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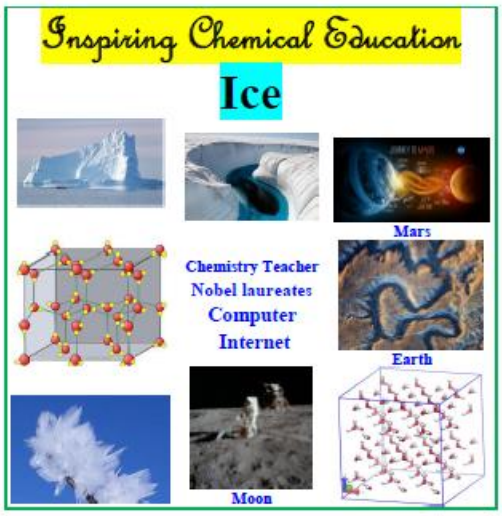

4. Nobel prizes in Physics (2000 to 2014)

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Every science practitioner discriminates physics from chemistry and biology with ease. The definition and scope of physics also evolved with scientific progress over the last five centuries. And, it is humanly impossible to know/speak all about physics. However, physics (right from classical to particle physics) deals with the energy of system at rest and/or under the influence of external (gravity, radiation, magnetic, electrical) force and their consequences. The primary concern of chemistry is around making and breaking of (covalent, co-ordinate) bonds in/between single molecules/ nanostructures and/or macromolecules. The main focus of biology is in probing into processes in animate species right from fertilization to lifelong chores. Each branch of science has a niche in the energy spectrum, of course sometimes with overlapping regions. The knowledge generated from these three major branches of science is a growing offspring on the lap of Mother Nature. Yet it resulted in noteworthy benefits to the mankind, animal kingdom, flora/fauna and environment.

One of the highest honors bestowed on a scientist on the globe is Nobel Prize in appreciation of the contribution for the benefit of mankind. The Nobel Prizes awarded since 1901 in physics cover diverse sub-disciplines (chart 1).

Chart 1 Panoramic view of physics research

Physics	[Experimental;
	Theoretical]
Theoretical	[Laws; Theories;
	Symmetry;
	Models; predictions;]

Experimental	[Expt;
	Instrumental;
	Magnetism;
	Optoelectronics;
	Spectroscopy
	Cryogenics]

System & Size		
$$$_Physics		Classification
Quantum		
Nuclear		Experimental
Particle		
Astro		Theoretical

Targets and goals
Experiments → New results or discoveries
New experimental designs (Instruments, procedures, protocols)
Experimental evidence for theoretical proposals
Experimental realization of postulated theoretically impossibilities

Hybrid_physics	
	$$$_physics
Binary	Bio
	Chemical
	Geo-
Ternary	Bio_Geo_
	Bio_Chem-
Quaternary	Phys-Chem_Chem-

Chart 1b Nobel prize won results in physics with sub-disciplines

Phys.Experimental.Expt
🕮 'production of liquid helium'
🕮 'fine structure of the hydrogen spectrum'
🕮 'crystal structure with X-rays'
🕮 'discovery of super fluidity in helium-3'

Phys.Experimental. Instrument
🕮 ' scanning tunneling microscope'
🕮 ' optical precision gadgets'
🕮 ' CCD sensors'
🕮 ' hydrogen maser'

Phys.Experimental.Spectroscopy
🕮 'X-ray'
🕮 'Raman-'
🕮 ' neutron-'
🕮 ' high_resolution_electron-'
🕮 ' laser-'
🕮 ' maser_laser-'

