistry. During this period, he also published a paper on the density of Earth. He also recognized the presence of clear parts of many chemical reactions in the air. He discovered the presence of Hydrogen in the atmosphere - a definite, peculiar and highly inflammable gas produced by the action of certain acids and metals. By dissolving alkalis in acids, Henry Cavendish made 'fixed air' (Carbon dioxide). He then measured their specific gravity and combustibility by upturning the carbon dioxide over water or mercury. He also determined the withholding properties of Calcium carbonate (chalk, calcareous earth). Cavendish also discovered Calcium Bicarbonate by mixing calcium carbonate and carbon dioxide, which is the cause of temporary hardness of water. The idea that the hardness of the water can be softened by adding lime (calcium hydroxide) was also given by him. Henry Cavendish found the properties of dielectrics (nonconducting electricity).

Cavendish was distinguished for great accuracy and precision in research into the composition of atmospheric air, the properties of different gases, the synthesis of water, the law governing electrical attraction and repulsion, a mechanical theory of heat, and calculations of the density (and hence the weight) of Earth. His experiment to weigh Earth has come to be known as the Cavendish experiment.

26. ISSAC NEWTON

Isaac Newton, in full Sir Isaac Newton, (born December 25, 1642, Woolsthorpe, Lincolnshire, England—died March 20, 1727, London), is an English physicist and mathematician, who was the culminating figure of the Scientific Revolution of the 17th century. In optics, his discovery of the composition of white light integrated the phenomena of colors into the science of light and laid the foundation for modern physical optics. In mechanics, his three laws of motion, the basic principles of modern physics, resulted in the formulation of the law of universal gravitation.

As a student at Cambridge University in 1661, he became interested in physics, mathematics, optics and astronomy. A plague caused the university to shut down so he spent two years at Woolsthorpe where he began to think about gravity and spent time pondering on mathematics and optics. After returning to Cambridge, he developed ideas on the reflecting telescope and from the mid 1660's, conducted many experiments on the composition of light. During this period, he investigated the refraction of light, demonstrating that the multicolored image produced by a prism, which he named a spectrum, could be recomposed into white light by a lens and a second prism. He discovered that white light is made up of the same system of colors that are in the rainbow and established the behavior of light. He published his findings on a book called 'Opticks'.

Newton is known for his theory of gravitation. According to a popular story, Newton discovered gravity when he saw an apple falling from a tree. It was this incident that made Newton realizes that it was a similar force that governed the motion of the Moon around the Earth. He calculated the force needed to hold the Moon in its orbit, comparing this force with the force pulling an object to the ground. He wrote the principia in three stages where he described gravitation as the most important force controlling the motion of celestial bodies. His Laws of Motion and Law of Universal Gravitation predicted very accurately the motion of stars and the planets around the sun. The SI derived unit of force is named the Newton in his honor. Newton was knighted by Queen Anne in 1705. And he was buried in Westminster Abbey after his death.

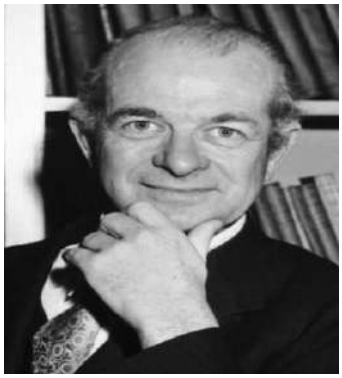
27. JOSEPH PRIESTLY

Joseph Priestley, (born March 13, 1733, Birstall Fieldhead, near Leeds, Yorkshire, England - died February 6, 1804, Northumberland, Pennsylvania, U.S.) was an English chemist, natural philosopher, separatist theologian, grammarian, multi-subject educator, and liberal political theorist.

Priestley's interest in science grew stronger in 1765, when he met Benjamin Franklin, an American scientist and statesman who encouraged him to publish 'The History and Present State of Electricity, with Original Experiments' (1767). In science, Priestley's preference for 'facts' over 'hypotheses' was compatible with his dissenting belief that bias and dogma of any kind impeded individual inquiry and private judgement. Priestley's electrical experiments, in which he predicted the inverse square law of electrical attraction, discovered that charcoal conducts electricity, and recognized the relationship between electricity and chemical change, were shaped by this understanding of scientific process. In 1766, he was elected a member of the Royal Society of London based on his experiments.

Priestley began extensive experimental chemistry research when he returned to the ministry at Mill Hill Chapel in Leeds in 1767. He published six volumes of Experiments and Observations on Different Kinds of Air and more than a dozen articles in the Royal Society's Philosophical Transactions between 1772 and 1790, detailing his experiments on gases, or airs as they were then known.Priestley discovered ten new gases: nitric oxide, nitrogen dioxide, nitrous oxide, hydrogen chloride, ammonia, Sulphur dioxide, silicon tetrafluoride, nitrogen, oxygen (independently co-discovered by Carl Wilhem Scheele) and a gas later identified as carbon monoxide.. Priestley received the prestigious Copley Medal in 1773 from the Royal Society for his work on gases. Priestley's scientific legacy is built on the discovery of Oxygen he made on August 1, 1774, when he heated red mercuric oxide to produce a colorless gas as this revolutionized Chemistry.

28. LINUS KARL PAULING



Linus Carl Pauling (born 28 February 1901, Portland, Oregon, USA- died 19 August 1994, Big Sur, California, USA) was an American chemist, biochemist, chemical engineer, peace activist, author, and educator.

The development of Quantum Mechanics in the 1920s had a significant impact not just on Physics but also on Chemistry. Linus Pauling was a pioneer in using quantum mechanics to study and characterize chemical bonding in the 1930s. Linus Pauling worked in a broad range of areas within chemistry. He studied the chemical structures of biologically significant chemical compounds. He revealed the structure of the alpha helix, which is a crucial component of many proteins, in 1951.

The atom bombs detonated on Hiroshima and Nagasaki were a turning point in Linus Pauling's life. He spoke out against the nuclear arms race with other scientists, and he was a driving force behind the Pugwash campaign. It sought to reduce the role of nuclear arms in international politics and was awarded the Peace Prize in 1995.Linus Pauling penned the renowned "Hiroshima Appeal," the concluding declaration of the Fifth World Conference against Atomic and Hydrogen Bombs, in 1959. He was one of the main proponents of a nuclear test prohibition treaty between the nuclear powers of the United States, the Soviet Union, and the United Kingdom, which went into effect on October 10, 1963.The Norwegian Nobel Committee announced on the same day that Linus Pauling had been given the Nobel Peace Prize, which had been held over from 1962.

Linus Pauling has received two Nobel Prizes in total. He was awarded the Nobel Prize in Chemistry in 1954. He was given the Nobel Peace Prize eight years later for his opposition to weapons of mass devastation.

29. MARIE CURIE

Maria Sklodowska, later known as Marie Curie, was born on November 7, 1867, in Warsaw (modern-day Poland). Curie was the youngest of five children, Both of Curie's parents were teachers. Her father, Wladyslaw, was a math and physics instructor. She had a bright and curious mind and excelled at school. But despite being a top student in her secondary school, Curie could not attend the men's-only University of Warsaw. She instead continued her education in Warsaw's "floating university," a set of underground, informal classes held in secret. For roughly five years, Curie worked as a tutor and a governess. She used her spare time to study, reading about physics, chemistry and math. In 1891, Curie finally made her way to Paris and enrolled at the Sorbonne. She threw herself into her studies, but this dedication had a personal cost: with little money, Curie survived on buttered bread and tea, and her health sometimes suffered because of her poor diet. Curie completed her master's degree in physics in 1893 and earned another degree in mathematics the following year. Marie married French physicist Pierre Curie on July 26, 1895. They were introduced by a colleague of Marie's after she graduated from Sorbonne University; Marie had received a commission to perform a study on different types of steel and their magnetic properties and needed a lab for her work. A romance developed between the brilliant pair, and they became a scientific dynamic duo who were completely devoted to one another. At first Marie and Pierre worked on separate projects. But after Marie discovered radioactivity, Pierre put aside his own work to help her with her research. In 1897 Marie and Pierre welcomed a daughter, Irène. The couple had a second daughter, Ève, in 1904. Irène Joliot-Curie followed in her mother's footsteps, winning the Nobel Prize in Chemistry in 1935. Joliot-Curie shared the honour with her husband, Frédéric Joliot, for their work on the synthesis of new radioactive elements. In 1937, Ève Curie wrote the first of many biographies devoted to her famous mother, Madame Curie, which became a feature film a few years later. In 1895, Wilhelm Roentgen discovered the existence of X-rays, though the mechanism behind their production was not yet understood. In 1896, Henri Becquerel discovered that uranium salts emitted rays that resembled X-rays in their penetrating power. Fascinated with the work of Henri Becquerel, a French physicist who discovered that uranium casts off rays weaker than the X-rays found by Wilhelm Conrad Röntgen, Curie took his work a few steps further. Curie's systematic

studies included two uranium minerals, pitchblende and torbernite (also known as chalcolite). Her electrometer showed that pitchblende was four times as active as uranium itself, and chalcolite twice as active. Curie conducted her own experiments on uranium rays and discovered that they remained constant, no matter the condition or form of the uranium. The rays, she theorized, came from the element's atomic structure. This revolutionary idea created the field of atomic physics. Curie herself coined the word "radioactivity" to describe the phenomena. Working with the mineral pitchblende, the pair discovered a new radioactive element in 1898. They named the element polonium, after Curie's native country of Poland. On 26 December 1898, the Curies announced the existence of a second element, which they named "radium", from the Latin word for "ray". In the course of their research, they also coined the word "radioactivity ". Between 1898 and 1902, the curies published, jointly or separately, a total of 32 scientific papers, including one that announced that, when exposed to radium, diseased, tumor-forming cells were destroyed faster than healthy cells. In December 1903, the Royal Swedish Academy of Sciences awarded Pierre Curie, Marie Curie, and Henri Becquerel the Nobel Prize in Physics, "in recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor HenriBecquerel. In 1911, Curie won her second Nobel Prize, this time in Chemistry, for her discovery of radium and polonium. While she received the prize alone, she shared the honor jointly with her late husband in her acceptance lecture. The award money allowed the Curies to hire their first laboratory assistant. She became the director of the Red Cross Radiology Service and set up France's first military radiology centre, operational by late 1914. After the war, Curie used her celebrity to advance her research. Curie died on July 4, 1934, of aplastic anemia, believed to be caused by prolonged exposure to radiation. She was known to carry test tubes of radium around in the pocket of her lab coat. Her many years working with radioactive materials took a toll on her health. Marie Curie became the first woman to win a Nobel Prize and the first person — man or woman — to win the award twice. With her husband Pierre Curie, Marie's efforts led to the discovery of polonium and radium and, after Pierre's death, the further development of X-rays. The famed scientist died in 1934 of aplastic anemia likely caused by exposure to radiation.

