Neutrino Frank Close

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Frank Close breaks down complex concepts in physics in this collection of three of his bestselling books. Including Neutrino, Antimatter, and The Void, this set brings to life the fascinating science of particle physics, neutrinos, antimatter, and nothing. Combing the knowledge of a renowned physicist with the art of a skilled writer, enter the world of physics in an enthralling and readable way.

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Not since Newton’s apple has there been a physics phenomenon as deliciously appealing to the masses as Frank Close’s Cosmic Onion. Widely embraced by scientists and laypersons alike, the book quickly became an international bestseller. Translated into seven languages, it propelled the author to become a worldwide celebrity as well as an inspiration to a generation of scientists. The book’s title itself has entered popular usage as a metaphor for the layers that can be peeled away to understand the foundations of the physical world, from dimensions and galaxies, to atoms and quarks. “Close is a lucid, reliable, and enthusiastic guide to the strange and wonderful microcosmic world that dwells deep within reality” — Frank Wilczek, Herman Feshbach Professor of Physics, MIT, 2004 Nobel Prize in Physics NEW Material Explains the principles behind the Hadron Collider as well as the potential it presents Considers the recent development of the Electroweak Theory as a law of nature Explores the mysteries uncovered and the ones that may be in store with regard to top and bottom quarks Keeping still-pertinent contents from the original volume that caught the world’s attention in 1983, this fresh edition of the Cosmic Onion includes extensive new material to reflect new views of the universe.

Providing explanations that explore the foundations of 21st Century science and future directions, this work offers ready access and unique perspectives to more typical topics such as the forces of nature, atoms, the nucleus, and nuclear particles. It also travels down paths that only a true pioneer and educator can venture, such as a discussion of what Professor Close refers to as the Eightfold Way including the findings, surprises, and new questions emerging from the latest work with accelerators.

Describes the development of the field of particle physics, examines the nature of matter and energy, and profiles the careers of leading particle physicists

Everything around us is made of 'stuff', from planets, to books, to our own bodies. Whatever it is, we call it matter or material substance. It is solid; it has mass. But what is matter, exactly? We are taught in school that matter is not continuous, but discrete. As a few of the philosophers of ancient Greece once speculated, nearly two and a half thousand years ago, matter comes in 'lumps', and science has relentlessly peeled away successive layers of matter to reveal its ultimate constituents. Surely, we can't keep doing this indefinitely. We imagine that we should eventually run up against some kind of ultimately fundamental, indivisible type of stuff, the building blocks from which everything in the Universe is made. The English physicist Paul Dirac called this 'the dream of philosophers'. But science has discovered that the foundations of our Universe are not as solid or as certain and dependable as we might have once imagined. They are instead built from ghosts and phantoms, of a peculiar quantum kind. And, at some point on this exciting journey of scientific discovery, we lost our grip on the reassuringly familiar concept of mass. How did this happen? How did the answers to our questions become so complicated and so difficult to comprehend? In Mass Jim Baggott explains how we come to find ourselves here, confronted by a very different understanding of

the nature of matter, the origin of mass, and its implications for our understanding of the material world. Ranging from the Greek philosophers Leucippus and Democritus, and their theories of atoms and void, to the development of quantum field theory and the discovery of a Higgs boson-like particle, he explores our changing understanding of the nature of matter, and the fundamental related concept of mass.

In this compelling introduction to the fundamental particles that make up the universe, Frank Close takes us on a journey into the atom to examine known particles such as quarks, electrons, and the ghostly neutrino. Along the way he provides fascinating insights into how discoveries in particle physics have actually been made, and discusses how our picture of the world has been radically revised in the light of these developments. He concludes by looking ahead to new ideas about the mystery of antimatter, the number of dimensions that there might be in the universe, and to what the next 50 years of research might reveal. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

