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Book Reviews

Lisa Randall, *Knocking on Heaven's Door: How Physics and Scientific Thinking Illuminate the Universe and the Modern World*. New York: HarperCollins, 2011, xxi + 442 pages. $29.99 (cloth).

Explaining esoteric frontier science to a lay audience is both challenging and rarely done as well as one would hope. The need for such efforts is great and increases with the growing abstraction and exploding cost of particle physics and its machines. So I appreciate the effort that Prof. Randall has made to communicate the excitement of particle physics and the prospects of the Large Hadron Collider (LHC) to a broad audience through this book. She has done some important things well while still leaving much to be desired in the execution of the project.

Lisa Randall is a well-known particle theorist, currently a professor at Harvard. She has made important contributions to models exploring fundamental questions in particle physics and, more recently in cosmology—for example, proposing ways to understand the relative weakness of gravity compared to the other forces.

Her book focuses on the LHC and what we hope to learn from experiments there, with a second book's worth of explaining the nature of science and how it is really done. It is strongest in showing the lines of argument that guide the design of LHC experiments: what can we hope to learn and on what basis do these hopes rest, how should we look, what kinds of experiments can most likely distinguish competing proposals about what might happen in this extreme energy range and small length scale.

A large section of the book is devoted to a detailed description of the LHC and its major experimental installations: CMS and ATLAS. Unfortunately, the level of detail is not calibrated well for a general audience. It seems more like an attempt to be exhaustive than to illuminate with a carefully conceived storyline. There are many interesting facts about the LHC and the experiments, many that are relevant to understanding what the experiments can hope to accomplish, others that are just "Gee Whiz" facts and figures, and others that seem designed to showcase the author's insider knowledge. Even some of the illustrations seem to be more for experts than for the lay audience of this book. For example, in Figure 34, "Simulation of an event in the ATLAS detector," she says, "The distinctive toroidal magnets are clearly visible." But the lay reader is not given a clue what to look for or how to understand what is "clearly visible" in this illustration. In fact, the only explanation or definition of "toroidal" I found in the book is given on p. 225: "The word 'toroid' refers to the magnets [in the ATLAS experiment], whose field is less strong than that of CMS but extends over an enormous region."

The most important part of the book in terms of explanation of physics for a lay audience (or even for an audience of nonspecialist physicists) is the chapter on the Higgs boson and the Higgs mechanism. What are these ideas that have caused so much fuss, including being a major motivation for the building of this huge accelerator and for the planning of exciting and expensive experiments? She gives a general idea of the nature of the Higgs mechanism, with considerable discussion of why a consistent understanding of particle masses is a problem in particle physics and how the Higgs mechanism can solve this problem. She presents these complicated concepts clearly, in a way that focuses the reader nicely on the essential issues. However, she follows this discussion of the Higgs mechanism with an opaque explanation of "why the Higgs mechanism

allows masses that are consistent with sensible high-energy predictions." (p. 282) Next she explains spontaneous symmetry breaking clearly, with a good everyday example. Finally, she recaps the previous discussion—but with repetition rather than increased clarity. This reminded me of the experience of someone speaking to me in a foreign language and speaking louder instead of more slowly or with simpler words when I did not understand.

Aside from the discussion of the accelerator and experimental systems, much of the rest of the science sections of the book reviews the Standard Model and what we already know, or think we know, about the fundamental nature of matter. This includes summaries of the ideas, speculations, and our limited knowledge of dark matter and dark energy. These parts of the book have been done more clearly and in more engaging prose, certainly with better narrative flow, in previous works by other physicist authors. She would have used better judgment to abbreviate much of this material and refer to other work.

The sections on the nature of science and how science is actually done, spread throughout the book, have much of value. I very much like her continual reminders that science always questions its ideas and that experiment is the final arbiter of scientific knowledge. Her explicit acknowledgement of the diversity of approaches among scientists working on related problems is excellent. Furthermore, her discussion of the roles of uncertainty and probability in science are significant. However, the philosophical and historical context she gives to demonstrate the nature of science are relatively weak, including discussions of science as fundamentally materialist and the relationship of science and religion. In particular, the arguments she gives in support of her philosophical positions seem superficial—even though I generally agree with the positions she describes. And she sets the stage historically with rather naïve use of anecdotes.

I have some broader concerns about her judgment of the book's audience, beyond those expressed above. In particular, I expected her experience as a university-level teacher of physics to inform her awareness of the difficulties her lay readers would have with this subject matter so she could give special attention to explaining those concepts that would be most likely to be problematic. Unfortunately, I did not see evidence that she kept her audience clearly in focus during the writing of the book. For example, why does she expect her audience to understand the very large and very small numbers that come up in the discussion, with relatively little depth of explanation and no reminders later in this long book to ensure understanding? In fact, why does she mix exponential notation and awkward formulations like "a tenth of a thousandth of a trillionth of a millimeter," (p. 129) never making specific connections between the two ways to express numbers well outside the human scale? Why does she use jargon or terms likely unfamiliar to her intended audience without explaining them—like "collimator," "toroidal," "dipole and quadrupole magnets," "valence quarks," "oscillation modes of gauge bosons," "weak charge," "weak mass," "weak length scale"? She reaches out to nonscience creative pursuits, including the artistic, in good ways in some sections, yet does not seem to feel a need to reach out by defining these unfamiliar terms in the science sections. Why does she not give more attention to explaining the copious illustrations, leading the lay reader to see the meaning she hints at?

A related set of concerns is that Randall too often tosses off a comment with no elaboration to give it meaning. For example, in discussing science and religion, she writes, "Even so, science doesn't address all moral issues (though it doesn't disown them either as is sometimes alleged)." (p. 45) This comment cries out for discussion, but I could not find satisfactory connections to it in any of the following paragraphs. I reacted similarly to short comments or asides throughout the book. And insufficient explanation shows up at times even in the science sections—where she explains that we cannot probe within the atom with visible light because the wavelength of the light is too long, (pp. 77–78) she makes the analogy that this would be like "threading a needle with mittens on." The following sentence helps a little, explaining that long wavelengths "implicitly smear over the smaller sizes that these overly extended waves could never resolve," but this needs much more for the general audience than the beginnings of an explanation and an analogy that really doesn't clarify until you further understand the issue itself.

Finally, the book needed much more editing. The prose is self-conscious and repetitive. The level of explanation is too frequently superficial, reminding me of Edith Wharton's characterization of one superficial conversation as "pensive dilettantism." This is not to suggest that Prof. Randall is a dilettante, far from it, but that she addresses her general readers at this level. The prose is not engaging; it lacks narrative flow. Rather it frequently rambles, proceeding from one anecdote or aside to another.

For all of this, I believe it is vital that more physicists tackle projects like this one. This book, even with its weaknesses, makes an important contribution. It is especially valuable that physicists of some eminence, like Prof. Randall, address the general reader. The example of Richard Feynman, who invested tremendous effort in making abstract concepts clear to the lay reader, is a worthy ideal, both in showing the effort that is necessary and in inspiring us with the possibilities for such work. I only plead that, whatever the eminence of the author, physicists authoring books for general audiences avail themselves of careful and able editors.