30. MAX KARL ERNST LUDWIG PLANCK

Max Planck, the father of quantum theory, was born on the 23rd of April 1858 in the town of Kiel, Germany [1–5]. His father had been a professor of law in the same town, while his paternal grandfather and great grandfather had been leading Lutheran theologians at the University of Gottingen. During his studies, Planck took an early interest in thermodynamics and immersed himself in Rudolf Clausius' work on the subject. He would receive his doctorate in physics in 1879 from the University of Munich at the age of 21. His thesis was focused on the second law of thermodynamics. In 1885, through the influence of his father, Max Planck received an appointment as an associate professor of physics at the University of Kiel. Later, he would present a paper on thermodynamics that would result in an appointment for him at the University of Berlin upon the death of Kirchoff in 1889. Kirchhoff had been the chair of theoretical physics in Berlin and Planck would become the only theoretical physicist on the faculty. He would hold this chair until his retirement in 1927, having become a full professor in 1892. In 1913, Planck would offer Albert Einstein a professorship in Berlin. The two of them, along with Planck's student, Professor Max von Laue, would remain close personal friends and scientific colleagues even after Einstein departed for Princeton. Rosenthal-Schneider describes Planck as gentle, reserved, unpretentious, noble-minded and warm-hearted. He deeply loved mountain- climbing and music. He might well have been a concert pianist rather than a theoretical physicist, but he believed that he would do better as an average physicist than as an average pianist. He was revered by his colleagues not only for the importance of his discoveries but for his great personal qualities. He was also a gifted pianist and is said to have at one time considered music as a career. He suffered a personal tragedy when one of them was executed for his part in an unsuccessful attempt to assassinate Hitler in 1944.He died at Göttingen on October 4, 1947.

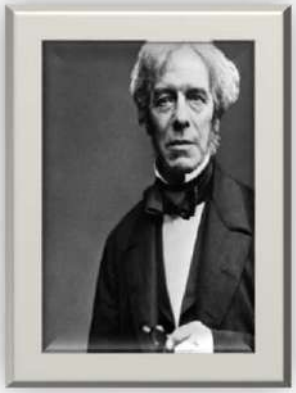
31. MEGHNAD SAHA

Meghnad Saha FRS (6 October 1893 – 16 February 1956) was an Indian astrophysicist who developed the Saha ionization equation, used to describe chemical and physical conditions in stars. His work allowed astronomers to accurately relate the spectral classes of stars to their actual temperatures. Saha became professor of physics at the University of Allahabad in 1923 and was elected a fellow of the Royal Society in 1927. He went to the University of Calcutta in 1938, where he was instrumental in the creation of the Calcutta Institute of Nuclear Physics, of which he became honorary director.

In his later years Saha increasingly turned his attention to the social relation of science and founded the outspoken journal Science and Culture in 1935. In 1951 he was elected to the Indian Parliament as an independent. He co-authored A Treatise on Heat (4th ed., 1958) and A Treatise on Modern Physics (1934). One of his most important papers is “Ionization in the Solar Chromosphere,” Phil. Mag. (vol. 40, 1920). Dr. Meghnad Saha has established several institutes for the promotion of science, he first established the National Academy of Sciences at Prayag and then laid the foundation of the National Institute of Sciences of India, the Indian Physical Society. After this, Meghnad started the Saha Institute of Nuclear Physics in 1951 on the strength of his hard efforts. Not only this, Meghnad Saha also established the International Astronomy Association and in 1953 played his role as Director of Indian Science Association. Apart from this, he also started a magazine called Science and Clutch to explain the aspects of science to people in easy language. Saha actively participated in the parliament in the areas of Education, Refugee and Rehabilitation, Atomic Energy, Multipurpose River Projects and Flood Control and long term planning. In the book "Meghnad Saha in Parliament" Saha is described as "Never unduly critical, Saha was so forthright, so incisive, so thorough in pointing out lapses that the treasury bench was constantly on the defensive. This is brought out by the way he was accused of leaving his laboratory and straying into a territory not his own. But the reason why he was slowly drifting towards this public role (he was never a politician in the correct sense of the term) was the gradually widening gulf between his dream and the reality—between his vision of an industrialized India and the

Government implementation of the plan." Saha was the chief architect of river planning in India and prepared the original plan for the Damodar Valley Project.

32. MICHAEL FARADAY



Michael Faraday, (Born on 22 September, 1791 Newington Butts, England-Died on 25 August 1867 (aged 75) Hampton Court, Middlesex, England) English physicist and chemist whose many experiments contributed greatly to the understanding of electromagnetism.

Faraday, who became one of the greatest scientists of the 19th century, began his career as a chemist. He wrote a manual of practical chemistry that reveals his mastery of the technical aspects of his art, discovered a number of new organic compounds, among them benzene, and was the first to liquefy a "permanent" gas (i.e., one that was believed to be incapable of liquefaction). His major contribution, however, was in the field of electricity and magnetism. He was the first to produce an electric current from a magnetic field, invented the first electric motor and dynamo, demonstrated the relation between electricity and chemical bonding, discovered the effect of magnetism on light, and discovered and named diamagnetism, the peculiar behavior of certain substances in strong magnetic fields. He provided the experimental, and a good deal of the theoretical, foundation upon which James Clerk Maxwell erected classical electromagnetic field theory. Faraday's work on electrochemistry provided him with an essential clue for the investigation of static electrical induction. Faraday's law of induction, in physics, a quantitative relationship between a changing magnetic field and the electric field created by the change, developed on the basis of experimental observations made in 1831 by the English scientist Michael Faraday.

The phenomenon called electromagnetic induction was first noticed and investigated by Faraday; the law of induction is its quantitative expression. Faraday discovered that, whenever the magnetic field about an electromagnet was made to grow and collapse by closing and opening the electric circuit of which it was a part, an electric current could be detected in a separate conductor nearby. Moving a permanent magnet into and out of a coil of wire also induced a current in the wire while the magnet was in motion. Moving a conductor near a stationary permanent magnet caused a current to flow in the wire, too, as long as it was moving.

33. LORD RAYLEIGH

John William Strutt, third Baron Rayleigh, was born on November 12, 1842 at Langford Grove, Maldon, Essex, as the son of John James Strutt, second Baron, and his wife Clara Elizabeth La Touche.

Throughout his infancy and youth, he was of frail physique; his education was repeatedly interrupted by ill-health, and his prospects of attaining maturity appeared precarious. After a short spell at Eton at the age of 10, mainly spent in the school sanatorium, three years in a private school at Wimbledon, and another short stay at Harrow, he finally spent four years with the Rev. George Townsend Warner (1857) who took pupils at Torquay.

In 1861 he entered Trinity College, Cambridge, where he commenced reading mathematics, not at first equal in attainments to the best of his contemporaries, but his exceptional abilities soon enabled him to overtake his competitors. He graduated in the Mathematical Tripos in 1865 as Senior Wrangler and Smith's Prizeman. In 1866 he obtained a fellowship at Trinity which he held until 1871, the year of his marriage.

In 1879 he was appointed to follow James Clerk Maxwell as Professor of Experimental Physics and Head of the Cavendish Laboratory at Cambridge. In 1884 he left Cambridge to continue his experimental work at his country seat at Terling, Essex, and from 1887 to 1905 he was Professor of Natural Philosophy in the Royal Institution of Great Britain, being successor of Tyndall. He served for six years as President of a Government Committee on Explosives, and from 1896 to 1919 he was Scientific Advisor to Trinity House. He was Lord Lieutenant of Essex from 1892 to 1901.

Lord Rayleigh's first researches were mainly mathematical, concerning optics and vibrating systems, but his later work ranged over almost the whole field of physics, covering sound, wave theory, colour vision, electrodynamics, electromagnetism, light scattering, flow of liquids, hydrodynamics, density of gases, viscosity, capillarity, elasticity, and photography. His patient and delicate experiments led to the establishment of the standards of resistance, current, and electromotive force; and his later work was concentrated on electric and magnetic problems. Lord

Rayleigh was an excellent instructor and, under his active supervision, a system of practical instruction in experimental physics was devised at Cambridge, developing from a class of five or six students to an advanced school of some seventy experimental physicists. His *Theory of Sound* was published in two volumes during 1877-1878, and his other extensive studies are reported in his *Scientific Papers* – six volumes issued during 1889-1920. He has also contributed to the *Encyclopaedia Britannica.*

He had a fine sense of literary style; every paper he wrote, even on the most abstruse subject, is a model of clearness and simplicity of diction. The 446 papers reprinted in his collected works clearly show his capacity for understanding everything just a little more deeply than anyone else. Although a member of the House of Lords, he intervened in debate only on rare occasions, never allowing politics to interfere with science. His recreations were travel, tennis, photography and music.

Lord Rayleigh, a former Chancellor of Cambridge University, was a Justice of the Peace and the recipient of honorary science and law degrees. He was a Fellow of the Royal Society (1873) and served as Secretary from 1885 to 1896, and as President from 1905 to 1908. He was an original recipient of the Order of Merit (1902), and in 1905 he was made a Privy Councillor. He was awarded the Copley, Royal, and Rumford Medals of the Royal Society, and the Nobel Prize for 1904.

In 1871 he married Evelyn, sister of the future prime minister, the Earl of Balfour, and daughter of James Maitland Balfour and his wife Blanche, the daughter of the second Marquis of Salisbury. They had three sons, the eldest of whom was to become Professor of Physics at Imperial College of Science and Technology, London.

Lord Rayleigh died on June 30, 1919, at Witham, Essex.

34. ROBERT BOYLE

Robert Boyle, (born January 25, 1627, Lismore Castle, County Waterford, Ireland—died December 31, 1691, London, England) an Anglo-Irish natural philosopher and a theological writer was a prominent figure of 17th-century intellectual culture. He was best known as a natural philosopher, particularly in the field of chemistry, but his scientific work covered many areas including hydrostatics, physics, medicine, earth sciences, natural history, and alchemy.

In 1654 he was invited to Oxford and was exposed to the latest developments in natural philosophy and became associated with a group of notable natural philosophers and physicians, including John Wilkins, Christopher Wren, and John Locke. These individuals, together with a few others, formed the 'Experimental Philosophy Club', which at times convened in Boyle's lodgings. Much of Boyle's best-known work dates from this period. In 1659 Robert Boyle and Robert Hooke, the clever inventor and subsequent curator of experiments for the Royal Society, completed the construction of their famous air pump and used it to study pneumatics. Their resultant discoveries regarding air pressure and the vacuum appeared in Boyle's first scientific publication, 'New Experiments Physico-Mechanicall, Touching the Spring of the Air and Its Effects' (1660). Boyle and Hooke discovered several physical characteristics of air, including its role in combustion, respiration, and the transmission of sound. One of their findings, published in 1662, later became known as "Boyle's law." This law expresses the inverse relationship that exists between the pressure and volume of a gas, and it was determined by measuring the volume occupied by a constant quantity of air when compressed by differing weights of mercury.Boyle's scientific work is notable for its dependence on experiment and observation, as well as his aversion to formulating generalised hypotheses.