In the fall of 1950, newspapers around the world reported that the Italian-born nuclear physicist Bruno Pontecorvo and his family had mysteriously disappeared while returning to Britain from a holiday trip. Because Pontecorvo was known to be an expert working for the UK Atomic Energy Research Establishment, this raised immediate concern for the safety of atomic secrets, especially when it became known in the following months that he had defected to the Soviet Union. Was Pontecorvo a spy? Did he know and pass sensitive information about the bomb to Soviet experts? At the time, nuclear scientists, security personnel, Western government officials, and journalists assessed the case, but their efforts were inconclusive and speculations quickly turned to silence. In the years since, some have downplayed Pontecorvo’s knowledge of atomic weaponry, while others have claimed him as part of a spy ring that infiltrated the Manhattan Project. The Pontecorvo Affair draws from newly disclosed sources to challenge previous attempts to solve the case, offering a balanced and well-documented account of Pontecorvo, his activities, and his possible motivations for defecting. Along the way, Simone Turchetti reconsiders the place of nuclear physics and nuclear physicists in the twentieth century and reveals that as the discipline’s promise of military and industrial uses came to the fore, so did the enforcement of new secrecy provisions on the few experts in the world specializing in its application.

Theoretische achtergrond binnen de kernfysica over elementaire deeltjes met de nadruk op het neutrino.

Selectivity and Discord addresses the fundamental question of whether there are grounds for belief in experimental results. Specifically, Allan Franklin is concerned with two problems in the use of experimental results in science: selectivity of data or analysis procedures and the resolution of discordant results. By means of detailed case studies of episodes from the history of modern physics, Franklin shows how these problems can be--and are--solved in the normal practice of science and, therefore, that experimental results may be

legitimately used as a basis for scientific knowledge.

Forty years ago, three physicists - Peter Higgs, Gerard 't Hooft, and James Bjorken - made the spectacular breakthroughs that led to the world's largest experiment, CERN's Large Hadron Collider. Against a backdrop of high politics and billion dollar budgets, this is the story of their work, the quest for the Higgs boson, and its eventual discovery.

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Originally published: Oxford; New York: Oxford University Press, 2000.

This is a broad-ranging, non-mathematical introduction to recent and ongoing research that has illuminated the physical conditions necessary for our universe to support structure and life. The primary focus is on particle and nuclear physics and cosmology, which have exposed the fine-tuning and imperfections vital for a habitable universe.

Physicist Frank Close takes the reader to the frontiers of science in a vividly told investigation of revolutionary science and enterprise from the seventeenth century to the present. He looks at what has been meant by theories of everything, explores the scientific breakthroughs they have allowed, and shows the far-reaching effects they have had on crucial aspects of life and belief. Theories of everything, he argues, can be described as those which draw on all relevant branches of knowledge to explain everything known about the universe. Such accounts may reign supreme for centuries. Then, often as a result of the advances they themselves have enabled, a new discovery is made which the current theory cannot explain. A new theory is needed which inspiration, sometimes, supplies. Moving from Isaac Newton's work on gravity and motion in the seventeenth century to thermodynamics and James Clerk Maxwell's laws of electromagnetism in the nineteenth to Max Planck's and Paul Dirac's quantum physics in the twentieth, Professor Close turns finally to contemporary physics and the power and limitations of the current theory of everything. The cycle in which one theory of everything is first challenged and then replaced by another is continuing right now.

A history of the neutrino discusses how the atomic particle was sought and found, and how it allows astronomers to perform more in-depth research about distant galaxies and stars.

In the waning years of the Soviet Union scientific research falls far behind. Vasili, head of KGB, tries to gain Western knowledge by espionage. He persuades Dmitri, a physicist, to defect to the USA. Dmitri obtains a position at NSF and later at FermiLab, while remaining entangled in the KGB web. After the disintegration of the Soviet Union Vasili becomes very powerful and wants to strengthen science in the new Russia. He asks Dmitri to return home, because

Russian knowledge needs upgrading. Dmitri is appointed director of IHEP in Moscow. He is not successful, because the best Russian scientists have emigrated to the West. Blackmail and intimidation pursue him. To escape Vasili's influence, Dmitri accepts a job at CERN in Geneva, where the largest particle accelerator in the world, the LHC, is under construction. Vasili now wants revenge. When he does not succeed in obtaining Western knowledge through espionage and cybercrime he wants to ruin Dmitri and to obstruct research at CERN.