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Frank Close, *The Infinity Puzzle: Quantum Field Theory and the Hunt for an Orderly Universe*. New York: Basic Books, 2011, 448 pages. $28.99 (cloth).

Frank Close is one of the most prominent and prolific writers of popular accounts of physics. His ten books include accounts of the history of the neutrino, antimatter, the vacuum, and asymmetry. I've reviewed three of them so far, for various publications, and in each case enjoyed and valued his work. His new book is no less fine and even carries his work further into the realm of historical writing.

Close combines the virtues of the insider and the outsider. I first met him when he was a postdoc at SLAC during the early '70s, the heady period of the discovery of scaling and the "November revolution" that signaled the confirmation of what came to be called the Standard Model of particle physics. Already remarkably bright and personable in those days, his career has taken him to Oxford, where he is professor of theoretical physics. He combines an inside view of physics with a notable flair for clear, vivid, unpretentious description, as if he were at the same time an excellent, keen-eyed journalist as well as a professional physicist. Not many people combine these skills, or wield them as comfortably as he does.

Indeed, it is not easy to write accounts for the general reader of highly technical developments. One must balance accuracy and scientific scruple against the difficulties of understanding such material. Too many accounts dumb things down or become patronizing. Close's strength lies in his directness and his intelligence, which keeps the central questions in view, so that he maintains the thread of the argument in terms of underlying issues that the readers are invited to consider for themselves.

His new book is a history of modern quantum field theory, from quantum electrodynamics up to the present day. As such, it overlaps to a considerable extent with Close's own life and career; born in 1945, he reached maturity just as quantum field theory triumphed over the weak, electromagnetic, and strong interactions. Accordingly, he is personally acquainted with many of the principal protagonists in his story, for which he conducted extensive interviews. His concentration on original papers and collection of oral histories is new in his work, at least compared to his earlier books that I know, and adds a great deal of value. To skilful popular accounts, he here adds considerably more historical detail. This adds to the narrative interest but also represents a real contribution to untangling a very complex story.

A great deal of this concerns the complex issues of who exactly discovered what when, and to whom credit should rightfully be given for major insights. Close emphasizes the complexity of the history and the manifold ways in which an important discovery can be discovered nearly simultaneously by different people. He devotes particular attention to the mechanism by which spontaneously broken gauge theories can associate mass with particles that otherwise would have been massless, often called the "Higgs mechanism."

Though he gives an extensive and sympathetic portrait of Peter Higgs himself, Close devotes much attention to Robert Brout, François Englert, Gerald Guralnik, Richard Hagen, Thomas Kibble, who all, about the same time, came upon this very mechanism, as well as to others who came very close or in some other way deserve recognition (notably Philip Anderson and Gerard 't Hooft). Close is evidently moved by issues of fairness: is it right to ascribe to a single individual credit that should be shared among many? He notes the historical (and political) vagaries that tend to oversimplify these matters, but is also aware of practical realities, including the sheer awkwardness of referring to the "ABEGHHKtH mechanism" in an effort to include all who deserve credit. Close also distinguishes between this mass-generating mechanism and the massive boson associated with it, whose detection became the final missing piece in the experimental quest to confirm the Standard Model of particle physics.

Most of all, he ponders the rule (or at least practice) that the Nobel Prize not be divided more than three ways, with its corollary dilemma of how to allot these spots to those most worthy. Though this surely corresponds to widespread fascination among physicists as well as the general public, at some point the baleful effects of Nobel fever need to be confronted. Why, exactly, should so much attention fall on the choice of the Swedish Academy, which otherwise is only one of many such learned bodies in the world, with no special right or qualification to adjudicate scientific credit worldwide? Does the legacy of the explosives inventor and munitions manufacturer Alfred Nobel really deserve such abject acceptance, not to speak of semireligious awe? Though troubled by the problems of allocating Nobel Prizes fairly, Close does not go as far as critiquing the fundamental premises of its operation or suggesting alternatives.

These issues might be compared with parallel problems in experimental physics, which now routinely involves groups of thousands of physicists. The prevailing practice of recognizing the leaders of these groups as representing their collectivity may offer an interesting way to think about the activities of theorists, though they still tend to work alone or in small groups. Close's focus on theory rather than experiment reflects the personal element of his life-reflections as a theorist. Particularly concerned with the history of theoretical developments, he evidently felt that he could not devote equal attention to experimental aspects. He had his hands full in this present book, with its wide-ranging and difficult material. Still, the reader of *The Infinity Puzzle* receives rather schematic help in balancing its theoretical account with the experimental grounding.

Even on the theoretical side, Close's treatment varies in its level of detail. As closely (forgive the pun) as he treats the cast of characters and order of events behind the discovery of the ABEGHHKtH mechanism, he is somewhat less detailed on the history behind the theory of quark confinement. He usefully assembles the different accounts of Frank Wilczek and David Gross, then at Princeton, and David Politzer, then a graduate student at Harvard, as well as commentary by Antony Zee and Sidney Coleman, deeply involved in the larger issues. Here (as often through the book) Close's ability to question the protagonists closely and critically yields helpful information.

In the end, though, the reader has the feeling of not having reached the bottom of the story, nor of being quite sure whether such a decisive resolution can be reached. Close seems to feel, with some justification, that the divergent accounts may never be fully reconciled. He questions all involved as an informed, interested observer who wants to get everything straight. But I wondered whether he might not have gone further. For instance, he mentions that Polizer's Nobel lecture "hints at tension below the surface and differs in several respect from the version in Gross's talk," (p. 273) but Close never really brings these differences forward with sufficient clarity that the

reader might fully contemplate what these differences are or mean. Are they truly significant or merely part of the all-too-human fallibility of memory? Or does Close draw a decorous curtain over what may be unseemly wrangling, which may even raise animosities between eminent living persons?

A distinguished professor in the theoretical community might hesitate setting himself as arbiter or judge over his peers, not to speak of the wrath of those who disagreed with him. To what extent does this lead Close to be cautious in his judgments, pull punches, or avoid pressing unpleasant questions? At times, he reaches clear conclusions, as when he complains of the neglect of the achievement of John Ward and Freeman Dyson. At other times, he emphasizes the contradictory (and perhaps unreconcilable) views and memories of the participants. His "Postscript" reflects on the tricks played by memory, even as he reviewed his own tape-recorded recollections from the 1970s.

The fundamental tension in the book reflects its dual ambition as popularization and as historical investigation. Its author probably wanted to maintain the broad appeal of the book through combining these divergent projects. Close has achieved a *tour de force* of compelling, page-turning interest that holds the reader's attention while conveying a great deal of solid material. As far as he went in the historical direction, I would have appreciated even more. As admirable as it is, the book is fairly demanding for a popularization, of which there are quite a number for the Standard Theory. We also need really probing histories of contemporary physics, on the model of the writings of Abraham Pais or Silvan Schweber, whose historical inquiries blend technical understanding with incisive writing. Close has the investigative ability to give us even more historical insight.