Overall, Boyle argued so forcefully for the importance of applying chemistry's concepts and methods to the study of the natural world and medicine that he was eventually dubbed the "Father of Chemistry."

35. ERWIN SCHRODINGER

Erwin Schrödinger was born on August 12, 1887, in Vienna, the only child of Rudolf Schrödinger, who was married to a daughter of Alexander Bauer, his Professor of Chemistry at the Technical College of Vienna.

Erwin's father came from a Bavarian family which generations before had settled in Vienna. He was a highly gifted man with a broad education. After having finished his chemistry studies, he devoted himself for years to Italian painting. After this he took up botany, which resulted in a series of papers on plant phylogeny.

Schrödinger's wide interests dated from his school years at the Gymnasium, where he not only had a liking for the scientific disciplines, but also appreciated the severe logic of ancient grammar and the beauty of German poetry. (What he abhorred was memorizing of data and learning from books.)

From 1906 to 1910 he was a student at the University of Vienna, during which time he came under the strong influence of Fritz Hasenöhrl, who was Boltzmann's successor. It was in these years that Schrödinger acquired a mastery of eigenvalue problems in the physics of continuous media, thus laying the foundation for his future great work. Hereafter, as assistant to Franz Exner, he, together with his friend K. W. F. Kohlrausch, conducted practical work for students (without himself, as he said, learning what experimenting was). During the First World War he served as an artillery officer.

In 1920 he took up an academic position as assistant to Max Wien, followed by positions at Stuttgart (extraordinary professor), Breslau (ordinary professor), and at the University of Zurich (replacing von Laue) where he settled for six years. In later years Schrödinger looked back to his Zurich period with great pleasure – it was here that he enjoyed so much the contact and friendship of many of his colleagues, among whom were Hermann Weyl and Peter Debye. It was also his most fruitful period, being actively engaged in a variety of subjects of theoretical physics. His papers at that time dealt with specific heats of solids, with problems of thermodynamics (he was greatly interested in Boltzmann's probability theory) and of atomic spectra; in addition, he indulged

in physiological studies of colour (as a result of his contacts with Kohlrausch and Exner, and of Helmholtz's lectures). His great discovery, Schrödinger's wave equation, was made at the end of this epoch-during the first half of 1926.

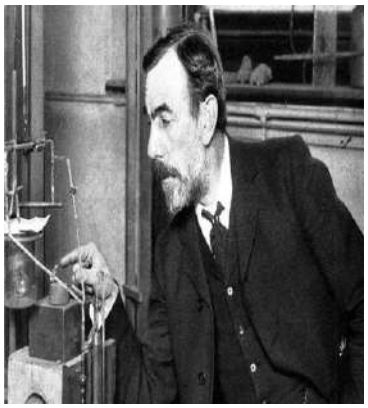
It came as a result of his dissatisfaction with the quantum condition in Bohr's orbit theory and his belief that atomic spectra should really be determined by some kind of eigenvalue problem. For this work he shared with Dirac the Nobel Prize for 1933.

In 1927 Schrödinger moved to Berlin as Planck's successor. Germany's capital was then a centre of great scientific activity and he enthusiastically took part in the weekly colloquies among colleagues, many of whom "exceeding him in age and reputation". With Hitler's coming to power (1933), however, Schrödinger decided he could not continue in Germany. He came to England and for a while held a fellowship at Oxford. In 1934 he was invited to lecture at Princeton University and was offered a permanent position there, but did not accept. In 1936 he was offered a position at University of Graz, which he accepted only after much deliberation and because his longing for his native country outweighed his caution. With the annexation of Austria in 1938, he was immediately in difficulty because his leaving Germany in 1933 was taken to be an unfriendly act. Soon afterwards he managed to escape to Italy, from where he proceeded to Oxford and then to University of Ghent. After a short stay he moved to the newly created Institute for Advanced Studies in Dublin, where he became Director of the School for Theoretical Physics. He remained in Dublin until his retirement in 1955.

All this time Schrödinger continued his research and published many papers on a variety of topics, including the problem of unifying gravitation and electromagnetism, which also absorbed Einstein and which is still unsolved; (he was also the author of the well-known little book "What is Life?", 1944). He remained greatly interested in the foundations of atomic physics. Schrödinger disliked the generally accepted dual description in terms of waves and particles, with a statistical interpretation for the waves, and tried to set up a theory in terms of waves only. This led him into controversy with other leading physicists.

After his retirement he returned to an honoured position in Vienna. He died on the 4th of January, 1961, after a long illness, survived by his faithful companion, Annemarie Bertel, whom he married in 1920.

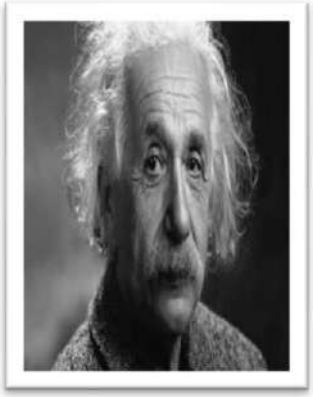
36. WILLIAM RAMSAY



Sir William Ramsay, (born Oct. 2, 1852, Glasgow, Scotland—died July 23, 1916, High Wycombe, Buckinghamshire, England) was a British physical chemist who discovered four gases (neon, argon, krypton, xenon) and showed that they (with helium and radon) formed an entire family of new elements, the noble gases. He was awarded the 1904 Nobel Prize for Chemistry in recognition of this achievement. The recipient of many awards and honours, Ramsay was elected a fellow of the Royal Society in 1888 and knighted in 1902; and he served as president of the Chemical Society (1907–09) and the British Association for the Advancement of Science (1911).

Ramsay became a doctoral student under the German organic chemist Rudolf Fittig at the University of Tuebingen in Germany, where he received a doctorate in 1872.After graduating from Tuebingen, Ramsay returned to Glasgow to work at Anderson College (1872–74) and then at the University of Glasgow (1874–80). During this period, Ramsay's research focused on alkaloids. He studied their physiological action and established their structural relationship to pyridine. In 1879 he turned to physical chemistry to study the molecular volumes of elements at their boiling points. Following his appointment to the chair of chemistry at University College, Bristol (1880–87; he became principal of the college in 1881), he continued this research with the British chemist Sydney Young; they published more than 30 papers on the physical characteristics of liquids and vapours. This work helped Ramsay to develop the technical and manipulative skills that later formed the hallmark of his work on the noble gases. In 1887 Ramsay became professor of general chemistry at University College London, where he remained until his retirement in 1913. For several years he continued to work on projects related to the properties of liquids and vapours, and in 1893 he and chemist John Shields verified Hungarian physicist Roland Eotvos law for the constancy of the rate of change of molecular surface energy with temperature. During the following year, Ramsay began the research that was eventually to make him the most famous chemist in Britain—the discovery of the noble gases.

37. ALBERT EINSTEIN



Albert Einstein (born March 14,1879, Ulm, Germany –died April 18,1955, Princeton,New jersey) was a great scientific genius who profoundly influenced the development of science and human thoughts and redefined the world view. He is generally considered the most influential Physicist of the 20th century.

In 1896 he entered the Swiss federal polytechnic school in Zurich to be trained as a teacher in physics and mathematics. In 1901 he gained his diploma and he secured a permanent position at the Swiss patent office in Bern. In 1905 he was awarded a PhD by the University of Zurich. In 1914 he was appointed as Director of the Kaiser Wilhelm physical institute and Professor in the University of Berlin.

Einstein is best known for developing the special and general theories of relativity and he also made important contributions to the development of the theory of quantum mechanics. At the start of his scientific work, Einstein realized the inadequacies of Newtonian mechanics and his special theory of relativity stemmed from an attempt to reconcile the laws of mechanics with the laws of the electromagnetic field. He dealt with classical problems in which they were merged with quantum theory: this led to an explanation of the Brownian movement of molecules. He contributed to statistical mechanics by his development of the quantum theory of a mono atomic gas and he has also accomplished valuable work in connection with atomic transition probabilities and relativistic cosmology. His mass-energy equivalence formula $E=mc^2$, has been dubbed the world's most famous equation. He received the 1921 Nobel Prize in Physics, and especially for his discovery of the law of the photoelectric effect.

His intellectual achievements and originality have made the word "Einstein" synonymous with "Genius." Throughout his life, Einstein published hundreds of books and articles. He published more than 300 scientific papers and 150 non-specific ones. Albert Einstein received honorary doctorate degrees in science, medicine and philosophy from many European and American universities. During the 1920's he lectured in Europe, America and he was awarded fellowships or Memberships of all the leading scientific academies throughout the world. He gained

numerous awards in recognition of his work, including the Copley Medal of the Royal Society of London in 1925, and the Franklin Institute in 1935.

38. HENRY MOSELEY

Henry Moseley, in full Henry Gwyn Jeffreys Moseley,(born, November 23,1887,Weymouth,Dorset,England-diedAugust10,1915,Gallipoli,Turkey),English physicist who experimentally demonstrated that the major properties of an element are determined by the atomic number, not by the atomic weight, and firmly established the relationship between atomic number and the charge of the atomic nucleus.

He was educated at Trinity college, oxford. Moseley in 1910 was appointed lecturer in physics at Ernest Rutherford's laboratory at the University of Manchester, where he worked until the outbreak of world War1, when he entered the army. At Manchester, Moseley created the world's first atomic battery or beta cell. His first researches were concerned with radioactivity and beta radiation in radium.

The periodic table of the elements had been created by Dimitri Mendeleev, in1869. Elements were arranged on it according to their atomic weight and their chemical properties. Then in 1911, Dutch Physicist Antonius Van den Broek published a hypothesis that stated that there was something called atomic number, and that it was equal to the amount of charge in an atoms nucleus. In 1913, Moseley returned to Oxford where he had to self; fund experiments. He set up apparatus that shot high –energy electrons at various chemical elements, and he then measured the wavelengths and frequencies of the resulting x-rays. Moseley discovered that each element emits x-rays at a unique frequency, and he discovered that if he plotted the square –root of the x-rays frequency against the various elements atomic numbers, he got a straight line graph. From that data he found that the positive charge in an atomic nucleus increased by one unit from one element to the next in the periodic table. Thus the atomic number is same as the number of protons in the nucleus .This work became known as Moseley's Law, this fundamental discovery concerning atomic numbers was a milestone in advancing the knowledge of the atom. In 1914 Moseley's published a paper in which he concluded that there were three unknown elements with atomic number 43, 61, 75, between aluminium and gold. Moseley identified gaps in the periodic table for technetium [43], promethium [61], and rhenium [75].

39. JAMES CHADWIK

Sir James Chadwick (born October 20, 1891, Manchester, England –died July 24, 1974, Cambridge) English physicist who received the Nobel prize for physics in1935 for the discovery of neutron. he graduated from the Honours School of Physics in 1911 and spent the next two years under professor Rutherford in the physical Laboratory in Manchester, where he worked on various radioactivity problems, gaining his M. Sc degree in 1913.He elected to study beta radiation under Hans Geiger in Berlin .Using Geiger's recently developed Geiger counter, Chadwick was able to demonstrate that beta radiation produced a continuous spectrum, and not discrete lines as had been thought.

