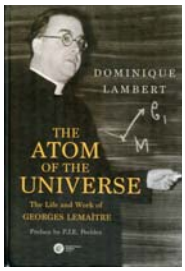

The Atom of the Universe

The Life and Work of Georges Lemaître

Dominique Lambert

Copernicus Center Press, 2015. $59.90 (484 pp.). ISBN 978-83-7886-071-6

Cosmology textbooks shortchange the pioneering Belgian priest Georges Henri Lemaître (1894–1966). They describe the Friedman-Robertson-Walker metric, which underpins the application of general relativity to cosmology. They show Edwin Hubble's redshift–distance relation, which describes the local expansion of the universe. They recount Albert Einstein's "blunder," the introduction of λ, the cosmological constant. And sometimes they recount Fred Hoyle's caustic coining of "Big Bang" as an epithet: a cosmic ricochet that has prevailed over his own steady-state vision. Yet all of those were discovered, rediscovered, or least presaged by Lemaître. That's what you get for publishing in French.

The Atom of the Universe: The Life and Work of Georges Lemaître is an exhaustive account of the cosmologist, mathematician, priest, and legendary faculty member at Belgium's Université Catholique de Louvain—the same university from which author Dominique Lambert received his doctoral degrees in physics and philosophy. Although Lemaître possessed an enduring religious faith, it was coupled to his sharp and clearly articulated sense that physical phenomena, including observations related to the origin of the universe, cannot test the validity of religious belief. That is a useful reminder for both atheists and popes.

PHYSICS TODAY readers may find the details of Lemaître's religious training less fascinating than his uncanny knack for being in the right place at the right time for the intellectual adventure of cosmology. He took courses from Arthur Eddington at the University of Cambridge in 1923 and thus was an early student of Einstein's general relativity theory. By 1924 he was pursuing his PhD with Harlow Shapley, who had developed methods for measuring distances in the Milky Way based on Henrietta Leavitt's work on Cepheid variables. That work prepared Lemaître to understand what he heard at the January 1925 meeting of the American Astronomical Society in Washington, DC. It was there that Henry Norris Russell famously read Hubble's "Cepheids in Spiral Nebulae," the paper that established the existence of distant galaxies distinct from the Milky Way.

By 1927 Lemaître had worked out the basics of a time-dependent universe in general relativity (as Alexander Friedman had done before) and footnoted the empirical linear relation that today we call Hubble's law, which links velocity and distance. That was before Hubble's 1929 publication of his eponymous plot of galaxy distances (in hand since 1925) and velocity (determined by Vesto Melvin Slipher's redshifts as published in Eddington's 1923 book on general relativity).

Lambert would have us believe that Lemaître's publishing his paper in French in a Belgian journal was not a disadvantage. But the evidence is clear that the Anglo-Saxon scientific world was not paying close attention to the *Annales de la Société scientifique de Bruxelles*. The fascinating story of the English publication (which occurred with Eddington's help) is told here, including the interesting detective work carried out by Mario Livio and described in the November 2011 issue of *Nature*. Lemaître himself did the translation and left out the velocity–distance footnote because, by 1931, when Eddington arranged for the work to appear in the *Monthly Notices of the Royal Astronomical Society*, Hubble had much better data.

With its rich use of archival material and careful attention to Lemaître's academic life at Louvain, *The Atom of the Universe* is both broader and thicker than John Farrell's *The Day Without Yesterday: Lemaître, Einstein, and the Birth of Modern Cosmology* (Thunder's Mouth Press, 2005), which focuses on Lemaître's encounters with Einstein and his contributions to cosmology. Like Farrell, Lambert recounts Lemaître's ongoing dialog with Einstein, in peripatetic conversations at Caltech, about the cosmological constant "little lambda." Eavesdropping journalists in 1933 rendered the discussion as one about a "little lamb" that followed them to school one day on their walks.

Lemaître's interpretation of λ is almost shockingly modern: "Everything happens as though the energy *in vacuo* would be different from zero . . . we associate a pressure $p = -\rho c^2$ to the density of energy ρc^2 of vacuum. This is essentially the meaning of the cosmological constant λ." That is more or less what we say today about the origin of the accelerating universe.

Lemaître was a significant player in the formative years of relativistic cosmology. There's no question that his contributions are undervalued—not primarily out of ignorance or linguistic bias, but because by the mid 1930s he stopped doing original research in cosmology and devoted himself to other aspects of academic life and to matters of faith. He had no school of students to build on his contributions. If you don't cite your own work, and if you don't have any students to do it, who will?