Yet even within its chosen limitations, Close's book has great value. He brings forward protagonists whom he considers unjustly neglected, such as Ward and especially James Bjorken, who so greatly advanced physics in the late twentieth century. He also emphasizes the immense achievement and influence of Julian Schwinger, too often neglected next to the flamboyant, ever-popular Richard Feynman; Close compares their different styles to Proust's subtle novels *versus* comic books.

Close's explanations are admirably clear and helpful, especially his extended comparison of renormalization to the pixels into which digital images are rendered. This analogy seemed to me a fresh way to give intuitive meaning to what otherwise seems a bewilderingly abstract procedure. I also thought he was wise to emphasize the positive and omnipresent role of "mistakes" and "missed opportunities" throughout his story. Despite a tacitly prevailing view (among physicists as well as the general public) that only "success" is important, the investigation of the full, twisted history shows how significant are all the moments of apparent confusion or even error not only in the process of finding the "right answer" (as if that were a simple, unequivocal matter) but in laying bare the larger issues at stake.

In the end, the reader, though richly instructed and entertained, may remain somewhat puzzled about the denouement of the book's central question, the issue of infinities. Having emphasized the problem of the divergent results throughout quantum electrodynamics, Close unfolds the story of renormalization with admirable clarity. What remains unclear is whether the developments he describes with such verve have or have not really solved the problem, or where it stands at the end of the story. Readers might wonder whether the triumphant renormalizability of the gauge theories only isolates finite, observable residues from infinitely divergent calculations or whether some theories could obtain finite results. Has the time come to set aside Dirac's profound distaste for the divergent results of field theory? Does nature abhor infinity, or embrace it?

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Tibor Frank, *Double Exile: Migrations of Jewish-Hungarian Professionals Through Germany to the United States, 1919–1945* [Exile Studies: An Interdisciplinary Series, Vol. 7]. Oxford, Bern, Berlin, Bruxelles, Frankfurt am Main, New York, Wien: Peter Lang, 2009, 501 pages. $85.95 (paper).

Since the beginning of the crisis in the financial markets in 2007–2008 in the United States, which now has become a sovereign-debt crisis of the eurozone, no prominent player on the global financial markets has been interviewed more often by the press and on television than George Soros (b. 1930 and until 1936 György Schwartz), who certainly is the best known émigré Hungarian today. A survivor of the Holocaust, Soros left Hungary in 1947 for England to study at the London School of Economics and Political Science (LSE) where one of his most influential teachers was the philosopher and émigré Austrian, Karl Popper (1902–1994), who had emigrated to New Zealand in 1937, and had accepted a position at the LSE in 1946. Soros left England for the United States in 1956 and became a business magnate, investor, and philanthropist. Soros and Popper are outstanding examples of highly successful émigré professionals from Central Europe, Austria, and Hungary. Soros and his emigration from Hungary after 1945, and in particular after the Hungarian revolution of 1956, are not included in this study of Jewish-Hungarian emigrants, since it is restricted to the period 1919 to 1945, one of multiple traumata for Hungary and its multiethnic population.

The migration of peoples, tribes, or diverse ethnicities over millennia has been characterized predominantly by geography, and thus migration from East to West, as told by Jared Diamond. The *Magyars* are a valid example of one of the many waves of migrating populations or tribes from central and eastern Asian territories to what we now call Central Europe. Modern waves of migration from Europe to the West, to the United States, have been caused by political, religious, social, and ethnic conflicts within the European nation states. On the Jewish side, anti-Semitism, pogroms, and poverty have been the driving forces for many to leave Russia, Poland, and Austria for good, and to start a new life in America, "God's own country," since the middle of the 19th century. Frank's book deals with Hungary, its history, and the migration of Jewish-Hungarian professionals during the early 20th century.

Originating from the area between the Volga River and the Ural mountains, the *Magyars*, united by Grand Prince Árpád at the end of the 9th century, settled in the Carpathian basin, became integrated into Christianity, and around the year 1000 established the Kingdom of Hungary under King Saint Stephan I. At the battle of Mohács in 1526, the Ottoman army gained a decisive victory over the Hungarian forces, and Hungary was subsequently ruled by the Ottomans until 1718. Owing to the wars against the Ottomans, the ethnic composition of Hungary's population was drastically changed; the new Habsburg rulers settled Serbs and other Slavs in depopulated areas, and Germans ("Swabians") in various parts of the country among the diminished ethnic Hungarians, the *Magyars*. The Carpathian basin is a model for a region with a multiethnic population.

To understand Hungary and the Hungarians without specifying its and their ethnicity is impossible. One must become acquainted with Hungary's history after the middle of the 19th century to understand the complex political and social preconditions and conditions of migration from Hungary after 1918. Genius, survival, and trauma are keywords of the introductory chapters of Tibor Frank's book, which paint the historical background to the phenomenon of migration in the interwar period. Hungary and its multiethnic population cannot be understood without a minimum of understanding of and sympathy for the complex and partly disastrous history of the country.

The failed revolution in 1848 to free the country from Habsburg's dominance and suppression was followed by the Austro-Hungarian Compromise (*Ausgleich*) of 1867, which gave rise to a period of strong economic and industrial development that came to a close in 1918 with Hungary on the side of the losers of the Great War. On February 16, 1918, a short-lived democratic republic

was founded but was quickly taken over on March 21 by a Bolshevik experiment, the "Republic of Councils" under Béla Kun, which ended after 133 days on October 1 and gave rise to a counterrevolution, the "White Terror." The new régime installed itself under Admiral Miklós Horty, who was elected Regent and Head of State by the National Assembly on March 1, 1920. Hungary was forced to sign the Peace Treaty of Trianon at Versailles on June 4, 1920, which in Frank's words, "became synonymous with defeat, disgrace, and despair—and the single most important event in modern Hungarian history." Hungary lost 63% of its former territory to Czechoslovakia, Romania, Yugoslavia, and Austria, and about 2.5 million of its pre-Trianon inhabitants. Frank pays special attention to the not widely known fact that the Horty regime produced the first anti-Semitic legislation in Europe, the quota system of 1920, which limited the percentage of students of Jewish origin in higher education to that of the overall population of Hungarian Jews (about 5%). In 1895 the Mosaic religion had gained equal rights with Catholics and Protestants in Hungary. Times changed radically after 1918, and became worse after 1920.