In 1919, he returned to England to accept the Wollaston studentship at Gonville and Caius College, Cambridge, and to resume work under Rutherford, who in the meantime had moved to the Cavendish Laboratory, Cambridge. Rutherford had succeeded that year in disintegrating atoms by bombarding nitrogen with alpha particles, with the emission of proton. This was the first artificial nuclear transformation. In Cambridge, Chadwick joined Rutherford in accomplishing the bombardment with alpha particles, and in making studies of the properties and structure of atomic nuclei.

In 1932, Chadwick made a fundamental discovery in the domain of nuclear science; he proved the existence of neutrons –elementary particles devoid of any electrical charge. This discovery contributed to the successful controlled fissioning of Uranium-235, and eventually to the development of atomic bomb .For this discovery he was awarded the Hughes Medal of the Royal society in 1932, and subsequently the Nobel prize for physics in 1935. Chadwick has had many papers published on the topic of radioactivity and connected problems and, with Lord Rutherford and C.D. Ellis, he is the co-author of the book Radiations from Radioactive substances (1930).In addition to receiving Nobel prize in Physics, James Chadwick was knighted in 1945.He was awarded the US Medal of Merit in 1946 and the Copley prize by the British Royal Society in 1950.

40. A.P.J. ABDUL KALAM

A.P.J Abdul Kalam,in full Avul Pakir Jainulabdeen Abdul Kalam, (born October 15,1931,Rameswaram, India-died July 27,2015, Shillong), Indian scientist and politician who played a leading role in the development of India's missile and nuclear weapons programs. He was president of India from 2002 to 2007.

Dr. Abdul Kalam, specialized in Aeronautical Engineering from Madras Institute of Technology and in 1958 joined the Defence Research and Development Organisation (DRDO).In 1969 he moved to the Indian Space Research Organisation, he made significant contribution as project Director to develop India's first indigenous Satellite Launch Vehicle (SLV-III) which successfully injected the Rohini satellite in the near earth orbit in july1980 and made India an exclusive member of space club. Rejoining DRDO in 1982, Kalam planned the programme that produced a number of missiles, which helped earn him the nickname "missile Man". He was responsible for the development and operationalisation of AGNI and PRITHVI Missiles in critical technologies through networking of multiple Institutions. He was the Scientific Adviser to Defence Minister and Secretary, Department of Defence Research and Development from July 1992 to December 1999. During this period he led to the weaponisation of strategic missile systems and the Pokhran-II nuclear tests in collaboration with Department of Atomic Energy, which made India a nuclear weapon state.Dr. Kalam took up academic pursuit as professor, Technology and Societal Transformation at Anna University, Chennai from 2001 and was involved in teaching and research tasks.In his literary pursuit four of Dr. Kalam's books – "Wings of fire", India 2020-A Vision for the New Millenium", "My journey" and "Ignited Minds ;Unleashing the power within India" have become household names in India and among the Indian national abroad.

Dr. Kalam is one of the most distinguished scientists of India with the unique honour of receiving honorary doctorates from 30 Universities and Institutions. He has been awarded the coveted civilian awards-Padma Bhushan (1981) and Padma Vibhushan (1990) and the highest civilian award Bharath Ratna (1997). He is a recipient of several other awards and fellow of many professional institutions.

41. VENKATRAMAN RAMAKRISHNAN

Venkatraman Ramakrishnan (born 1952, Chidambaram,Tamil Nadu, India) , Indian born physicist and molecular biologist who was awarded the 2009 Nobel prize for chemistry, along with American biophysicist and biochemist Thomas Steitz and Ada Yonath , for his research into the atomic structure and functions of cellular particles called ribosomes.

In 1971 Ramakrishnan earned a bachelor's degree in physics from Baroda University in Gujarat, and in 1976 he received a doctoral degree in physics from Ohio University in the United States. From 1976 to 1978 he took classes as a graduate student in biology at the University of California, San Diego.He conducted his postdoctoral research from 1978 to 1982 at Yale University in New Haven, Connecticutm. At Yale he worked in the laboratory of American molecular biophysicist and biochemist Peter Moore and learned to use a technique known as neutron scattering to investigate the structure of the small subunit of ribosomes in the bacterium Escherichia coli .Thus, although Ramakrishnan's initial academic back ground prepared him for a career in theoretical physics, his interests later shifted toward molecular biology.

From 1983 to 1995 Ramakrishnan was a biophysicist at Brookhaven National Laboratory in New York. In 1999 Ramakrishnan took a position in the Medical Research Council Laboratory of Molecular Biology at the university of Cambridge in England.The following year he published a series of groundbreaking scientific papers in which he presented data on the RNA structure and organization of the small ribosomal subunit of thermos thermophilus and revealed the structure of antibiotics bound to small subunits of ribosomes at resolution of just 3 angstroms. Ramakrishnan later wrote "Gene Machine: The race to Decipher the Secrets of the Ribosome"(2018).Rama Krishnan was elected a member of the U.S National Academy of Science in 2004 and a foreign member of the Indian National Science Academy in 2008.Ramakrishnan received the Louis-Jeantet prize for Medicine in 2007 and the Healthy Medal, awarded by the British Biochemical Society, in 2008.He was included in the kingdom's New year Honours list for 2012 as knight bachelor.

42. D S KOTHARI

D S Kothari was born in Udaipur in Rajasthan on 6 July 1906. His father, Shri Fateh Lal Kothari, was a school teacher. Kothari had three brothers and one sister. His father died in the plague epidemic of 1918 and was raised by his mother. He had his early education at Udaipur and Indore and received a masters degree in physics from Allahabad university in 1928 under guidance of Meghnad Saha. For his PhD, Kothari worked at the cavendish laboratory, university of Cambridge under the supervision of Rutherford, to whom he was recommended by Meghnad Saha. After obtaining his PhD degree from the Cambridge university he came back to India and resumed his duties as demonstrator in the physics department of Allahabad university.

In May 1934 Kothari joined the Delhi University as reader and head of the physics department. Soon after his joining a number of developments took place towards the improvement of the university. Kothari established an active research group in physical science at Delhi University. He published a number of research papers in various branches of physics and astrophysics. His famous book is 'Nuclear explosions and their effects'

In 1948 the Government of India appointed Kothari as scientific advisor to the Ministry of Defense, a post he held until 1961 when he was appointed chairman of the university grant commission. Kothari had immense faith in the youth of the country and he did everything whatever he could to encourage the young scientists. The National Science Talent Search Program and the subsequent National Talent Search Program started by The National Council for Educational Research and Training (NCERT) owe their origin to Kothari's vision.

The Government of India honored him with a Padma Bhushan in 1962 and Padma Vibhushan in1973.

43. M K VAINU BAPPU

Manali Kallat Vainnu Bappu was born on august 10, 1927 to a senior astronomer in the Nizamiah Observatory, Hyderabad. A brilliant student throughout, Vainnu Bappu not only excelled in studies but took active part in debates, sports and other extracurricular activities. However, astronomy to which he was exposed from an early age, became his passion. Being a keen amateur astronomer, even as an undergraduate, he had published papers on variable star observations. After obtaining his masters degree in physics from Madras University Vainu Bappu joined prestigious Harward Unversity on a scholarship.

Within a few months of his arrival at Harward, Vainnu Bappu discovered a comet. This comet was named Bappu-Bok-Newkirk, after Bappu and his colleagues Bart Bok and Gorden Newkirk who worked out the details of this comet. He completed his Ph.D. in1952 and joined the Palomer observatory on the prestigious Carnegie Fellowship. There he and colin Wilson discovered a relationship between the luminosity od particular kinds of stars and some of their spectral characteristics. This important observation came to be known as the Bappu- Wilson effect and is used to determine the luminosity and distance of these kind of stars.

He returned to India in 1953 and largely through his efforts, he set up the Uttar Pradesh state observatory in Naintal. In 196 he left Naintal to take over as the director of the kodikanal observatory. He modernized the facilities there and it is today an active center of astronomical research. He however realized the Kodikanal Observatory was inadequate for making stellar observations and started searching for a good site for a stellar observatory. As a result of his efforts a totally indigenous 2.3-meter telescope was designed, fabricated and installed in Kavalur, Tamil Nadu. Both the telescope and the observatory were named after him when it as commissioned in 1986.

He was awarded the Donhoe Comet- medal (1949) by the Astronomical society of the pacific, elected as Honorary Foreign Fellow of the Belgium Academy of sciences and was an Honorary member of the American astronomical society. He was elected president of the international Astronomical union in 1979.

44. PADMANABHAN KRISHNAGOPALA IYENGAR

Padmanabhan Krishnagopala Iyengar (29 June 1931 – 21 December 2011; best known as **P. K. Iyengar**), was an Indian nuclear physicist who is widely known for his central role in the development of the nuclear program of India. PK Iyengar did his BSc and MSc from Travancore University and PhD from the University of Bombay, Mumbai. He joined the Department of Atomic Energy (DAE) in 1952 as a young research scientist. He worked as Research Assistant at TIFR (1952-55); Scientific Officer at Bhabha Atomic Research Centre (BARC) (1955-65); Head, Nuclear Physics Division, BARC (1965-72); and Director, Physics Group, BARC (1972-84). Dr Iyengar took over as Director of the Bhabha Atomic Research Centre in 1984. Dr Iyengar worked in the field of neutron scattering up to early sixties. He worked with BN Brockho. In 1974, Iyengar played a leading role in terms of planning and coordination in the peaceful nuclear explosion at Pokhran. Over the last decade he has been actively involved in science policy and science administration, and after retirement has served in various positions such as Member of the Atomic Energy Commission; Scientific Advisor to the Government of Kerala; on the Board of the Global Technology Development Centre; President of the Indian Nuclear Society; and a Member of the Inter-governmental Indo-French Forum, besides serving on various national committees. His current interests focus on advances in nuclear technology for nuclear applications, issues of nuclear policy and national security, science education and the application of science in nation building. He has participated in various international meetings on non-proliferation issues. Most recently, as a Founder Trustee of the Agastya International Foundation, he has been focusing on rural education and instilling creativity and scientific temperament in rural children. He was Member INSA Council (1982-84) and President, International Radiation Physics Society (1986-91). Iyengar previously served as the director of BARC and former chairman of the Atomic Energy Commission of India, he raised his voice and opposition against the nuclear agreement between India and the United States and expressed that the deal favoured the United States. Iyengar joined the Tata Institute for Fundamental Research, Department of Atomic Energy in 1952 as a junior research scientist, undertaking a wide variety of research in neutron scattering. He later got shifted to Atomic Energy Establishment (later renamed as Bhabha Atomic Research Centre) when it was formed in 1954. In

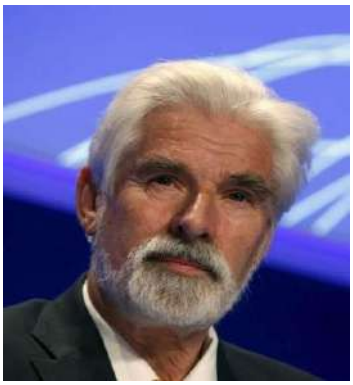
1956, Iyengar was trained in Canada working under Nobel laureate in Physics Bertram Neville Brockhouse, contributing to path-breaking research on lattice dynamics in germanium. At the DAE, he built up and headed the team of physicists and chemists that gained international recognition for their original research contributions in this field. In 1960s, he indigenously designed the PURNIMA reactor and headed the team that successfully commissioned the reactor on 18 May 1972 at BARC. When Ramanna took over as director of Bhabha Atomic Research Centre in 1972, the mantle of directorship of the Physics Group (PG) was handed over to Iyengar. He was one of the key scientists in the development of India's first nuclear device. The team, under Raja Ramanna tested the device under the code name Smiling Buddha on 18 May 1974. Iyengar played a leading role in the peaceful nuclear explosion at Pokharan-I, for which he was conferred the Padma Bhushan in 1975. He died in 21 st December 2011 at the age of 80.