We are living in a Golden Age of physics. With the mind of a scientist and the skill of a journalist, bestselling author and renowned physicist Frank Close gives us an insider's look at one of the most inspiring - and challenging - scientific breakthroughs of our time: the Large Hadron Collider in Geneva. About 40 years ago, 3 brilliant, yet little-known scientists made breakthroughs that later inspired the construction of the Large Hadron Collider at CERN in Geneva: a 27-kilometre-long machine which has already cost $10 billion, taken 20 years to build and now promises to reveal how the universe itself came to be. The Infinity Puzzle is the inside story of those 40 years of research, breakthrough and endeavour. The work of Peter Higgs, Gerard 't Hooft and James Bjorken is explored here, played out across the decades against a backdrop of high politics, low behaviour and billion-dollar budgets. In The Infinity Puzzle, eminent physicist and award-winning author Frank Close writes from within the action and draws upon his close friendships with those involved.

We are living in a Golden Age of Physics. Forty or so years ago, three brilliant, yet little-known scientists - an American, a Dutchman, and an Englishman - made breakthroughs which later inspired the construction of the Large Hadron Collider at CERN in Geneva: a 27 kilometre-long machine that cost ten billion dollars, took twenty years to build, and finally discovered a particle consistent with the Higgs boson. The Infinity Puzzle is the inside story of those forty years of research, breakthrough, and endeavour. Peter Higgs, Gerard 't Hooft and James Bjorken were the three scientists whose work is explored here, played out across the decades against a backdrop of high politics, low behaviour, and billion dollar budgets. Written by Frank Close, the eminent physicist and award-winning writer, The Infinity Puzzle also draws upon the author's close friendships with those involved. In July 2012, in the days leading up to the momentous announcement that the Higgs boson had indeed been discovered, Frank Close and Peter Higgs were together at a conference in Sicily. In this paperback edition, Close includes a substantial epilogue reflecting on the announcement, its implications, and the impact on Peter Higgs and others.

It was at the height of the Cold War, in the summer of 1950, when Bruno Pontecorvo mysteriously vanished behind the Iron Curtain. Who was he, and what caused him to disappear? Was he simply a physicist, or also a spy and communist radical? A protégé of Enrico Fermi, Pontecorvo was one of the most promising nuclear physicists in the world. He spent years hunting for the Higgs boson of his day—the neutrino—a nearly massless particle thought to be essential to the process of particle decay. His work on the Manhattan Project helped to usher in the nuclear age, and confirmed his reputation as a brilliant physicist. Why, then, would he disappear as he stood on the cusp of true greatness, perhaps even the Nobel Prize? In Half-Life, physicist and historian Frank Close offers a heretofore untold history of Pontecorvo’s life, based on unprecedented access to Pontecorvo’s friends and family and the Russian scientists with whom he would later work. Close takes a microscope to Pontecorvo’s life, combining a thorough biography of one of the most important scientsts of the twentieth century with the drama of Cold War espionage. With all the elements of a Cold War thriller—classified atomic research, an infamous double agent, a possible kidnapping by Soviet operatives—Half-Life is a history of nuclear physics at perhaps its most powerful: when it created the bomb.physics at perhaps its most powerful: when it created the bomb.

Cultural critics say that "science is politics by other means," arguing that the results of scientific inquiry are profoundly shaped by the ideological agendas of powerful elites. They base their

claims on historical case studies purporting to show the systematic intrusion of sexist, racist, capitalist, colonialist and/or professional interests into the very content of science. Physicist Alan Sokal recently poked fun at these claims by foisting a sly parody of the genre on the unwitting editors of the cultural studies journal Social Text touching off a still unabated torrent of editorials, articles, and heated classroom and Internet discussion. This hard-hitting collection picks up where Sokal left off. The essayists offer crisp and detailed critiques of case studies offered by the cultural critics as evidence that scientific results tell us more about social context than they do about the natural world. Pulling no punches, they identify numerous crude factual blunders (e.g. that Newton never performed any experiments) and egregious errors of emission, such as the attempt to explain the slow development of fluid dynamics solely in terms of gender bias. Where there are positive aspects of a flawed account, or something to be learned from it, they do not hesitate to say so. Their target is shoddy scholarship. Comprising new essays by distinguished scholars of history, philosophy, and science (including Sokal himself), this book raises a lively debate to a new level of seriousness.