Within the borders of the Kingdom of Hungary, the census of 1910, as ranked by first language (mother tongue), identifies a distribution of 54.5% Hungarian, 16.1% Romanian, 10.7% Slovak, 10.4% German, 2.5% Serbian, 2.5% Ruthenian, and 1.1% Croatian; by religion, 5.5% were of Mosaic denomination. (The percentage of first language in the case of Hungarian should not be identified with *Magyars*, ethnic Hungarians, because an imposed but voluntary *Magyarization* of non-*Magyar* ethnic groups—Jews prominently among them—distorts the high figure of 54.5%.) Archeological evidence documents a Jewish presence in the future Hungary already in Roman times, when the country was part of the province of Pannonia; the first written documents date from the second half of the 11th century. In 1910 about 910,000 Jews lived within the pre-Trianon borders of Hungary (the total population then was 18,264,533); after Trianon (1920) this figure decreased to 470,000 because of the territorial losses to Romania, Slovakia, and Serbia (the total population of post-Trianon Hungary then was 7.89 million).

Figures are necessary signposts but are of limited explanatory power, especially when tackling a historical compound like Hungary in the period between the political "Compromise" of 1867 and the end of the Great War. The social, economic, and political changes in Hungary in that period were great compared to other European nations (with the possible exception of Austria). History is not causally determined by any mechanism but is a deeply contingent reality, and the writing of history is a sort of *ex post* prophesy, identifying causes and effects, impulses and influences, to reconstruct patterns and structures to give meaning to historical facts.

An extensive production of books, beginning with Laura Fermi's *Illustrious Immigrants: The Intellectual Migration from Europe 1930–41* published in 1968, and numerous articles dealing with the intellectual migration from Europe cover many of the aspects and people under consideration in Frank's analysis and in his exemplary portraits of émigré Hungarians. Frank's attention does not differ from earlier studies in focusing on the most talented, successful, and widely known scientists, writers, musicians, sociologists, film makers, actors, and the like—in short, the Hungarian geniuses, as Hungarians prefer to denote this exceptional cohort of partly voluntary but mostly forced emigrants of outstanding intellectual and artistic abilities.

Tibor Frank, Professor of History in the Department of American Studies and Director of the School of English and American Studies at the Eötvös Loránd University in Budapest, has written a 500-page monograph on the migration of Jewish-Hungarian professionals. The book paints a social history of Hungary after World War I to the end of World War II; his declared aim is to present a prosopographic study of the large cohort of Hungarians who left Hungary for different European countries, mainly Germany, and later settled in the United States. Besides presenting a collective biography of this cohort of émigré Hungarians, Frank's presentation has a central theme that has not been covered explicitly and extensively in comparable studies: With few exceptions, these emigrants were Jews by religion, or converts of Jewish origin, mostly highly assimilated members of the Budapest middle and upper middle classes. Frank summarizes the goals of his book: "This book offers possible social, political, psychological, educational, and economic

explanations for some of the special distinguishing features of the Hungarian, in fact often Jewish-Hungarian, mind, in and out of Hungary."

Frank's book is especially enlightening and useful for the reader not familiar with the subtleties of Hungary's historical changes from the late 19th century onward, in that it carefully analyzes the historical and social roots of the country's development to foster a better understanding of the "Hungarian genius phenomenon." The *Ausgleich* of 1867 secured the political supremacy of the *Magyars* within the Transleithanian part of the Austro-Hungarian Monarchy and "created unparalleled economic opportunities for Hungary, opening up a 'golden age' of rapid economic and social advance…." In 1873, the separate municipalities of Buda, Obuda, and Pest were unified, and Budapest became a modern and dynamic metropolis, competing with Vienna and looking outward to Western Europe and in particular to Germany. At the time of the 1896 Millennium Exhibition, celebrating the arrival of the *Magyars* to the Carpathian basin, the first subway on the European continent was opened in Budapest, then a city of 730,000 inhabitants.

This rapid development was in need of a social group willing to accept *Magyarization* and eager to climb the ladder of upward social mobility. This group, predominantly living in Budapest, came "partly from the decaying landed gentry of feudal origin and partly from aspiring members of the assimilating (predominantly German and Jewish) middle class." As a result of the transformation of the Habsburg Monarchy and the beginnings of a (late) new, capitalistic formation of a former predominantly agrarian society, a young Hungarian intellectual élite emerged in science, technology, and the arts. The slowly declining feudal system of the late Habsburg Empire gave rise to singular creativity in *fin-de-siècle* Vienna and Budapest. The representatives of this social group came from a professionally defined middle class of predominantly Jewish origin. A largely premodern landowning nobility was not qualified to step in as the driving force of the rapid modernization of Hungary in the late 19th century, and thus provided an opportunity for Hungary's Jewish population to take the initiative and to be integrated into Hungarian society as patriots, with conversion and intermarriage as accepted forms of assimilation. It was the second and third generations of these early and already highly successful professionals who became visible and were praised as Hungarian geniuses, among whom were John von Neumann's father Max, a lawyer and banker, ennobled in 1913, whose ancestors came from Russia, and the Nobel Prize winning chemist George de Hevesy's father, Lajos Bischitz de Heves, industrialist and developer of the Hungarian mining and metallurgy industry, landowner and hunting partner of Emperor Francis Joseph I.

Already in the 1870s the school system in Hungary, partly modeled on the German *Gymnasium*, was developed into an educational system of exceptionally high standards and selectivity, which provided the opportunity to further integrate children of Jewish origin into the middle and upper middle classes, the new urban Hungarian élite. Frank devotes an entire chapter to schooling and its decisive influence especially on students gifted in mathematics and the natural sciences. John von Neumann, Eugene P. Wigner, Edward Teller, and Theodor von Kármán, to name a few, attended these hotbeds for educating an élite, which often were secondary schools of various Christian denominations for the socially selected happy few, but without any discrimination against Jews. The high percentage of Jewish students around 1930—35% at the *gimnázium*, the type of secondary school requiring Latin and Greek—was by 1941–1942 drastically reduced to 17% owing to emigration, conversion, and anti-Semitic legislation.

It is little surprise that the urban professional middle class mirrored the upward mobility of the first and second generations of assimilated Jews. Hungarian Jews were disproportionately represented in the "free" professions. To give a few numbers: 60% of the merchants, 49% of doctors, 45% of businessmen and lawyers, 42% of journalists were of Jewish origin, but virtually no Jews were present within the public administration. (This was not a Hungarian or Budapest peculiarity; similar figures are found for Vienna.)

"Hungarian Jew"—what does this adjectival-substantival combination signify? What do we know about the religious affiliations of the émigré professionals? What role did assimilation play

for the self-confidence of this group? And note that not all émigré Hungarians were Jewish. Frank suspects that Jews arriving in America were more Hungarian than Jewish, adding that further research is needed in regard to their religious affiliations. Is Frank's book about illustrious immigrants, famous Hungarians, or gifted Jews? I suspect that the answer is different when this question is posed in Hungary or in America. It depends on the predominant attitude toward identity. For the anti-Semitic and rightist Hungarians the Hungarian geniuses of Jewish origin present a dilemma, because race and not religion is for them the criterion for counting as Hungarian; they therefore exclude Hungarian Jews as not being proper Hungarians. This is not just an academic observation on the past based on the legal prescriptions of the Nuremberg Racial Laws of 1935; we observe today a growing number of supporters of Hungary's extreme right wing and anti-Semitic and anti-Roma Jobbik Party, which currently occupies 12% of the seats in the Hungarian Parliament.