45. JAMES CLERK MAXWELL

James Clerk Maxwell of Glenlair (13 June 1831 – 5 November 1879) was a Scottish physicist and mathematician. Maxwell's parents did not meet and marry until they were well into their thirties, which was unusual for the time; moreover, his mother was nearly 40 years old when James was born. They had had one earlier child, a daughter, Elizabeth, who died in infancy. They named their only surviving child James, a name that had sufficed not only for his grandfather, but also many of his other ancestors. Having had the opportunity to attend the University of Cambridge after his first term Maxwell instead decided to complete the full course of his undergraduate studies at Edinburgh. Recognising the potential of the young boy, his mother Frances took responsibility for James' early education, which in the Victorian era was largely the job of the woman of the house. She was however taken ill with abdominal cancer, and after an unsuccessful operation, died in December 1839 when Maxwell was only eight. James' education was then overseen by John Maxwell and his sister-in-law Jane, both of whom played pivotal roles in the life of Maxwell. His formal schooling began unsuccessfully under the guidance of a sixteen-year-old hired tutor. The 25-year-old Maxwell was a decade and a half younger than any other professor at Marischal, but engaged himself with his new responsibilities as head of department, devising the syllabus and preparing lectures. His most prominent achievement was formulating classical electromagnetic theory. This united all previously unrelated observations, experiments and equations of electricity, magnetism and even optics into a consistent theory. Maxwell's equations demonstrated that electricity, magnetism and even light are all manifestations of the same phenomenon, namely the electromagnetic field. Subsequently, all other classic laws or equations of these disciplines became simplified cases of Maxwell's equations. Maxwell's achievements concerning electromagnetism have been called the "second great unification in physics", after the first one realised by Isaac Newton. He was the first cousin of notable 19th century artist Jemima Blackburn. Maxwell demonstrated that electric and magnetic fields travel through space in the form of waves, and at the constant speed of light. In 1865 Maxwell published A Dynamical Theory of the Electromagnetic Field. It was with this that he first proposed that light was in fact undulations in the same medium that is the cause of electric and magnetic phenomena. His work in producing a unified model of electromagnetism is one of

the greatest advances in physics. Maxwell also helped develop the Maxwell–Boltzmann distribution, which is a statistical means of describing aspects of the kinetic theory of gases. These two discoveries helped usher in the era of modern physics, laying the foundation for such fields as special relativity and quantum mechanics. Maxwell is also known for presenting the first durable colour photograph in 1861 and for his foundational work on the rigidity of rod-and-joint frameworks like those in many bridges. Maxwell is considered by many physicists to be the 19th-century scientist who had the greatest influence on 20th-century physics. He died in Cambridge of abdominal cancer on 5 November 1879 at the age of 48.

46. KLAUS HASSELMAN



Klaus Hasselmann, in full Klaus Ferdinand Hasselmann, born on October 25, 1931, Hamburg, Germany. German oceanographer who was awarded the Nobel Prize for Physics in 2021 for the foundational progress he and Japanese-born American meteorologist SyukuroManabe made in developing scientific models of Earth's climate, quantifying variability, and predicting global warming. Hasselmann and Manabe shared the prize with Italian physicist Giorgio Parisi.

In 1934

from 1961 to 1964. He then returned to the University of Hamburg, where he would spend the majority of his career. After a short visiting professorship at the Woods Hole Oceanographic Institution in Massachusetts from 1970 to 1972, Hasselmann earned the rank of full professor for theoretical geophysics and served as managing director at the university's Institute of Geophysics until 1975, when he became the founding director for the Max Planck Institute for Meteorology in Hamburg, where he served as director until 1999. He also served as the scientific director at the German Climate Computing Centre, also in Hamburg, from 1988 to 1999.

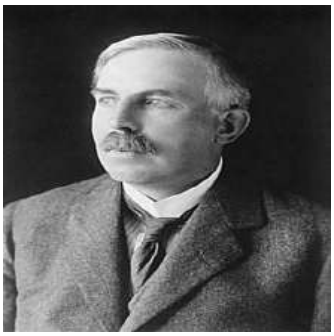
Hasselmann's seminar work in 1976 involved the creation of a stochastic Hasselmann and his family emigrated from Hamburg to England, where he spent his childhood in Welwyn Garden City in Hertfordshire. They returned to Hamburg after World War II. Hasselmann studied physics and mathematics at the University of Hamburg and graduated in 1955, after completing a thesis on isotropic turbulence. He continued his work in physics and fluid dynamics at the University of Göttingen and at the Max Planck Institute of Fluid Dynamics, earning a Ph.D. from the University of Göttingen in 1957.

He served as a research assistant at the Institute of Naval Architecture at the University of Hamburg from 1957 to 1961 before accepting a professorship at the Institute of Geophysics and Planetary Physics and Scripps Institution of Oceanography, University of California, San Diego, climate model that shows how weather disturbances could be integrated into larger, more stable atmospheric and ocean circulation patterns to produce changes in climate. In other words,

he showed how weather that appears as noise and that can change rapidly and chaotically can be incorporated into a model to frame longer-term climate changes. This model led him to consider how warming signals generated by human activities, such as those produced from greenhouse gas emissions and their effects on temperature, could be separated from the background noise of natural climate variability. In 1979 he published statistical techniques that allowed climate scientists to identify the presence and relative strength of these warming signals. This work became the basis for attribution studies—which seek to explain the links between human activities that contribute to climate change and specific weather and climate events, such as tropical cyclones (hurricanes), droughts, extreme rainfall events, and the pattern of rising global average temperatures—that appear frequently in national and global climate risk assessments that help to guide climate policy.

Among Hasselmann's Many Accolades, He Is The Recipient Of The Sverdrup Gold Medal Of The American Meteorological Society (1971), The Symons Memorial Medal Of The Royal Meteorological Society (1997), And The Vilhelm Bjerknes Medal Of The European Geophysical Society (2002). Hasselmann Has Either Authored Or Co-Authored More Than 175 Scientific Publications And Has Contributed To Six Books, Including *Ocean Wave Modeling* (1985) And *Reframing The Problem Of Climate Change: From Zero Sum Game To Win-Win Solutions* (2012).

47. ERNEST RUTHERFORD



On August 30th, 1871 in Spring Grove, New Zealand, Ernest Rutherford was born to James Rutherford, a Scottish wheelwright and engineer, and Martha Rutherford, an English school teacher. Ernest Rutherford grew up in a large family; he was the fourth child in a family with 12 children. Ernest Rutherford spent his early education in the schools provided by the government. In 1887, at the age of 16, he won a scholarship to attend Nelson Collegiate School now know as Nelson College; Rutherford won this scholarship on his second attempt. Two years later, again on his second attempt, Rutherford won another scholarship this time to attend Canterbury College which was administered by the University of New Zealand. At Canterbury College, Rutherford received his BA in Pure Mathematics and Latin, Applied Mathematics, English, French, and Physics in 1892. Rutherford also won a scholarship that allowed him to continue at Canterbury to achieve his Masters. A year later, Rutherford obtained his Masters of Arts with double first-class honours, first in Mathematics and Mathematical Physics then in Physical Sciences. After obtaining his Masters Rutherford failed three times at finding a job as a school-teacher and remained as a tutor. The Royal Commissioners for the Exhibit of 1851 initiated a scholarship that allowed graduates of universities of the British Empire to go anywhere in the world and work on research of importance to their home country's industry. With this news Rutherford returned to Canterbury College in 1894 since it was a requirement to be enrolled at a university. Rutherford also extended his research from his undergraduate and graduate careers. Rutherford won the scholarship and attended Cambridge University in England. At Cambridge University, Rutherford elected to work with Professor Joseph John (J. J.)Thomson at the Cavendish Laboratory. While at Cambridge University, Rutherford adapted his detector of transient currents for use as a frequency meter and used it to measure the dielectric properties of electrical insulators. Rutherford was encouraged by Sir Robert Ball to continue this research so that ships could detect lighthouses in the fog. His apparatus was able to detect electromagnetic waves over a distance of several hundred meters. However, J. J. Thomson invited Rutherford to join in a study of the electrical conduction of gases and wireless telegraphy was later developed by Guglielmo Marconi. While working under J. J. Thomson, Rutherford began a lot of work in radioactivity, using X-rays from radioactive atoms discovered in 1896. In 1898, Rutherford discovered alpha and beta rays in uranium radiation. However, Rutherford was later

barred from advancement at Cambridge University and accepted a professorship at McGill University in Montreal, Canada. At McGill, Rutherford discovered radon, a chemically un-reactive but radioactive gas and later showed that some heavy atoms would spontaneously decay into slightly lighter atoms; thus, discovering radioactive decay. In 1904 Rutherford published his first book Radioactivity and in 1908 received the Nobel Prize in Chemistry 'for his investigations into the disintegration of the elements and the chemistry of radioactive substances'. Since Rutherford realized that lead was the final decay product of uranium, he was able to propose a rate of decay of uranium atoms that would allow mineral dating. Rutherford transferred to Manchester University in 1907 and showed that the alpha particles he had discovered before was a helium atom stripped of its electrons. While at McGill, Rutherford had noted that a narrow beam of alpha particles became fuzzy on passing through a thin sheet of mica. With this information, Rutherford employed his assistant Hans Geiger to measure the relative numbers of alpha particles as a function of scattering angle. Geiger selected Ernest Marsden to help investigate the scattering of alpha particles and found that some alpha rays were scattered directly backwards, even from a thin film of gold. Surprised Rutherford stated 'it was as if one had fired a large naval shell at a piece of tissue paper and it had bounced back'. This experiment later became known as the gold foil experiment. In 1911, at the age of 40, proposed from these results that almost all of the mass of an atom is concentrated in a nucleus that is a thousand times smaller than the atom itself. This was the first suggestion of the nuclear model of an atom. Rutherford continued working as an administrator at Cambridge University until his death on October 19th, 1937 due to delaying an operation on his partially strangulated umbilical hernia.

