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Physics in Perspective

Book Reviews

Klaus Hentschel, *The Mental Aftermath: The Mentality of German Physicists, 1945–1949*, translated from the German by Ann M. Hentschel. New York: Oxford University Press, 2007, vi + 205 pages. $49.50 (cloth).

Recent years have witnessed the appearance of many examinations exploring the German scientific community's attempt after the Second World War to deal with its professional legacies during the Nazi era. In fact, *Physics in Perspective* published two articles in 2006 that investigate the chemist Otto Hahn's attempts to either repress or explain away the role that he and his colleagues played in the functioning of the Nazi war machine.[1] Such examinations certainly raise larger questions regarding scientists' responsibility to come to terms with the reprehensible aspects of the society in which they live and work. Indeed, even the nonspecialist whose interests do not gravitate toward postwar German history of science may find an examination of this episode useful. Thus, it is important that books like Hentschel's – a slim volume that is largely accessible to a general readership – continue to appear. A translation of the German edition of 2005, *The Mental Aftermath* provides what the author calls a prosopographical examination into the "collective psychology" (p. 1) of German physicists in the late 1940s. Examining both published and unpublished letters and articles, Hentschel collects the commonalities among the views expressed therein to create a "mosaic of the mentality of German physicists." (p. 18) To this end, he effectively incorporates lengthy quotations that allow the physicists to demonstrate for themselves the myriad dimensions of their mentality.

Dividing 174 pages of text among eighteen chapters – which on occasion interrupts the book's flow – Hentschel examines thirteen characteristics common to the mentality of German physicists, including tensions with the Allied occupiers, a sense of isolation and fragmentation, bitterness over the export of German scientists to foreign countries, feelings of shame, listlessness and apathy, intentional and unintentional "forgetting" of one's wartime activities, and insensitivity in communicating with émigré colleagues. What Hentschel makes clear throughout is that German physicists were infused with a sense of solidarity against Allied policies limiting their research and subjecting them to potentially career-threatening "denazification" procedures. Believing that these policies were implemented inconsistently and punished them "for crimes others had committed," (p. 172) German physicists practiced "damage limitation for the discipline" (p. 49) through their published articles and correspondence with foreign colleagues. This enabled them to hinder investigations into the pasts of individual scientists for the benefit of the image of the larger community of physicists. Overall, Hentschel does not paint a favorable picture of his subjects, portraying them as concerned more with fashioning self-serving apologias and lamenting their own hardships rather than reflecting on the reprehensible nature of Nazi Germany and their professional role within it. This becomes especially apparent in the physicists' correspondence with their émigré colleagues who had fled Nazi Germany primarily because of "racial" and political oppression. Hentschel shows how their inability to sympathize with the plight of the émigrés often led the émigrés, such as James Franck and Lise Meitner, to harbor long-lasting feelings of bitterness and distrust toward their former colleagues.

Although quite damning, Hentschel's portrayal of German physicists is not one-sidedly bleak, as he makes clear in his discussion of their "new awareness of a scientist's responsibility." (pp. 139–143) Taking their cue from their American counterparts working on the atomic bomb, the German physics community called upon its members to foster the internationalization of their science and to promote its peaceful uses. This awareness, Hentschel argues, had the positive effect of "making a clean break with the 19th-century apolitical self-image of [German] scientists" (p. 141) and resulted in formal protests against West Germany's nuclear armament: the Göttingen and Mainau manifestos. The nonspecialist reader would have benefited from a more detailed discussion of these documents, including mentioning that the Göttingen manifesto was composed by leading German physicists like Werner Heisenberg and Max von Laue.[2] In addition, Hentschel does not explain how this awareness of one's responsibility could coexist with the "political apathy" (pp. 133–138) he believes was also characteristic of the German physicists' postwar mindset. Indeed, Hentschel's claim that this political aloofness was "a part of a scientist's self-image from as early as the 19th century" (p. 137) stands in contradiction to the previously mentioned "clean break" with the past.

By and large, Hentschel's portrayal of the state of German science just after the Third Reich's capitulation is excellent, giving the general reader a clear sense of the extent of the material destruction that plagued scientific institutions as well as the restrictions placed upon German science by the Allies. One peculiarity in his treatment, however, does bear mentioning. The reader gets a sense from Hentschel's description that the overall condition of German science remained static throughout the late 1940s, although other historians have demonstrated how quickly the Allies' science policy changed from one of stringent control and limitation to reconstruction in light of emerging Cold War tensions.[3] A consideration of these changing circumstances might explain the above-mentioned contradiction within the minds of German physicists. Indeed, this mentality may have been just as malleable and dynamic as the context in which it existed; the easing of restrictions on research in the late 1940s may have coincided with a demise of the physicists' apathy, listlessness, and political aloofness. Also, accounting for this shifting science policy may prompt one to reinterpret what Hentschel refers to as the ultimate "failure" of the Allies' denazification campaign, for which the physicists' sense of solidarity, he believes, was crucial. Certainly, Hentschel does state that the Allied occupation authorities were guilty of "breaking their self-imposed restrictions" (p. 106) for the sake of rehabilitating certain valued scientists. Nonetheless, his greater emphasis on the active role of German physicists allows Hentschel to pronounce denazification's ultimate ineffectiveness as a "failure" rather than as a conscious policy shift by the Allies.