Further research, Frank notes, is needed to assess the number of Hungarian–American refugees. He has compiled in an appendix a list of some 250 eminent Hungarian professionals who emigrated to the United States between 1919 and 1945. What is so impressive—although the list is certainly far from complete—is the wide variety of outstanding personalities in the various professions, among whom are a surprisingly large number of women.

Béla Kun's "Republic of Soviets" came to an end after 133 days when the counterrevolutionary group headed by Miklós Horthy gained power. Men of Jewish origin played an important role within Kun's Soviet-type regime, which resulted in open anti-Semitic attacks at the universities and elsewhere. After the end of the lost war and beginning in 1919, Hungarian Jews opposed to leftist radicalism as well as to the illiberal and anti-Semitic Horthy regime left the country for Germany, which in the early 1920s was a flourishing scientific hotbed in the natural sciences, with Berlin as its vibrant center. Leo Szilard, Eugene Wigner, Edward Teller, and John von Neumann left for Germany in their early twenties, most as students. For all of them and for many more, Germany became an interstate, a whistle stop in their flight from Hitler and Germany after 1933. This was, Frank rightly observes, a double expulsion and a double trauma. He devotes a special chapter to the generally not-so-well-known fact that immigration laws and a restrictive quota system played crucial roles for immigration to the United States. The selection principle was clear-cut: "the perfectly legitimate needs of American interests"—to put U.S. immigration policy in a nutshell. Frank writes: "Despite the numerous difficulties associated with immigrating into the U.S. and recording exact figures, by the end of 1941, an estimated group of up to 12—15,000 Hungarian interwar immigrants could have claimed the U.S. as their home." This was the selective group out of which emerged the celebrated geniuses. In March 1944 Hungary was occupied by German troops and, by the end of the war the Hungarian Holocaust took 565,000 victims; 280,000 Jews survived the Hungarian and German atrocities, mainly in Budapest.

As an extension to his structural and collective analysis of the double-step migration of Hungarian professionals between 1919 and 1945, Frank paints portraits of four luminaries within the context of the U.S. war effort. Besides Leo Szilard and John von Neumann, who have been well covered by many other authors, the chapter on the mathematician George Pólya and the one on the engineer, physicist, and aerospace scientist Theodor von Kármán provide valuable information otherwise available only in diverse publications.

One of the insights the reader gains from Frank's scholarly book is that the Hungarian Jewry contributed twice to a step forward in modernizing a country, first in their native Hungary and finally in the United States. The war effort opened doors to contribute in science, technology, and the arts. The outstanding contributions of Hungarian scientists to the development of the atomic and hydrogen bombs (Szilard, Teller) and to the first electronic computers (von Neumann) are the best-known examples. (The decisive insights of the British mathematician Alan Turing, laid down in his 1945 paper, "Proposed Electronic Calculator," which was certainly known to von Neumann, could at least have been mentioned in connection with von Neumann's achievements for

information science and technology, the "von Neumann architecture" of computing devices, but this is another, partly controversial story. Genius is not an exclusively Hungarian phenomenon.)

Michael Curtiz (born Manó Kaminer, *Magyarized* to Mihály Kertész), after having worked in Sweden, Hungary, Austria, Germany, and France, came to the United States in 1926 and became one of the most important directors of Warner Brothers; he directed *Casablanca* (1942) as part of the war effort and made Ingrid Bergmann a movie star. At the Warner film studio in Hollywood in those days one probably could see a sign: "It is not enough to be a Hungarian; one must also have talent." Hungarians do not lack irony.

Frank's book is based on a wide variety of archival sources and library collections, mainly in the United States, and supplemented by archival sources in Hungary, Germany, and Austria. A comprehensive bibliography of primary and secondary literature makes his book a rich source for the specialist and the student of Hungarian and transatlantic studies. Its broad scope, from science to the arts, make it instructive reading for people not familiar with this intricate piece of history. Nowadays, it is not always a matter of course for a book to provide an index—which this book thankfully has—and it is virtually free of typos.

Tibor Frank's *Double Exile* will probably prove to be a standard in the field of exile studies.

A book review is not the right place to express political opinions. I thus hesitate to express my strong disgust of the current Hungarian government, euphemistically labeled national conservative by polite journalists, ruling with a two-thirds' majority in Parliament and not shying away from authoritarian, partly undemocratic political measures. As of February 1, 2012, the far right actor György Dörner took up the position as director of the prominent Budapest theatre Uj Szinház (New Theater) while the nomination of the notorious anti-Semitic writer and politician István Csurka, leader of the right extremist party MIEP, by the Budapest Lord Mayor István Tarlós, a fellow traveller of the Fidesz Party, as the theatre manager had to be withdrawn after strong public pressure before he died on February 4, 2012. Hungary, a member state of the European Union but not of the eurozone, currently (February 2012) is on the verge of state bankruptcy. Younger people talk about emigration. Ill fares the land.

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Dieter Hoffman and Mark Walker, ed., *The German Physical Society in the Third Reich: Physicists Between Autonomy and Accommodation*. Translated by Ann M. Hentschel. Cambridge: Cambridge University Press, 2012, xxiii + 458 pages. $90.00 (cloth).

The behavior of scientists, particularly physicists, during and immediately after the Nazi period in Germany is a subject of immense interest, one that historians of science never tire of exploring. There is a vast literature on the subject,* including books already written and edited by the highly qualified editors of this volume. Here is yet another effort to explore the external events of that unfortunate period, as well as an effort to get into the heads of all those scientists who either by

* Of the innumerable sources, two are indispensable: Alan D. Beyerchen, *Scientists under Hitler: Politics and the Physics Community in the Third Reich* (New Haven and London: Yale University Press, 1977), and for a treasure trove of primary sources (in English), Klaus Hentschel, ed., *Physics and National Socialism: An Anthology of Primary Sources.* Ann M. Hertschel, Editorial Assistant and Translator (Basel, Boston, Berlin: Birhäuser Verlag, 1996). See also Mark Walker, *Nazi Science: Myth, Truth, and the German Atomic Bomb* (New York and London: Plenum Press, 1995).

choice or lack of choice lived through it. But this is not another monograph. Rather, it is a collection of essays written mostly by historians of science, mostly Germans of a younger generation, one that possesses the luxury of being able to scrutinize objectively the generation that spanned the Hitler period.