48. ERWIN SCHRÖDINGER

Erwin Schrödinger was born on August 12, 1887, in Vienna. After having finished his chemistry studies, he devoted himself for years to Italian painting. After this he took up botany, which resulted in a series of papers on plant phylogeny.

From 1906 to 1910 he was a student at the University of Vienna, during which time he came under the strong influence of Fritz Hasenöhrl, who was Boltzmann's successor. It was in these years that Schrödinger acquired a mastery of eigenvalue problems in the physics of continuous media, thus laying the foundation for his future great work.During the First World War he served as an artillery officer. In 1920 he took up an academic position as assistant to Max Wien, followed by positions at Stuttgart (extraordinary professor), Breslau (ordinary professor), and at the University of Zurich (replacing *von Laue*) where he settled for six years. His great discovery, Schrödinger's wave equation, was made at the end of this epoch-during the first half of 1926. It came as a result of his dissatisfaction with the quantum condition in Bohr's orbit theory and his belief that atomic spectra should really be determined by some kind of eigenvalue problem. For this work he shared with Dirac the Nobel Prize for 1933.

In 1934 he was invited to lecture at Princeton University and was offered a permanent position there, but did not accept. In 1936 he was offered a position at University of Graz, which he accepted only after much deliberation and because his longing for his native country outweighed his caution. With the annexation of Austria in 1938, he was immediately in difficulty because his leaving Germany in 1933 was taken to be an unfriendly act. Soon afterwards he managed to escape to Italy, from where he proceeded to Oxford and then to University of Ghent. After a short stay he moved to the newly created Institute for Advanced Studies in Dublin, where he became Director of the School for Theoretical Physics. He remained in Dublin until his retirement in 1955.

After his retirement he returned to an honoured position in Vienna. He died on the 4th of January, 1961, after a long illness, survived by his faithful companion, Annemarie Bertel, whom he married in 1920.

49. DR. VIKRAM SARABHAI

Dr. Vikram Sarabhai was born on 12 August 1919 in Ahmedabad, Gujarat. Dr. Vikram A Sarabhai obtained his Tripos (1939) and Ph. D. (1947) in Cosmic Ray Physics from Cambridge University, U.K. He worked with Sir C.V. Raman, the Nobel Laureate, at the Indian Institute of Science, Bangalore. On his return from Cambridge, Dr. Sarabhai set up the Physical Research Laboratory (PRL), Ahmedabad. He also established the Ahmedabad Textile Industry's Research Association (ATIRA) and the Indian Institute of Management (IIM), Ahmedabad.

With a belief that space technology could play a meaningful role in national development and solving the problems of common man, Dr. Vikram A. Sarabhai shaped the Indian Space Programme in 1960. He saw tremendous potential of using modern science to help in the process of development. He drew up plans to take education to the remotest villages by using satellite television. The Indian Space programme concentrated on achieving self reliance and developing capability to build and launch communication satellites for television broadcast, telecommunications and meteorological applications; remote sensing satellites for management of natural resources.

Establishing the Indian National Committee for Space Research in 1962, which was later renamed the Indian Space Research Organization (ISRO), Sarabhai also set up the Thumba Equatorial Rocket Launching Station in southern India. After the death of physicist Homi Bhabha in 1966, Sarabhai was appointed chairman of the Atomic Energy Commission of India. Carrying forward Bhabha's work in the field of nuclear research, Sarabhai was largely responsible for the establishment and development of India's nuclear power plants. He laid the foundations for the indigenous development of nuclear technology for defense purposes.

Dr. Vikram Sarabhai further established the Community Science Centre under the aegis of the Nehru Foundation for Development, which was renamed as Vikram A. Sarabhai Community Science Centre. In 1966, Dr. Sarabhai was appointed as Chairman, Atomic Energy Commission, and Government of India. He was awarded in 1962 the Shanti Swaroop Bhatnagar Memorial

Award for Physics. He was also honored with the award of Padma Bhusan in 1966 by the government of India. The Padma Vibhusan was awarded to him posthumously.

50. ASIMA CHATTERJEE

Asima Chatterjee (Born: 23 September 1917 in Kolkata, Bengal, India - Death: 2006 in Kolkata, West Bengal, India) was a chemist from India who specialised in organic chemistry and phytomedicine. Her study on vinca alkaloids and the invention of anti-epileptic and anti-malarial medications are among her most famous accomplishments. She also wrote extensively on medicinal herbs native to the Indian subcontinent.

Asima Chatterjee earned a master's degree in organic chemistry from the University of Calcutta in 1938 and a doctoral degree from the same institution in 1944. Her doctoral research was focused on plant product chemistry and synthetic organic chemistry. She also got research experience from the University of Wisconsin, Madison, and the California Institute of Technology. Chaterjee's research focused on natural product chemistry, which led to the development of anti-convulsant, anti-malarial, and chemotherapeutic medications.

She was a University of Calcutta Premchand Roychand Scholar. After Janaki Ammal, she was the second woman to be awarded a Doctorate of Science by an Indian university, the University of Calcutta in 1944. She was the Khaira Professor of Chemistry at the University of Calcutta from 1962 until 1982, one of the university's most prominent and desired seats. She was named Honorary Coordinator of the University Grants Commission-approved Special Assistance Programme to strengthen teaching and research in natural product chemistry in 1972. (India). She was made a Fellow of the Indian National Science Academy in New Delhi in 1960. She got the Shanti Swarup Bhatnagar Award in chemical science in 1961, making her the first woman to receive this honour. She received the prestigious Padma Bhushan award in 1975 and was the first woman to be elected General President of the Indian Science Congress Association. A number of universities awarded her the DSc (Honoris causa) degree. From February 1982 to May 1990, she served in the Rajya Sabha after being nominated by the President of India.

51. DOROTHY HODGKIN

Dorothy Hodgkin (born May 12, 1910, Cairo, Egypt—died July 29, 1994, Shipston-on-Stour, Warwickshire, England) was an English chemist who won the Nobel Prize in Chemistry in 1964 for her work on the structure of penicillin and vitamin B12.

In 1928, she was accepted to Somerville College, University of Oxford, to pursue a degree in chemistry. In 1932, Hodgkin relocated to the University of Cambridge to do doctoral research with British physicist John Desmond Bernal and she continued his work on biological molecules, including sterols (the subject of her thesis), and assisted him in performing the first X-ray diffraction investigations of pepsin, a crystalline protein, in his laboratory. She accepted a temporary research scholarship at Somerville College, one of Oxford's few women's colleges, in 1934 and stayed there until her retirement in 1977. Crowfoot set up an X-ray laboratory in a corner of the Oxford University Museum of Natural History and began work taking X-ray photographs of insulin. In 1939, when Australian pathologist Howard Florey and his Oxford colleagues succeeded in isolating penicillin and urged Hodgkin to unravel its structure, her insulin research was placed on hold. Hodgkin's work on penicillin was recognised in 1947 when she was elected to the Royal Society, Britain's highest scientific academy, barely two years after the first woman was elected. Hodgkin discovered the structure of vitamin B12 in the mid-1950s, and she made substantial use of computers to perform the intricate calculations required. Her successes led to her appointment as the Royal Society's first Wolfson Research Professor in 1960, a position she held while still at Oxford. She was nominated for the Nobel Prize several times and won it in 1964 for her work on penicillin and vitamin B12. The Order of Merit, Britain's highest honour for excellence in science, the arts, and public life, was bestowed on her the following year. She never gave up on understanding the structure of insulin, a big, complex protein molecule that could not be understood until X-ray diffraction and high-speed computing tools had improved sufficiently. Her perseverance paid off in 1969, when she found its structure with an international team of young researchers, 34 years after taking her first X-ray snapshot of an insulin crystal.

52. IRENE JOLIOT-CURIE

Irène Joliot-Curie born in Paris, September 12, 1897, was the daughter of Pierre and Marie Curie, and since 1926 the wife of Frédéric Joliot. The young Joliot-Curie was raised by her paternal grandfather, who taught her to love nature, poetry, and radical politics. After having started her studies at the Faculty of Science in Paris, she served as a nurse radiographer during the First World War. She became Doctor of Science in 1925, having prepared a thesis on the alpha rays of polonium. Either alone or in collaboration with her husband, she did important work on natural and artificial radioactivity, transmutation of elements, and nuclear physics.

In the early 1930s, the Joliot-Curies twice came close to making significant discoveries, but misinterpreted the results. After bombarding aluminium foil with alpha-particles (helium nuclei), they noticed that the aluminium continued to emit positrons even after the bombardment of alpha-particles had stopped. They deduced that alpha-particle bombardment had converted stable aluminium atoms into radioactive atoms. The ability to artificially create radioactive atoms changed the course of modern physics. For this in 1935 she shared the Nobel Prize in Chemistry with her husband. The work has been summarized in their joint paper 'Production artificielle d'elements radioactifs'.

In 1938 her research on the action of neutrons on the heavy elements, was an important step in the discovery of uranium fission. Appointed lecturer in 1932, she became Professor in the Faculty of Science in Paris in 1937, and afterwards Director of the Radium Institute in 1946. Being a Commissioner for Atomic Energy for six years, Irène took part in its creation and in the construction of the first French atomic pile (1948). She took a keen interest in the social and intellectual advancement of women. Years before women could vote in France, in 1936 she became the Undersecretary of State for Science, advocating for state funding of scientific research. She was a member of several foreign academies and of numerous scientific societies, had honorary doctor's degrees of several universities, and was an Officer of the Legion of Honour. She died in Paris in 1956.

53. LISE MEITNER

Lise Meitner (7 November 1878 – 27 October 1968) was a leading Austrian-Swedish physicist who was one of those responsible for the discovery of the element protactinium and nuclear fission.

After receiving her doctorate at the University of Vienna (1906), Meitner attended Max Planck's lectures at Berlin in 1907 and joined Hahn in research on radioactivity. During three decades of association, she and Hahn were among the first to isolate the isotope protactinium-231 (which they named), studied nuclear isomerism and beta decay, and in the 1930s (along with Strassmann) investigated the products of neutron bombardment of uranium. Because she was Jewish, she left Nazi Germany in the summer of 1938 to settle in Sweden.

After Hahn and Strassmann had demonstrated that barium appears in neutron-bombarded uranium, Meitner, with her nephew Otto Frisch, elucidated the physical characteristics of this division and in January 1939 proposed the term *fission* (which Frisch elicited from American biophysicist William Arnold) for the process. In 1944 Hahn received the Nobel Prize for Chemistry for discovering nuclear fission, though some have argued that Meitner merited a share of the award. During this time she was invited to work on the Manhattan Project (1942–45) in the United States. Meitner opposed the atomic bomb, however, and she rejected the offer.