What is matter? Matter is the stuff from which we and all the things in the world are made. Everything around us, from desks, to books, to our own bodies are made of atoms, which are small enough that a million of them can fit across the breadth of a human hair. Inside every atom is a tiny nucleus and orbiting the nucleus is a cloud of electrons. The nucleus is made out of protons and neutrons, and by zooming in further you would find that inside each there are even smaller particles, quarks. Together with electrons, the quarks are the smallest particles that have been seen, and are the indivisible fundamental particles of nature that have existed since the Big Bang, almost 14 billion years ago. The 92 different chemical elements that all normal matter is made from were forged billions of years ago in the Big Bang, inside stars, and in violent stellar explosions. This Very Short Introduction takes us on a journey from the human scale of matter in the familiar everyday forms of solids, liquids, and gases to plasmas, exotic forms of quantum matter, and antimatter. On the largest scales matter is sculpted by gravity into planets, stars, galaxies, and vast clusters of galaxies. All the matter that that we normally encounter however constitutes only 5% of the matter that exists. The remaining 95% comes in two mysterious forms: dark matter, and dark energy. Dark matter is necessary to stop the galaxies from flying apart, and dark energy is needed to explain the observed acceleration of the expansion of the universe. Geoff Cottrell explores the latest research into matter, and shows that there is still a lot we don't know about the stuff our universe is made of. ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly. Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Almost weightless and able to pass through the densest materials with ease, neutrinos may offer answers to questions ranging from relativity and quantum mechanics to more radical theories about dark energy and supersymmetry. Heinrich Päs serves as our fluent guide to a particle world that tests the boundaries of space, time, and human knowledge.

Beginning with a guide to what matter is and what it is made of this book discusses everything from quarks and electrons to exotic matter and antimatter. The author concludes by speculating as to the number of dimensions that might be in the universe, and what the next 50 years of research might uncover.

This updated, expanded edition of the classic Physics Vade Mecum is a compact, comprehensive storehouse of the most useful information, formulas, numerical data, definitions, and references, designed for easy access with minimal searching. Saves you time and effort in solving a wide range of scientific and technical problems. A complete listing of physics data centers is included. The index has more than doubled in size from the first edition for even more efficient use. The perfect quick-reference tool. A Library of Science selection.

Antimatter explores a strange mirror world, where particles have identical yet opposite properties to those that make up the familiar matter we encounter everyday; where left becomes right, positive becomes negative; and where, should matter and antimatter meet, the two annihilate in a blinding flash of energy that makes even thermonuclear explosions look feeble by comparison. It is an idea long beloved of science-fiction stories--but here, renowned science writer Frank Close shows that the reality of antimatter is even more fascinating than the fiction itself. We know that once, antimatter and matter existed in perfect counterbalance, and that antimatter then perpetrated a vanishing act on a cosmic scale that remains one of the greatest mysteries of the universe. Today, antimatter does not exist normally, at least on Earth, but we know that it is real for scientists are now able to make small pieces of it in particle accelerators, such as that at CERN in Geneva. Looking at the remarkable prediction of antimatter and how it grew from the meeting point of relativity and quantum theory in the early 20th century, at the discovery of the first antiparticles, at cosmic rays, annihilation, antimatter bombs, and antiworlds, Close separates the facts from the fiction about antimatter, and explains how its existence can give us profound clues about the origins and structure of the universe. Oxford Landmark Science books are 'must-read' classics of modern science writing which have crystallized big ideas, and shaped the way we think.