There are eleven articles, by ten historians. Each addresses a particular aspect of the activities of physicists and their physics during and after the Third Reich, concentrating mainly on the activities of the *Deutsche Physikalische Gessellschaft* (DPG), the German Physical Society. The topics include, for example, "The German Physical Society under National Socialism in Context" (Walker), "Marginalization and Expulsion of Physicists under National Socialism: What was the German Physical Society's role?" (Stefan L. Wolff), "The German Physical Society and 'Aryan Physics'" (Michael Eckert), "The Ramsauer Era and Self-Mobilization of the German Physical Society" (Hoffmann), as well as several articles on the postwar period, and two articles on similar societies of German mathematicians and chemists.

The DPG had a long, distinguished history before Hitler. Germany, after all, was the dominant country of those involved in the enormously productive European physics community for a good part of the century before Hitler. The editors were particularly interested in certain aspects of this broad subject as clearly identified in the qualification to the title that refers to "autonomy and accommodation." This book does not attempt to cover all aspects of physics and the DPG during the Hitler era but rather it pretty much sticks to the question: how the physics community, as personified by DPG and its leadership, dealt with the constraints imposed on it by the Nazis. To what extent did it maintain its independence and integrity, and to what extent did it adjust itself—that is, "accommodate"—to Nazi control?

First, a short description of the DPG. As it is constituted today (not really different than its traditional role), it is strikingly similar to the American Physical Society (APS). It acts in the service of the German physics community. It runs conferences and workshops, concerns itself with physics and society functions, and in general performs the full gamut of activities required by the physics profession. It has a huge membership—significantly more than APS, with a large international representation. The chief difference between the two societies lies in their publication activities. APS publishes a wide array of top-notch physics journals. It has a multimillion dollar budget for publication, and employs and houses a vast editorial staff. DPG does not publish most of its own journals. Its present form, after predecessors dating back to 1845 (about 50 years older than APS), dates from 1919. Its presidents, like those of APS, reign for only one or two years, with a paid staff actually running the organization.

The book concentrates on the Hitler period, 1933 to 1945, with additional sections on the immediate postwar aftermath. If I may telegraph the general conclusions of the book, pretty much shared by all the authors, physicists by and large and DPG in particular did the best they could to stay independent of the politics swirling around them. But this group of authors were not as tolerant of "accommodation" as were the physicists of that era. While sympathetic to their plight, the virtually unanimously judgment was shall we say not totally benign.

This book is an elaboration of an article with the same title published by Dieter Hoffmann in this very journal in 2005,* although it covers much more ground and of course presents views of a large group of historians. But, as already noted, there is general agreement among the authors: DPG tried to act "autonomously" of Nazi doctrine, but was forced in one degree or another to accommodate. The question that concerns us as much today as it did three quarters of a century ago is, Should we weigh their behavior in the balance and find it wanting? While fortunately the issues and situations confronting us today are hardly as desperate as they were in the 1930s and

* Dieter Hoffmann, "Between Autonomy and Accommodation: The German Physical Society during the Third Reich," *Physics in Perspective* **7** (2005), 293–329.

1940s, science and politics are still having a good deal of trouble in remaining independent of each other, not to mention the problem of accommodation.

I list here the time line of the DFG Presidents from 1931–1945: Max von Laue 1931–1933; Karl Mey 1933–1935; Jonathon Zenneck 1935–1937; Peter Debye 1937–1939; Carl Ramsauer 1940–1945, with Wolfgang Finkelnburg as deputy; for nine years thereafter the DPG was split into regional groups defined by the occupational powers. Without exception these individuals were firmly on the side of autonomy, that is, they did their best to insulate the physics community from the always strong effort to Nazify physics. Nazifying physics meant trying to abide by the "Fuhrer principle," that is, a strong leader at the top (a Nazi, of course) following what passes for Nazi philosophy. This included unrelenting Anti-Semitism and a strong belief in experimental physics, coupled with distain for pure theory, as exemplified by opposition to relativity (Einstein!) and quantum mechanics.

The authors take on various aspects of the conflict, as can be seen by the chapter titles noted above. Even so there is a duplication of material, inevitable because of the closely related issues confronting the DPG. Occasionally one comes across the same primary quotations in different chapters. But the duplications add to the consensus—there is little disagreement I could discern in the various approaches taken—an indication, I believe, of the remarkable objectivity and fine scholarship of this generation of historians of that period.

The tone of the DPG was set early in the Nazi period by its leadership. In a famous address in 1933, Max van Laue very subtly referred to the conflict between Church and science in the seventeenth century (Galileo), fooling nobody, but without burning bridges. Von Laue, an anti-Nazi throughout, survived the entire Hitler period essentially unscathed. The various presidents and others consistently resisted Nazification. Many worked diligently to help allay the suffering of their non-Aryan colleagues. The integrity of the physics supported by DPG was rarely if ever compromised. They were not shy in complaining that politicization and deportations were harming the war effort. But herein lies the fatal flaw that prevents the authors from expressing unqualified admiration for their behavior. As the leaders of DPG never tired of pointing out, if the Nazis were less blinded by their hatreds, they might actually have had a better chance of winning the war! And where would the world be then? After everything that has been written on the subject, my own conclusion is that there should have been only one right course of action, which only a few German scientists took, including Schrödinger and Pauli: get the hell out of there!

I am fully aware of how easy it is to judge their behavior from the distance in time and culture that separate us. And I am hardly the first to judge from a distance. Here is what Sam Goudsmit said, in a review of the excellent Beyerchen book: "I can not make out who are the good and who the bad guys. I doubt that it matters, I think all were bad…. The question is often asked why the German scientists did not protest more openly and vigorously against the persecution of their colleagues…. I have tried to find an answer by imagining myself in their circumstances. If I had been living in Europe I would not have known how to react and my actions would have appeared cowardly, especially in retrospect."* You can see in this short quotation how ambivalently even the wisest of us judge the actions of those who were in the most part not only wonderful physicists but decent people as well.

Thus the fundamental question: suppose we found ourselves living in Hitler's Germany (and being not Jewish). How would we behave? To be sure, not many of us are particularly interested in becoming dead martyrs, which is what would surely transpire should one overtly confront Nazism during its heyday. But—and this is a big but—how hard did people try to leave Germany? We find that apart from the Jews—who *had* to leave–precious few physicists chose to. Instead, even the most moral of the physicists chose to "ride it out," for a variety of reasons. For senior physicists

* Samuel Goudsmit, [review of *Scientists under Hitler*], *Bulletin of the Atomic Scientists* **34** (September 1978), 47–49, on 47–48.

such a painful dislocation would seriously disrupt their lives, both professionally and personally. The conventional belief was that after the first wild days things would calm down. Or, after the Hitler regime ended they would be ready to reconstruct physics to its former glory.

Shortly after Hitler took power, in 1933, there was a concerted effort by Nazi physicists, led by Philipp Lenard and Johannes Stark, to capture the DPG leadership, but this effort was easily squelched. Thereafter throughout the war DPG remained essentially independent, although of course there was hardly any effort to actually oppose the regime. It should be borne in mind that aryanizing German physics was hardly a trivial undertaking. Probably 25% of physicists were not Aryan, to one degree or another, as defined by the Nuremburg laws, and of course some of them were of the very highest quality.