She retired to England in 1960. Eight years later she died, and her tombstone bears the inscription "A physicist who never lost her humanity." The chemical element meitnerium was later named in her honour.

54. THANU PADMANABHAN

Thanu Padmanabhan (Born on 10 March 1957 in Trivandrum, Kerala, India -Died on 17 September 2021 in Pune, Maharashtra, India) was an Indian theoretical physicist and cosmologist whose research spanned a wide variety of topics in gravitation, structure formation in the universe and quantum gravity. He published nearly 300 papers and reviews in international journals and ten books in these areas. He made several contributions related to the analysis and modelling of dark energy in the universe and the interpretation of gravity as an emergent phenomenon. He was a Distinguished Professor at the Inter-University Centre for Astronomy and Astrophysics (IUCAA) at Pune, India.

Born to Thanu Iyer and Lakshmi in Trivandrum. He did his schooling in Thiruvananthapuram and earned his B.Sc. (1977) and M.Sc. (1979) in Physics, from the University College Thiruvananthapuram under Kerala University. Prof. Padmanabhan's career started in the Tata Institute of Fundamental Research for his Ph.D. in 1979.He did his doctoral research work in Quantum Cosmology with Prof. Jayant Vishnu Narlikar. He obtained a Faculty position in TIFR in 1980 and held different Faculty positions there till 1992, when he moved to IUCAA, Pune. He had been Dean, Core Academic Programmes, and was a Distinguished Professor at IUCAA. He was an adjunct faculty member at IISER (Mohali), IISER (Trivandrum), and Jamia Millia Islamia in addition to TIFR, Mumbai, IISER (Pune), Raman Research Institute, Bangalore, and Harish Chandra Research Institute, Allahabad.

For his outstanding work, Prof. Thanu Padmanabhan was conferred with a large number of awards and distinctions. Some notable ones include: Padma Shri (from the President of India, 2007),Kerala Shastra Puraskaram(2021), TWAS Prize in Physics (2011), Infosys Science Foundation Prize for Physical Sciences (2009), Shanti Swarup Bhatnagar Award (1996), Young Scientist Award, (Indian National Science Academy) (1984), Nine times (in 1984, 2002, 2003, 2006, 2008, 2012, 2014, 2018 and 2020) including the First Prize in 2008 from the Gravity Research Foundation, USA.

55. VERA RUBIN

Vera Rubin (Born on July 23, 1928 in Philadelphia, Pennsylvania- Died on December 25 2016 in Princeton, New Jersey) was an American astronomer who pioneered work on galaxy rotation rates. She uncovered the discrepancy between the predicted and observed angular motion of galaxies by studying galactic rotation curves. Identifying the galaxy rotation problem, her work provided some of the first evidence for the existence of dark matter. These results were confirmed over subsequent decades.

Vera Rubin's father, Philip Cooper, was an electrical engineer. Her mother, Rose Applebaum, originally came from Bessarabia, and worked for Bell Telephone Company. Rubin earned her BA degree at Vassar College and attempted to enroll at Princeton but never received their graduate catalog, as women there were not allowed in the graduate astronomy program until 1975. She instead enrolled for her Master's degree at Cornell University, where she studied physics under Philip Morrison, Richard Feynman, and Hans Bethe. She completed her study in 1951, during which she made one of the first observations of deviations from the Hubble flow in the motions of galaxies. She argued that galaxies might be rotating around unknown centers, rather than simply moving outwards, as suggested by the Big Bang theory at that time. The presentation of these ideas was not well received. Rubin's doctoral work at Georgetown University was conducted under advisor George Gamow. Her PhD thesis upon graduation in 1954 concluded that galaxies clumped together, rather than being randomly distributed through the universe. The idea that clusters of galaxies existed was not pursued seriously by others until two decades later.

After her graduation, Rubin taught at Montgomery County Junior College, and also worked at Georgetown University as a research assistant, and in 1962 became an assistant professor there. Also, in 1965, she became the first woman allowed to use the instruments at the Palomar Observatory. Prior to this, women had not been authorized to access the facilities. In 1965 she also secured a position at the Department of Terrestrial Magnetism at the Carnegie Institution of Washington and has worked there as an astronomer since that time. Rubin is currently a Senior Fellow at the DTM, and her work area is described as "Galactic and extragalactic dynamics; large-

scale structure and dynamics of the universe." Since 1978, Vera has researched and analyzed over 200 galaxies. Rubin began work which was close to the topic of her previously controversial thesis regarding galaxy clusters, with instrument maker Kent Ford, making hundreds of observations. The Rubin–Ford effect is named after them, and has been the subject of intense discussion ever since it was reported. It describes the motion of the Milky Way relative to a sample of galaxies at distances of about 150 to 300 Mly, and suggests that it is different from the Milky Way's motion relative to the cosmic microwave background radiation. Wishing to avoid controversy, Rubin moved her area of research to the study of rotation curves of galaxies, commencing with the Andromeda Galaxy. She pioneered work on galaxy rotation rates, and uncovered the discrepancy between the predicted angular motion of galaxies and the observed motion, by studying galaxy rotation curves. Galaxies are rotating so fast that they would fly apart, if the gravity of their constituent stars was all that was holding them together. But they are not flying apart, and therefore, a huge amount of unseen mass must be holding them together. This phenomenon became known as the galaxy rotation problem. Her calculations showed that galaxies must contain at least ten times as much dark mass as can be accounted for by the visible stars. Attempts to explain the galaxy rotation problem led to the theory of dark matter. In the 1970s Rubin obtained the strongest evidence up to that time for the existence of dark matter. The nature of dark matter is as yet unknown, but its presence is crucial to understanding the future of the universe. The existence of dark matter jointly explains galaxy rotation curves, the motion of galaxies within galaxy clusters, patterns of gravitational lensing, and the distribution of mass in systems such as the Bullet Cluster. Alternative MOND (Modified Newtonian Dynamics) models for galaxy rotation curves have been excluded. Rubin has expressed disappointment about this result, stating "If I could have my pick, I would like to learn that Newton's laws must be modified in order to correctly describe gravitational interactions at large distances. That's more appealing than a universe filled with a new kind of sub-nuclear particle."

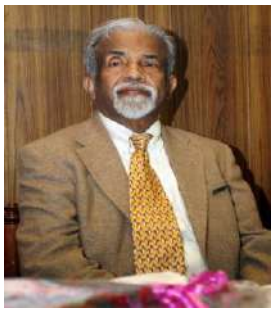
56. ANNA MANI

India's pioneering women scientists who made significant contributions in the field of solar radiation, ozone and wind energy instrumentation. Anna Mani, the weather woman of India was born in 1918 at Peermade, Kerala to an ancient Syrian Christian family. During her childhood, she was a voracious reader. She was impressed by the activities of Gandhi during Vaikom satyagraha.

In 1939, she graduated from the Presidency College in Madras, with a B.Sc. Honours degree in physics and chemistry. In 1940, she won a scholarship for research in the Indian Institute of Science, Bangalore. After graduating from the Presidency college, she worked under Prof. C V Raman, researching the optical properties of ruby and diamond. She authored five research papers, but she was not granted a PhD because she did not have a master's degree in physics. Then she moved to Britain to study physics, but she ended up studying meteorological instruments at Imperial College, London. After returning to India in 1948, she joined the Meteorological department in Pune. She published numerous research papers on meteorological instrumentation.

Anna Mani wished to make India independent in weather instruments. In Bangalore, she set up a small workshop that manufactured instruments for the purpose of measuring wind speed and solar energy. She worked on the development of an apparatus to measure the ozone. She was made a member of the International Ozone Association. She set up a meteorological observatory and an instrumentation tower at the Thumba rocket launching facility. She was associated with many scientific organizations such as the Indian National Science Academy, American Meteorological Society, International Solar Energy Society, World Meteorological Organisation (WMO), the International Association for Meteorology and Atmospheric Physics, etc. In 1987, she was a recipient of the INSA K. R. Ramanathan Medal. She was transferred to Delhi in 1969 as the Deputy Director General. She retired as the deputy director general of the Indian Meteorological department in 1976. In 1994 she suffered from a stroke, and died on 16 August 2001 in Thiruvananthapuram. The World Meteorological Organization remembered her on 100 birth anniversary and published her life profile.

57. E C G SUDHARSHAN



Ennackal Chandy George Sudarshan (also known as E. C. G. Sudarshan; born 16 September 1931) is an Indian theoretical physicist and a professor at the University of Texas. Sudarshan has been credited with numerous contributions to the field of theoretical Physics including Optical coherence, Sudarshan-Glauber representation, V-A theory, Tachyons, Quantum Zeno effect, Open quantum system, Spin-statistics theorem, non-invariance groups, positive maps of density matrices, quantum computation among others. George Sudarshan was born in Pallam, Kerala, India. He studied at CMS College Kottayam, and graduated with honors from the Madras Christian College in 1951. In 1958, he received his Ph.D. degree from the University of Rochester.

Sudarshan has made significant contributions to several areas of physics. He was the originator (with Robert Marshak) of the V-A theory of the weak force, which eventually paved the way for the electroweak theory. Feynman acknowledged Sudarshan's contribution in 1963 stating that the V-A theory was discovered by Sudarshan and Marshak and publicized by Gell-Mann and himself. He also developed a quantum representation of coherent light later known as Sudarshan–Glauber representation. Sudarshan's most significant work might be his contribution to the field of quantum optics. His theorem proves the equivalence of classical wave optics to quantum optics. The theorem makes use of the Sudarshan representation. This representation also predicts optical effects that are purely quantum, and cannot be explained classically. Sudarshan was also the first to propose the existence of tachyons, particles that travel faster than light. He developed formalism called dynamical maps that is one of the most fundamental formalism to study the theory of open quantum system. He, in collaboration with Baidyanath Misra, also proposed the quantum Zeno effect. Sudarshan and collaborators initiated the "Quantum theory of charged-particle beam optics", by working out the focusing action of a magnetic quadrupole using the Dirac equation. He awarded C V Raman award (1970), Bose Medal (1977), Dirac Medal of the ICTP (2010) etc. And the India Government honored him by giving Padma Bhushan in 1976 and Padma Vibhushan in 2007.

58. PRAFULLA CHANDRA RAY

Prafulla Chandra Ray (born on 2 August 1861- died on 16 June 1944) was a well-known Indian scientist and teacher and one of the first "modern" Indian chemical researchers. He studied chemistry at the Presidency College and this soon became his favourite subject, he built a laboratory at home and began experimenting. In 1882, Prafulla won a scholarship to Edinburgh University, UK and he gained his degree there in 1885. Remaining at Edinburgh to undertake research, he was awarded a D. Sc. in 1887 and the "Hope Prize" for his thesis on "Conjugated Sulphates of the Copper-Magnesium Group: A Study of Isomorphous Mixtures and Molecular Combinations".