The physicists won Nobel Prizes for their concerted experimental studies in development of cyclotron, wireless, telegraph, X-ray crystallography and applications in crystal structure, production of liquid helium, fine structure of the hydrogen spectrum, discovery of super fluidity in helium-3, conduction of electricity by gases, measuring and manipulation of individual quantum systems, discovery of superconductivity in ceramic materials, cooling and trapping of atoms with laser light. The discovery of chemical elements, allotropic forms of hydrogen, transmutation of atomic nuclei by artificially accelerated atomic particles, properties of liquid crystals/ polymers/ two-dimensional graphene, Doppler effect in canal rays, splitting of spectral lines in electric fields and reproducing colours photographically by interference are also the study areas those won Nobel prizes. The development of instrumentation and add-ons like scanning tunneling microscope, optical precision gadgets, CCD sensors, hydrogen maser, atomic clocks, spectroscopic tools viz. Raman-, neutron-, high_resolution_electron-, laser-, maser_laser-, influence of magnetism upon radiation phenomena, electronic structure of magnetic and disordered systems, studies on giant Magnetoresistance, opto-electronics received the coveted award. The discovery of electron/it's wave nature, positron, antiproton, mesons, muon neutrino and experimental evidences for theoretically predicated boson are subject matter of sub-atomic and particle physics. The experimental proof of existence of Gravitational waves and mass of neutrino which were theoretically postulated as non-existent is a challenge tackled by mega ventures involving thousands of scientists from different countries all over the globe for over a period of two decades. The other brainstorming topics are symmetry principles, spontaneous broken symmetry in subatomic physics, electro-weak interactions, studies in astrophysics like discovery of cosmic (microwave background) radiation, energy production and evolution of stars, nuclear reactions in the formation of chemical elements in the evolving universe, discovery of pulsars and study of gravitation. Chart 1b incorporates the object oriented representation of Nobel prize won topics in physics with sub-disciplines. The contribution, discipline, Nobel Laureate and year of award are in Chart 2. The heads of chart 3 are institute of affiliation at the time of Nobel Prize, date-of-birth and country of Nobel prize winner.

Chart 2 Nobel prize contributions in Physics during 2000-2014

Year of award	Contribution	Sub-fields	Photo
2014	Efficient blue light-emitting diodes	Bright and energy-saving white light sources	Isamu Akasaki  Hiroshi Amano  Shuji Nakamura

Chart 2 Nobel prize contributions in Physics during 2000-2014

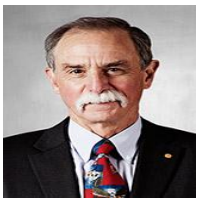
Year of award	Contribution	Sub-fields	Photo
			
2013	Discovery of Boson	Particle physics	François Englert  Peter W. Higgs 
2012	Experimental methods → measuring and manipulation of individual quantum systems		Serge Haroche  David J. Wineland 
2011	Accelerating expansion of the Universe	Astrophysics	Saul Perlmutter  Brian P. Schmidt

Chart 2 Nobel prize contributions in Physics during 2000-2014

Year of award	Contribution	Sub-fields	Photo
			
			Adam G. Riess 
2010	Two-dimensional material graphene -- experiments	Material science	Andre Geim 
			Konstantin Novoselov 
2009	Transmission of light in fibers	Optical communication	Charles Kuen Kao 
	Imaging semiconductor circuit - the CCD sensor	Semiconductot	Willard S. Boyle  **George E. Smith**

Chart 2 Nobel prize contributions in Physics during 2000-2014

Year of award	Contribution	Sub-fields	Photo
			
2008	Mechanism of spontaneous broken symmetry	Subatomic physics	Yoichiro Nambu 
	Origin of the broken symmetry → predicts existence of at least three families of quarks in nature		Makoto Kobayashi 
			Toshihide Maskawa 
2007	Giant magnetoresistance		Albert Fert 
			Peter Grünberg 
2006	Blackbody form and anisotropy of	Astrophysics	John C. Mather

Chart 2 Nobel prize contributions in Physics during 2000-2014

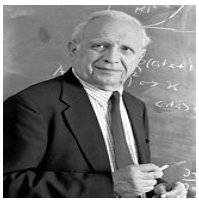
Year of award	Contribution	Sub-fields	Photo
	cosmic microwave background radiation		
			George F. Smoot 
2005	Quantum theory of optical coherence		Roy J. Glauber 
	Laser-based precision spectroscopy Optical frequency comb technique	Spectroscopy	John L. Hall 
			Theodor W. Hänsch 
2004	Theory of the strong interaction		David J. Gross 
			H. David Politzer

Chart 2 Nobel prize contributions in Physics during 2000-2014

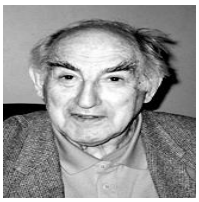
Year of award	Contribution	Sub-fields	Photo
			