During the war years, 1940–1944, Carl Ramsauer was president, and Wolfgang Finkelnberg was deputy. There was an informal journal published by DPG—*Physikalische Blätter* edited by Ernst Brüche, which was started toward the end of the war and continued until 1972, and which could very loosely be compared with *Physics Today*. It was used partly as a vehicle for the postwar whitewashing efforts of German physicists. I was intrigued by the several discussions in the book about Ramsauer, Finkelnberg, and Brüche, for a personal reason: I was very much involved, at different times, with all of these gentlemen. Decades ago I had spent a sabbatical leave at JILA, in Boulder, with much of the time working on a critical review project with a JILA physicist, L.J. Kieffer, examining the state of electron-atom cross section measurements. At the time this was an experimental field that contained a lot of data, but much of it inaccurate and even erroneous.

I quickly learned of the work of Ramsauer and Brüche. First Ramsauer, and then Brüche, had performed what turned out to be the most reliable of total cross section measurements in a wide variety of atomic and molecular gases. The Ramsauer–Townsend effect, an anomalous variation of cross section with energy that could not be explained on the basis of classical collisions, was one of the experimental consequences of quantum mechanics, and an early confirmation of it. I greatly admired the work of Ramsauer and Brüche, and was able to give them high marks for the quality of their measurements in that critical review. In 1948 one of the first postwar conferences on atomic physics was held at Brookhaven National Laboratory (the forerunner of the International Conference on Photonics, Electronic and Atomic Collisions). I gave a paper there (my first one). A German physicist appeared—Wolfgang Finkelnberg. He was among the first German physicists to get to America after the war. I have to say—he didn't give a good impression. Very Prussian, I suspected that he was an ex-Nazi. But I was wrong. As Ramsauer's assistant at DPG he also played a role in protecting the physics community against "Aryanization." I thus had a very soft spot in my heart for all three. And yet, as stalwart as were these defenders of physics, here is an excerpt from a letter written by Ramsauer in 1942 to Bernhard Rust, Reich Minister for Science, Education, and Culture: "The legitimate struggle against the Jew Einstein and against the excrescences of his speculative physics has spread to the whole of modern theoretical physics and has brought it largely into disrepute as a product of the Jewish spirit," separately quoted by both Hoffmann and Eckert. Reading this quotation 70 years after it was written was still capable of shocking me!

The uniform conclusion of all the authors is that after the war, DPG and its members essentially closed ranks. Even the "good guys" that Goudsmit refers to were very protective of their more compromised colleagues, and often went out of their way to write supportive letters. Even Lise Meitner did so.

The exemplar of the righteous physicist was Max von Laue. Although rebuked several times, he managed to stay out of real trouble throughout the war. But even he adapted a lenient position concerning some of his more shall we say pliable colleagues.

An interesting case in point is one discussed in detail by Gerhard Rammer, in the last Chapter, "Cleanliness among Our Circle of Colleagues: The German Physical Society's Policy toward Its Past." He writes about a doctoral physics student immediately after the war, Ursula Martius. She gave a talk at a postwar physics meeting, published in a German journal for all to read.

Abstracting from a long quote contained in Rammer's article, she states: "People who still appear to me in nightmares were sitting there alive and unchanged in the front rows. Unchanged, if you don't consider the simple blue suit, instead of the uniform of the missing party badge…," and much more, written in an angry tone. Rammer states: "this article was absolutely exceptional. Not a single comparable case is known to me of a physicist making such a public appeal." Shortly thereafter (she did complete her degree) she emigrated to Canada, where she developed a very distinguished career as a physicist–archaeologist (under her married name Ursula M. Franklin—see her impressive entry in Wikipedia). She was, in my opinion, the quintessential embodiment of the child who claimed that the Emperor has no clothes.

To summarize, while I did have similar difficulties on occasion in keeping the various individuals and organizations apart, as did Goudsmit, I was impressed by the vast amount of information contained in this volume. I was equally impressed by the fact that this collection by skilled historians evaluated that miserable period of history both objectively and accurately. As they point out more than once, physicists are human beings as well as scientists, and possess the same qualities—good and bad—as everyone else. Hoffmann and Walker deserve our thanks and congratulations.

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David C. Cassidy, *A Short History of Physics in the American Century*. Cambridge, Mass.: Harvard University Press, 2011, 220 pages. $29.95 (cloth).

Over the last half-dozen years I have had the pleasure of writing very favorable reviews for another journal of two earlier books by David Cassidy, *J. Robert Oppenheimer and the American Century* (2005) and *Beyond Uncertainty: Heisenberg, Quantum Physics, and the Bomb* (2009). I am also proud to have my web exhibit on the life and work of Marie Curie hosted by the same American Institute of Physics site (aip.org/history) as Cassidy's exhibit on Heisenberg. As a long-time fan, then, of Cassidy, I had been looking forward to reading this much shorter book ever since it came to my attention, particularly since the two blurbs on the cover are written by John Heilbron and Spencer Weart, colleague-friends of mine whom I greatly admire. While I do recommend *A Short History of Physics* to readers of *Physics in Perspective*, I think Cassidy could have made his short narrative even better had he made more use in it of his skills as a biographer. My guess is that the project was initiated when he decided or was asked to give a course on the subject at Hofstra University, where he is Professor of Natural Sciences, and wanted a brief summary to assign to his students. What I miss in this book is the passionate involvement of the author, so evident in both biographies, and I suspect that Cassidy was not as wrapped up, heart and soul, in *A Short History* as he clearly was in the biographical projects.

Not surprisingly, especially since he uses the term "the American Century" both in this book's title and in the title of his biography of Oppenheimer, Cassidy uses Oppenheimer's story to flesh out some of the themes he develops in *A Short History*, namely, the need for early 20th-century American physicists to be trained abroad, the hesitancy of the community of physicists and engineers to open itself up to women and minorities, the involvement of the U.S. military in shaping the nature of the research undertaken by physicists, and the figure of the American science manager-administrator in the development of 20th-century physics. Oppenheimer, a wealthy and assimilated New Yorker of German-Jewish descent and a Harvard graduate, was exposed to the exciting developments in the new and rapidly developing field of theoretical quantum physics by studying in several of the European centers where cutting-edge work was being done while theoretical work in the U.S. lagged behind. When, however, Harvard professor

Percy W. Bridgman wrote to Ernest Rutherford at the Cavendish Laboratory at the University of Cambridge, supporting Oppenheimer's application to do graduate work in physics there, he felt obliged to add, "As appears from his name, Oppenheimer is a Jew, but entirely without the usual qualifications of his race." Ultimately, of course, Oppenheimer made his name as the scientific director of the Manhattan Project, based in Los Alamos, New Mexico, where he was tasked with overseeing the design and assembly of the atomic bomb from components that were produced at the other locations of the Manhattan Engineer District, under the purview of Brigadier General Leslie R. Groves. Oppenheimer thus became one of what Cassidy describes as a series of "powerful scientist-administrators" who transformed physics research in the United States.