Prafulla Ray worked as an assistant professor of Chemistry at the Presidency College in Calcutta in 1889. He published around 150 research papers during his lifetime. His research included the discovery of the stable compound mercurous nitrite in 1896 while studying nitrite and hyponitrite compounds and their compounds. He also researched organic compounds containing sulfur, double salt, homomorphism and fluorination. In 1892 with a small capital of 700 INR, he established Bengal Chemical Works. It flourished under his management. The company initially produced herbal products and indigenous medicines. In 1901 the enterprise became a limited company, Bengal Chemical and Pharmaceutical Works Ltd (BCPW) and India's first pharmaceutical company. Gradually, the company expanded and became a leading chemicals and medicine producer. Prafulla Ray was interested in ancient texts and after much research published "The History of Hindu Chemistry" in two volumes in 1902 and 1908. The work detailed the extensive knowledge of metallurgy and medicine in ancient India. In 1916 Prafulla Ray retired from President College and joined Calcutta University where he worked for more than 20 years. He was elected as the Indian Science Congress President in 1920. His autobiography "Life and Experiences of a Bengali Chemist", published in two volumes in 1932 and 1935 documents his own motivations as a scientist and the sweeping changes India was experiencing during his lifetime. He promoted the khadi material and also established many other industries such as the Bengal Enamel Works, National Tannery Works and the Calcutta Pottery Works. He was a true rationalist and he was completely against the caste system and other irrational social systems.

59. KALPANA CHAWLA

Kalpana Chawla (Born on March 17, 1962 in karnal, Hariyana; died- February 17, 2003) was an Indo-American astronaut and the first woman of Indian origin in space. She first flew on space shuttle Columbia in1997 as a mission specialist and primary robotic arm operator. After getting a Bachelor of Engineering degree in Aeronautical Engineering from Punjab Engineering College, India, and she moved to the United states in 1982 and obtained a Master of Science degree in Aerospace Engineering from the University of Texas at Arlington in 1984. She went on to earn a second Masters in1986 and a PhD in Aerospace engineering in1988 from the University of Colorado Boulder.

Kalpana Chawla started working at NASA Ames Research Centre in 1988, where she did computional fluid dynamics research on vertical and /or short take –off and landing concepts. .In 1993 Kalpana became the Vice President and Research Scientist of Overset methods Inc, in Los Atlos ,California. Chawla held a certificated flight instructor rating for airplanes, gliders and commercial pilot licenses for single and multi-engine airplanes and gliders. Becoming a naturalized U.S. Citizen in April 1991, Chawla applied for the NASA Astronaut Corps. She joined the Corps in March 1995 and was selected for her first flight in 1996. She traveled 10.67 million km, as 252 times around the Earth. Her first space mission began on november 19, 1997 with all of the six –astronaut crew that flew the space shuttle Columbia flight STS-87. Chawla was the first Indian born-women and the second Indian person to fly in space. After the completion of STS-87 post-flight activities , Chawla was assigned to technical positions in the astronaut office to work on the space station, her performance in which was recognized with a special award from her peers. In 2000, Chawla was on her second flight as part of the crew of STS-107.

Chawla received several Awards and Honor; Congresssional Space Medal of Honor, NASA Space Flight Medal, NASA distinguished Service Medal. In honor of her, a street was named Kalpana Chawla street in Rayon Nagar in Sirumugai, a village in Coimbatore, TamilNadu, India, and The Kalpana Chawla Award was instituted by the Government of Karnatka in 2004 to recognize young women scientists.

60. TESSY THOMAS

Tessy Thomas (born April 1963 Alappuzha, Kerala) is an Indian scientist at the Defence Research and Development Organisation (DRDO) and Director General Aeronautical Systems. She is the first ever woman scientist to head a missile project in India and she is known as the 'Missile women of India'.

Tessy Thomas obtained her B. Tech in Electrical Engineering from Calicut University in 1985 and M. Tech in Guided Missiles from Institute of Armament Technology, Pune in 1986 and PhD IN Missile Guidance from Jawaharlal Nehru Technological University (JNTU), Hyderabad in 2014.She obtained MBA in Operations Management from Indira Gandhi National Open University (IGNOU), New Delhi, in 2007.

Tessy Thomas Joined IAT, Pune as a faculty of Guided Missiles in 1986. She joined Inertial Navigation group as scientist B in 1988 at Hyderabad .She has been associated with AGNI programme right from its developmental flights. She has designed the guidance scheme for long range missile systems which is used in all Agni missiles. An energy management guidance scheme was designed and developed for the first time in the country for an all-solid propelled long range systems for which she was conferred with Agni Self Reliance Award in 2001.In her work spanning more than 32 years , she has contributed in variation fields such as Guidance, Control, Inertial Navigation, Trajectory Simulation and Mission Design. She was a leading a major project AGNI-4 as Project Director , for a state-of –art system with many new technologies for the first time and successfully flight tested and proven and was also Project Director(Mission) for the long range AGNI-5 system and successfully flight tested and proven. As Director, Advanced Systems Laboratory, DRDO, she held multi-dimensional roles and responsibilities and lead the development of strategic system. The media loves to call her "AGNI PUTRI."

Dr. Tessy Thomas is the recipient of many prestigious awards including DRDO Agni Award for Execellence in self- Reliance in 2001; DRDO Award for path breaking Research Technology Development-2007;DRDO Scientist of the Year Award in 2008;CNN-IBN Indian of the year in2012; India today Women of the year Award in2009;Outstanding Women Achiever award in the field ofscience and technology by Women in science and Engineering (WISE),INDIA.

She received the Lal Bahadur Shastri National Award for her contribution for making India self – reliant in the field of missile technology.

She is a Fellow of Indian National Academy of Engineering (FNAE), Fellow of Telangana Academy of Sciences (FTAS), Life member of Astronautical Society of India (ASI), Life member of Aeronautical Society of India (AeSI) and Life member of Society for Aerospace Quality and Reliability (SAQR).

61. CHRISTIAN DOPPLER

Christian Doppler, (born Nov. 29, 1803, Salzburg, Austria—died March 17, 1853, Venice), Austrian physicist who first described how the observed frequency of light and sound waves is affected by the relative motion of the source and the detector. This phenomenon became known as the Doppler effect.

Educated at the Polytechnical Institute in Vienna, Doppler became director of the Physical Institute and professor of experimental physics of the University of Vienna in 1850. His earliest writings were on mathematics, but in 1842 he published Über das farbige Licht der Doppelsterne ("Concerning the Coloured Light of Double Stars"), which contained his first statement of the Doppler effect. He theorized that since the pitch of sound from a moving source varies for a stationary observer, the colour of the light from a star should alter, according to the star's velocity relative to Earth. Doppler effect is used in astronomical measurements, in Mossbauer effect studies, and in radar and modern navigation. It was first described (1842) by Austrian physicist Christian Doppler. In 1847, Doppler moved to Schemnitz in Germany, where he taught physics, math, and mechanics at the Academy of Mines and Forests. Political troubles forced the Doppler family to move once again—this time to the University of Vienna, where he was appointed director of the Physical Institute. By the time Doppler was appointed to his post at the University of Vienna, his health had begun to deteriorate even more. He suffered from chest pains and breathing problems, symptoms that today would most likely have led to a tuberculosis diagnosis. He continued to research and teach, but illness kept him from completing all of his research. In 1852, he traveled to Venice, Italy, looking for a better climate in which he could recuperate, but his health continued to fail. On March 17, 1853, he died of pulmonary disease, with his wife at his side. Christian Doppler left a significant scientific legacy. The Doppler effect has been used to advance research in astronomy, develop medical imaging technology, and much more.

62. RAJA RAMANNA

Raja Ramanna (28 January 1925 – 24 September 2004) was an Indian physicist who is best known for his role in India's nuclear program during its early stages. Having joined the nuclear program in 1964, Ramanna worked under Homi Jehangir Bhabha, and later became the director of this program in 1967. Ramanna expanded and supervised scientific research on nuclear weapons and was the first directing officer of the small team of scientists that supervised and carried out the test of the nuclear device, under the codename Smiling Buddha, in 1974.Ramanna was associated with and directed India's nuclear program for more than four decades, and also initiated industrial defence programmes for the Indian Armed Forces. He was a recipient of Padma Vibhushan, India's second highest civilian decoration, in honour of his services to build India's nuclear programme. In 1947 Ramanna went on to attend Bombay University where he gained his MSc in Physics, followed by M.Mus. in Music theory. Ramanna was awarded a Commonwealth Scholarship, and travelled to Great Britain in 1952 to complete his doctorate. Ramanna attended London University's King's College and enrolled in a doctoral programme there. In 1954, Raja Ramanna obtained a PhD in Nuclear Physics and also a LRSM from King's College London. In the United Kingdom, Ramanna was invited to do his research at the Atomic Energy Research Establishment (AERE) where he gained expertise in nuclear fuel cycles and reactor designing. After his doctorate in physics, Ramanna returned in 1954 to India, where he joined the senior technical staff of Bhabha Atomic Research Centre (BARC), where he worked under Homi J. Bhabha in classified nuclear weapons projects. Later in the 1980s and 1990s, Ramanna served as Director General of the Defence Research and Development Organisation (DRDO) and as scientific adviser to the Defence Minister of India in 2000. He was a member of the Defence Research & Development Service (DRDS). Ramanna also joined the International Atomic Energy Agency in 1984 where he served as the President of the 30th General Conference of the IAEA.

63. RITU KARIDHAL

Dr. Ritu Karidhal Srivastava (Born-13 April 1975 Lucknow, Uttar Pradesh, India) is an Indian scientist working with the Indian Space Research Organization (ISRO). She was a Deputy Operations Director to India's Mars orbital mission, Mangalyaan. She has been referred to as a "Rocket Woman" of India. She was born and brought up in Lucknow and is an aerospace engineer. Karidhal was born in Lucknow, Uttar Pradesh. She grew up in a middle-class family which placed great emphasis on education. She has two brothers and two sisters. Lack of resources and unavailability of coaching institutions and tuitions left her to rely only on her self-motivation to succeed. As a child, she knew that her interest was in the space sciences. Gazing at the night sky for hours and thinking about outer space, she wondered about the moon, as to how it changes its shape and size; studied the stars and wanted to know what lay behind the dark space. In her teens, she started collecting newspaper cuttings about any space-related activity and kept track of the activities of ISRO and NASA.

Karidhal completed her B. Sc. in Physics from University of Lucknow. She Completed her M. Sc. in Physics from University of Lucknow and got enrolled in a doctorate course in the Physics Department. She later taught in the same department. She was a research scholar at Lucknow University for six months. She joined IISc, Bangalore, to pursue masters in aerospace engineering. She has been conferred honoris causa (an honorary doctorate) D.Sc. by Lucknow University during annual convocation 2019. She supervised the Chandrayaan 2 mission as the mission director. Karidhal received the ISRO Young Scientist Award in 2007 from A. P. J. AbdulKalam, then president of India. Karidhal has also presented at TED and TEDx events describing the success of the Mars Orbiter Mission. Karidhal was awarded an honorary doctorate by the Lucknow University, her alma mater.

DESIDERIUM

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