			Frank Wilczek 
2003	Theory of superconductors and superfluids	Superconductors	Alexei A. Abrikosov 
			Vitaly L. Ginzburg 
			Anthony J. Leggett 
2002	Detection of cosmic neutrinos	Astrophysics	Raymond Davis Jr. 
			Masatoshi Koshiba

Chart 2 Nobel prize contributions in Physics during 2000-2014

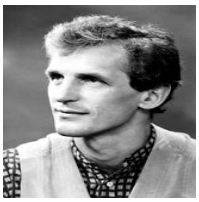
Year of award	Contribution	Sub-fields	Photo
			
	Discovery of cosmic X-ray sources	Astrophysics	Riccardo Giacconi 
2001	Bose-Einstein condensation in dilute gases of alkali atoms Early fundamental studies of the properties of the condensates	Condensed matter	Eric A. Cornell  Wolfgang Ketterle  Carl E. Wieman 
2000	Developing semiconductor heterostructures used in high-speed- and opto-electronics	Condensed matter physics,instrumentation	Zhores I. Alferov  *Herbert Kroemer*

Chart 2 Nobel prize contributions in Physics during 2000-2014

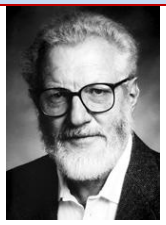
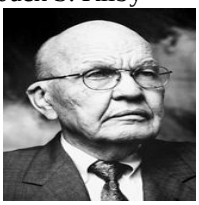
Year of award	Contribution	Sub-fields	Photo
			
	Invention of the integrated circuit	Electronics technology	Jack S. Kilby 

Chart 3: Date of birth and institute of affiliation of Nobel Laureates in Physics during 2000-2014

Affiliation at the time of award of Nobel Prize	Nobel Laureate	Country of Birth	DOB	Share	Year of award
Meijo University, Nagoya, Japan, Nagoya University, Nagoya, Japan	Isamu Akasaki	Chiran, Japan	30 January 1929	1/3	2014
Nagoya University, Nagoya, Japan	Hiroshi Amano	Hamamatsu, Japan	11 September 1960	1/3	2014
University of California, Santa Barbara, CA, USA	Shuji Nakamura	Ikata, Japan	22 May 1954	1/3	2014
Université Libre de Bruxelles, Brussels, Belgium	François Englert	Etterbeek, Belgium	6 November 1932	1/2	2013
University of Edinburgh, Edinburgh, United Kingdom	Peter W. Higgs	Newcastle upon Tyne, United Kingdom	29 May 1929	1/2	2013
Collège de France, Paris, France, École Normale Supérieure, Paris, France	Serge Haroche	Casablanca, Morocco	11 September 1944	1/2	2012
National Institute of Standards and Technology, Boulder, CO, USA, University of Colorado, Boulder, CO, USA	David J. Winel	Milwaukee, WI, USA	24 February 1944	1/2	2012
Lawrence Berkeley National Laboratory, Berkeley, CA, USA, University of California, Berkeley, CA, USA	Saul Perlmutter	Champaign-Urbana, IL, USA	1959	1/2	2011
Australian National University, Weston Creek, Australia	Brian P. Schmidt	Missoula, MT, USA	24 February 1967	1/4	2011

Chart 3: Date of birth and institute of affiliation of Nobel Laureates in Physics during 2000-2014