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The Human Side of Science

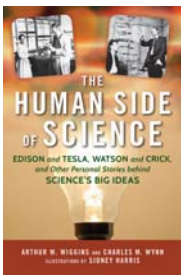
Edison and Tesla, Watson and Crick, and Other Personal Stories behind Science's Big Ideas

Arthur W. Wiggins and Charles M. Wynn Sr

Prometheus Books, 2016. $26.50 (360 pp.).
ISBN 978-1-633-88156-3

The Human Side of Science: Edison and Tesla, Watson and Crick, and Other Personal Stories behind Science's Big Ideas is an attempt to introduce nonscientists to the world of science. To that end, authors Arthur Wiggins and Charles Wynn Sr must confront one of the most stubborn problems in science outreach: how to make scientific subjects appealing to those whose interests lie elsewhere. There are approximately as many solutions to that problem as there are popular-science authors—restricted vocabulary lists, whimsical framing devices, drawing parallels with art and literature, and many more.

Wiggins and Wynn have chosen an approach they describe as reversing the emphasis of the usual explanatory science book that presents abstract ideas spiced with occasional personal anecdotes. Instead, they promise to put "people first, ideas second." That choice is not unique to them; indeed, it falls squarely within a broad class of books that anchor explanations of complex topics in stories about the sometimes colorful personalities who made the science.



Some examples of the "people first" approach include David Lindley's *Uncertainty: Einstein, Heisenberg, Bohr, and the Struggle for the Soul of Science* (Doubleday, 2007), Louisa Gilder's *The Age of Entanglement: When Quantum Physics Was Reborn* (Knopf, 2008), Richard Panek's *The 4 Percent Universe: Dark Matter, Dark Energy, and the Race to Discover the Rest of Reality* (Houghton Mifflin Harcourt, 2011), and Janna Levin's *Black Hole Blues and Other Songs from Outer Space* (Knopf, 2016), about the LIGO project and its detection of gravitational waves this past September.

What distinguishes *The Human Side of Science*, then, is less its choice of emphasis than its breadth. Wiggins and Wynn cover around 400 scientists—from Democritus to J. Craig Venter of the Human Genome Project—drawn from more than 2000 years of history; some minichapters at the end briefly mention key researchers of dark energy and the Higgs boson. The authors discuss a range of fields, mostly physics and astronomy, but also geology, biology, and pure mathematics.

That historical and disciplinary breadth is also the book's greatest weakness. Telling so many stories in such a short space—311 pages, not including the index—necessarily precludes going into much depth with any of them. As advertised, the emphasis is on people first, but the scientific ideas are a very distant second. In many cases, the ideas are sketched so roughly that it's difficult to say whether a reader who didn't already have some knowledge of the subject would fully appreciate the scientific accomplishments of the people profiled.

Also, most of the anecdotes in this book are familiar ones: Isaac Newton arguing with Robert Hooke and Gottfried Leibniz, Albert Einstein's troubled marriage to Mileva Marić and his discussions with Michele Besso and Marcel Grossmann, James Watson and Francis Crick getting their crucial insight from the work of Rosalind Franklin and Raymond Gosling. The stories are told well, even if compactly, but the authors miss clear opportunities to add to or correct existing popular notions. For example, their brief discussion of Galileo Galilei's work repeats the popular—and, they acknowledge, likely apocryphal—legend of weights dropped from the Tower of Pisa, but they do not describe Galileo's genuinely innovative experiments that demonstrated the constant acceleration of gravity by rolling objects on ramps. And it is disappointing that a book about the complex human aspects of science feeds the "lone genius" myth by failing to mention Galileo's contemporaries in physics—especially Simon Stevin, who, in 1586, really did drop objects of different weights from a tower.

Also, the choice to cover a wide range of topics may have been a factor in some minor but distracting oversights and errors slipping through the editing process. For example, some of the photographs and paintings of scientists (not including the many charming Sidney Harris cartoons) are credited only to Wikimedia, even in cases where more detail about their origin is readily available online. Some factual inaccuracies scattered throughout include a paragraph that mistakenly places Ernest Rutherford, instead of James Chadwick, in a prison camp during World War I. And noted astronomer Vesto Melvin Slipher is puzzlingly referred to only by his initials ("V. M. Slipher").

The Human Side of Science may provide nonscientists with a sense of science's grand scope, its colorful history, and its intensely human nature. Perhaps that will inspire them to read more deeply about particular characters and thus gain deeper knowledge. As a self-contained work of science communication, though, the book would have served readers better if it had covered a smaller range of topics in considerably greater depth.

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Andrei Sakharov

The Conscience of Humanity

Edited by Sidney D. Drell and George P. Shultz

Hoover Institution Press, 2015. $19.95 paper (184 pp.). ISBN 978-0-8179-1895-8

Andrei Sakharov: The Conscience of Humanity is the product of a conference at Stanford University in December 2014 that honored Soviet physicist Sakharov (1921–89) for his contributions to world peace and his courageous defense of human rights. The event brought together several distinguished diplomats, scientists, religious and military figures, journalists, and historians connected to Stanford University's political think tank, the Hoover Institution, and to other national-security advising bodies. The participants emphasized the role of Sakharov's ideas in ending the Cold War and their continuing importance for addressing fundamental challenges faced by humanity today.

Of the 11 essays published in the volume, nine are authored by experts on contemporary problems rather than on Sakharov, for which some of them offered frank apologies. Perhaps unreflectively, those nine essays promote