How does the physics we know today - a highly professionalised enterprise, inextricably linked to government and industry - link back to its origins as a liberal art in Ancient Greece? What is the path that leads from the old philosophy of nature and its concern with humankind's place in the universe to modern massive international projects that hunt down fundamental particles and industrial laboratories that manufacture marvels? J. L. Heilbron's fascinating history of physics introduces us to Islamic astronomers and mathematicians, calculating the size of the earth whilst their caliphs conquered much of it; to medieval scholar-theologians investigating light; to Galileo, Copernicus, Kepler, and Newton, measuring, and trying to explain, the universe. We visit the 'House of Wisdom' in 9th-century Baghdad; Europe's first universities; the courts of the Renaissance; the Scientific Revolution and the academies of the 18th century; the increasingly specialised world of 20th and 21st century science. Highlighting the shifting relationship between physics, philosophy, mathematics, and technology -- and the implications for humankind's self-understanding -- Heilbron explores the changing place and purpose of physics in the cultures and societies that have nurtured it over the centuries.

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A deeply fascinating, engaging, and highly accessible explanation of Einstein's equation, using everyday life to explore the principles of physics.

This is the absorbing account of one of the twentieth century’s most revolutionary discoveries — our first encounter with an essential mystery of the universe. Told by an active participant in this discovery, it is the saga of the search for quarks, the elementary particles lurking within the protons and neutrons of atomic nuclei, which constitute the fundamental basis of matter. Michael Riordan, physicist and author, was present at the key moments in this story. He brings to life the personalities, triumphs and failures of this true-life scientific detective story, vividly portraying the soaring ambitions and clashing egos of modern physicists at work, vying for the coveted Nobel Prize. The Hunting of the Quark gives readers an insider’s perspective on how frontier science actually occurs — the great leaps of imagination, the blind alleys followed, and the final resolution of the mysteries that had to be overcome on the road to unity. Like James Watson’s famous accountThe Double Helix, it has the immediacy and excitement of being on the trail of a monumental discovery — leading to a striking new scientific paradigm, the Standard Model of particle physics. “Many books on the 20th-century revolution in particle physics focus on the startling new notions introduced. Not as much attention is paid to those who dirtied their hands, nursing crotchety accelerator instruments, in order to prove the conjectures. Mr. Riordan, a physicist affiliated with the Stanford Linear Accelerator Center,

presents an authoritative account of this less-told tale. A veteran quark-stalker himself, he deftly combines his technical expertise with a journalistic flair, personally acquainting us with many of the men and women who joined in the hunt... Mr. Riordan enables us to behold exactly how physicists work and the tortuous paths that experimentalists must travel to gain just a scrap of insight into the puzzling laws of nature." — Marcia Bartusiak, The New York Times "A great book that I couldn't put down even though I knew the plot." — Sheldon Glashow, Eugene Higgins Professor of Physics, Emeritus, Harvard University, Nobel prize in physics (1979) "Machines two miles long, pieces of matter elusive as lost souls, the likes of Richard Feynman 'snooping around,' reputations made and lost on the contumacious front lines of science — what a wonderful mix for a book. Particle physics has seemed arcane, the quark business most of all. Michael Riordan, who lives the story he tells, makes it lively, literate and accessible." — Richard Rhodes, author of The Making of the Atomic Bomb "Mr. Riordan... understands the physics, but he also has an eye for the human comedy associated with the work. The result is a fine book on elementary particle physics." — Jeremy Bernstein, The New Yorker "Riordan was an active participant in the search for the enigmatic quark, and his story reflects the excitement, passion and revelation of peeking into nature's most elusive realm." — Rudy Rucker, San Francisco Chronicle "An enjoyable book with enough good explanations and clear discussions to make it well worth reading both for the expert in modern high-energy physics and for the general reader." — Alexander Firestone, Physics Today "A physicist with first-hand experience chasing quarks at the Stanford Linear Accelerator Center (SLAC) relates the high points of the search for those elusive subatomic particles... Riordan builds a suspenseful tale around the neck-and-neck race between MIT/Brookhaven (Sam Ting) and Stanford (Burton Richter) in discovering the J/psi particle... Riordan's epilogue is eloquent... Readers will... turn to Riordan for a close-in view and astute commentary on a pivotal period in 20th-century physics." —Kirkus

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