Other such scientific managers profiled in *A Short History* include George Ellery Hale, whom he calls the "premier managerial scientist-politician" of the World War I years, who spearheaded the effort "to promote and integrate science, especially physical research, into the power structure of American society," and Vannevar Bush, the science administrator who played the lead role in the U.S. involvement in World War II, whose aim was to "create a new model for the relationship of science, especially physics, with the military and political power centers of American society." While Bush appears not to have been conflicted about the role he played in transforming the American physicist from a "disinterested researcher of physical processes standing above practical research" to "little more than a technician of nature fulfilling a contract," the same cannot be said of Oppenheimer. After the use of the atomic bomb on Japan, many physicists, Oppenheimer among them, "felt they should have a voice in the direction of future development and use of such a weapon." To their dismay "most federal officials looked upon physics as primarily an instrument of national security," and felt that the physics community should not be "on top" but rather "on tap"—that is, they should be prepared to offer the nation their technical expertise without feeling they were owed "a responsible role in policy decisions." Oppenheimer's objection to the development of the hydrogen bomb led to his public disgrace in hearings held by the Atomic Energy Commission, which stripped him of his security clearance and of his governmental advisory status. As Cassidy notes, "The message was that…physicists…were to stick to technical details and avoid expressing any troubling concerns or contributing any broader policy statements regarding their work and its uses unless their views supported those of their superiors."

With Oppenheimer now out of the picture, Cassidy broadens the theme of the scientist-administrator to include the new position of presidential science advisor, which was innovated by President Eisenhower. He notes that U.S. military involvement once again got in the way of smooth interactions between the physics community and the government, from which so much of its funding came. When U.S. involvement in the Vietnam War accelerated under President Johnson, his science advisors spoke out against the war in public, leading the president simply to ignore them. As Cassidy notes, "It was the beginning of the end of the 'golden age' in science advising." President Nixon "effectively extinguished scientific advice in the White House," and beginning with President Carter, science advisors understood that their allegiance was to their president, not to the community of scientists.

As I mentioned above, one of the themes that Cassidy develops through *A Short History* is the discrimination experienced by women physicists. He makes frequent reference in this regard to Margaret Rossiter's superb volumes on *Women Scientists in America*. I wish, however, that he had included some profiles of specific women to enliven his coverage of this topic just as his focus on Oppenheimer's career particularizes many of the book's other general themes. Although the index to the book includes no reference to Curie, Cassidy refers more than once to Rossiter's discussion of the "Curie strategy," which led some highly gifted women scientists to get double degrees to compensate for their gender, just as Curie had been the recipient of Nobel Prizes in both physics and chemistry. Cassidy fails to note, however, what I consider a more significant aspect of the Curie strategy as described by Rossiter. Despite the hope of American women scientists that Curie's visit to the United States in 1921 to raise money for her Radium Institute would improve the professional prospects of her American colleagues, the visit may actually have worsened

scientific opportunities for aspiring American women scientists by providing a new rationale for discrimination. American universities now justified their failure to hire women scientists on the grounds that they failed to live up to the high standard set by the double Nobel Laureate.

When describing anti-Semitism within the American physics community in the 20th century, Cassidy does well to include the specific example of Oppenheimer. He notes that in July 1945, shortly before the atomic bombs were dropped on Japan, thus hastening the end of World War II, Robert A. Millikan, president of Caltech, wrote a colleague about his reluctance to bring Oppenheimer back to Caltech even after his success at the head of the Manhattan Project. Millikan did not want too many Jews on the faculty of his institution, which already included a "large percentage of [Oppenheimer's] fellow racists [*sic*]." I think Cassidy's discussion of sexual discrimination within the community would have likewise been more pointed had he included an example of a specific woman or women who experienced such discrimination. Millikan himself provides such an example of gender discrimination, in an episode detailed by Rossiter. In 1936, the president of Duke University appointed a female German refugee, Hertha Sponer—considered the third best woman physicist of the day, after Curie (who had died in 1934) and Lise Meitner—to a full professorship. Millikan sent him a letter arguing, as Rossiter summarizes, that though Curie and Meitner "had made worthwhile contributions to physics, …they showed how *unlikely* it was that any other women physicists would ever attain their high, but now the minimum acceptable level," and that "no good job should ever be wasted on a woman." While "Any male physicist of whatever ability would add to [the prestige of a physics department], …a woman of even great ability and proven accomplishments…would lower it."

In addition to feeling that more biographical insights would have concretized some of Cassidy's general arguments, and while I think that the themes Cassidy chooses to develop in his *Short History* are interesting and well presented, I find at least one additional theme I wish he had developed, namely, the history of antiscience in America. In the opening chapter he tells us that "all of the Founding Fathers held science in high esteem" because their world outlooks were rooted in the European Enlightenment." In at least two instances he notes how the American public "blamed physics" for helping to create a national crisis. At the time of the Great Depression, "the public believed that progress in physics had led to the overproduction of technical goods and to the invention of too many labor-saving technologies that had put people out of work," and during the Vietnam War many people, including science students and young scientists, demanded that research have clear potential for solving social problems and not be purely "in service to military and commercial interests." What he doesn't discuss, however, are the antecedents to the antiscientific stance championed by some 21st-century politicians and their constituents, and their rejection of "inconvenient truths" (to generalize Al Gore's term), including but not limited to global climate change, whether on religious grounds or because of the profit motives of big donors. Just as the stance of those who favor "creation science" over evolution has roots in the previous century, and just as belief in alien abduction and the conviction that the moon landings were a NASA charade are nothing new, I am sure that the dismissive attitudes toward atmospheric physics held by many Americans today are rooted in the country's past, and I would have been interested to read about those roots.

I have two final comments about this book, both relating to points Cassidy makes in its eighth and final chapter. Cassidy does a fine job of explaining the factors leading to the cancellation of the Superconducting Super Collider (SSC) in 1993 and of describing the scramble for jobs among newly minted Ph.D.'s in its wake. While he mentions that finance was among the fields to which young physicists now turned, he might have mentioned that these brilliant, mathematically trained individuals may have inadvertently contributed to the Great Recession of 2008, whose aftereffects still plague the nation and the world. Someone, after all, was responsible for designing the derivatives underlying the financial instruments that caused or at least aggravated the housing debacle that triggered the economic collapse. Cassidy also talks about the globalization of physics that is partly attributable to the cancellation of the SSC, since so many American physicists

gravitated instead to the Large Hadron Collider in Europe. Nonetheless, I am not sure that I agree with the gist of the final sentence of the book, where he argues that "it is doubtful that, a century from now, a similar history focused on physics in a single nation will be possible." If China or India or both fulfill their aspirations for succeeding the United States as the major player in space exploration, historians of science may well talk about the 21st as the Chinese, the Indian, or the Asian Century.

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