Affiliation at the time of award of Nobel Prize	Nobel Laureate	Country of Birth	DOB	Share	Year of award
Johns Hopkins University, Baltimore, MD, USA, Space Telescope Science Institute, Baltimore, MD, USA	Adam G. Riess	Washington, DC, USA	16 December 1969	1/4	2011
University of Manchester, Manchester, United Kingdom	Andre Geim	Sochi, Russia,	21 October 1958	1/2	2010
University of Manchester, Manchester, United Kingdom	Konstantin Novoselov	Nizhny Tagil, Russia	23 August 1974	1/2	2010
Standard Telecommunication Laboratories, Harlow, United Kingdom, Chinese University of Hong Kong, Hong Kong, China	Charles Kuen Kao	Shanghai, China	November 1933	1/2	2009
19 August 1924, Amherst, NS, Canada	Willard S. Boyle	Truro, NS, Canada	7 May 2011	1/4	2009
Bell Laboratories, Murray Hill, NJ, USA	George E. Smith	White Plains, NY, USA	10 May 1930	¼	2009
Enrico Fermi Institute, University of Chicago, Chicago, IL, USA	Yoichiro Nambu	Tokyo, Japan	18 January 1921	1/2	2008
High Energy Accelerator Research Organization (KEK), Tsukuba, Japan	Makoto Kobayashi	Nagoya, Japan	7 April 1944	1/4	2008
Kyoto Sangyo University, Kyoto, Japan, Yukawa Institute for Theoretical Physics (YITP), Kyoto University, Kyoto, Japan	Toshihide Maskawa	Nagoya, Japan	7 February 1940	1/4	2008
Université Paris-Sud, Orsay, France, Unité Mixte de Physique CNRS/THALES, Orsay, France	Albert Fert	Carcassonne, France	7 March 1938	1/2	2007
Forschungszentrum Jülich, Jülich, Germany	Peter Grünberg	Plzen, Czechoslovakia (now Czech Republic)	18 May 1939	1/2	2007
NASA Goddard Space Flight Center, Greenbelt, MD, USA	John C. Mather	Roanoke, VA, USA	7 August 1946	1/2	2006
University of California, Berkeley, CA, USA	George F. Smoot	Yukon, FL, USA	20 February 1945	1/2	2006
Harvard University, Cambridge, MA, USA	Roy J. Glauber	New York, NY, USA	1 September 1925	1/2	2005
University of Colorado, JILA, Boulder, CO, USA, National Institute of Standards and Technology, Boulder, CO, USA	John L. Hall	Denver, CO, USA	21 August 1934	1/4	2005

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Affiliation at the time of award of Nobel Prize	Nobel Laureate	Country of Birth	DOB	Share	Year of award
Max-Planck-Institut für Quantenoptik, Garching, Germany, Ludwig-Maximilians- Universität, Munich, Germany	Theodor W. Hänsch	Heidelberg, Germany	30 October 1941	1/4	2005
University of California, Kavli Institute for Theoretical Physics, Santa Barbara, CA, USA	David J. Gross	Washington, DC, USA	19 February 1941	1/3	2004
California Institute of Technology (Caltech), Pasadena, CA, USA	H. David Politzer	New York, NY, USA	31 August 1949	1/3	2004
Massachusetts Institute of Technology (MIT), Cambridge, MA, USA	Frank Wilczek	New York, NY, USA	15 May 1951	1/3	2004
Argonne National Laboratory, Argonne, IL, USA	Alexei A. Abrikosov	Moscow, USSR (now Russia)	25 June 1928,	1/3	2003
P.N. Lebedev Physical Institute, Moscow, Russia	Vitaly L. Ginzburg	Moscow, Russia	4 October 1916,	1/3	2003
University of Illinois, Urbana, IL, USA	Anthony J. Leggett	London, United Kingdom	26 March 1938,	1/3	2003
University of Pennsylvania, Philadelphia, PA, USA	Raymond Davis Jr.,	Washington, DC, USA	14 October 1914,	1/4	2002
University of Tokyo, Tokyo, Japan	Masatoshi Koshiba	Toyohashi, Japan	19 September 1926,	1/4	2002
Associated Universities Inc., Washington, DC, USA	Riccardo Giacconi	, Genoa, Italy	6 October 1931	1/2	2002
University of Colorado, JILA, Boulder, CO, USA	Eric A. Cornell	Palo Alto, CA, USA	19 December 1961,	1/3	2001
Massachusetts Institute of Technology (MIT), Cambridge, MA, USA	Wolfgang Ketterle	Heidelberg, West Germany (now Germany)	21 October 1957,	1/3	2001
University of Colorado, JILA, Boulder, CO, USA	Carl E. Wieman	Corvallis, OR, USA	26 March 1951,	1/3	2001
A.F. Ioffe Physico-Technical Institute, St. Petersburg, Russia	Zhores I. Alferov	Vitebsk, Belorussia, USSR (now Belarus)	15-03-1930	1/4	2000
University of California, Santa Barbara, CA, USA	Herbert Kroemer	Weimar, Germany	25-08-1928	1/4	2000

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Affiliation at the time of award of Nobel Prize	Nobel Laureate	Country of Birth	DOB	Share	Year of award
Texas Instruments, Dallas, TX, USA	Jack S. Kilby	Jefferson City, MO, USA	8 November 1923,	1/2	2000

Information source: http://www.nobelprize.org/