Overall, Oxford University Press has produced an excellent book, one that includes a spectacular 17-page bibliography by the author. It has only a name index, however, instead of a name and subject index, which probably is a vestige of the original German edition. Still, it would have been useful if Oxford University Press would have provided a combined name and subject index.

Despite such minor shortcomings, Hentschel's work provides a striking glimpse into the minds of German physicists during the late 1940s. Historians and scientists alike can learn valuable lessons from it about the importance of the scientific community maintaining a sense of moral and social responsibility.

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1 Ruth Lewin Sime, "The Politics of Memory: Otto Hahn and the Third Reich," *Physics in Perspective* **8** (2006), 3–51; Mark Walker, "Otto Hahn: Responsibility and Repression," *ibid*., 116–163.

2 For a detailed discussion of these manifestos, see Richard H. Beyler, "The Demon of Technology, Mass Society, and Atomic Physics in West Germany, 1945–1957," *History and Technology* **19** (2003), 227–239.

3 Richard H. Beyler and Morris F. Low, "Science Policy in Post-1945 West Germany and Japan: Between Ideology and Economics," in Mark Walker, ed., *Science and Ideology: A Comparative History* (New York: Routledge, 2003), pp. 97–123.

4 Special thanks to Joan Lisa Bromberg for helping me prepare this review.

Richard J. Weiss, *A Physicist Remembers*. Singapore: World Scientific, 2007, ix + 261 pages. $42.00 (cloth).

This is a fun memoir by an original character – who also happens to be an excellent and energetic physicist. It is an enjoyable, quick read, and worth the effort for anyone interested in the numerous fields to which Richard J. Weiss contributed (see below), or just ready to enjoy well-written anecdotes from the history of physics from the end of World War II until about 1990.

Weiss is an idiosyncratic physicist, and this is an idiosyncratic book. His puckish sense of humor comes through from beginning to end – one of the most enjoyable aspects for the casual reader. As history, this book is decidedly informal, on the level of anecdotes, but Weiss was so energetic and active in a variety of fields that the memories are valuable.

The book is written entirely in the third person, so the author refers to himself as "Richard," or occasionally "Weiss," throughout the book. This literary device tends to give the author some distance from his story and perhaps increases credibility in places by encouraging the reader to lose sight of possible personal biases. It is jarring at times, certainly hard not to notice, but all in all does not detract significantly from the book and may strengthen some sections. Since much of his humor is self-deprecating, even personal biases do very little harm.

Richard has broad interests. The book begins with his birth and youth. We learn early that he loved baseball and was a good player. He served as an engineering officer on a "baby aircraft carrier" in the U.S. Navy during World War II, learning a considerable amount of practical physics. The real physics started after the war when he began graduate work at Berkeley on the GI Bill. We learn of his interest in music (bass drum, guitar, appreciative concert-goer), drama, later efforts as a playwright, writer of popular science and some fiction, history buff, and finally, historical tavern keeper. He gives a longish account of organizing a group of experts in diverse disciplines to meet over dinner once a month and explore overlapping interests, beginning in 1959. They decided to concentrate on "communication within and between disciplines." This was a truly broad group, from physicist to psychiatrist, investment advisor, radiologist, historian, artist, dramatist, and scholar of religion.

Weiss's interests and contributions in physics are also broad. In graduate school he was scooped by a matter of weeks by Willis Lamb in the discovery of the Lamb shift in helium. He spent most of his career as a research physicist at the U.S. Army's Watertown (Massachusetts) Arsenal. As a graduate student doing research at Brookhaven National Laboratory, he was inspired by John C. Slater and focused for many years on the experimental measurement of electron distributions, starting with X-ray scattering and eventually getting to high-precision Compton-scattering profiles and electron-momentum distributions. He helped found the long-running series of Sagamore Conferences on these subjects. He followed his interest in verifying the Schrödinger equation through these topics and others. He worked on magnetism in iron for many years and a fine miscellany of subjects in the physics of solids to polymers. He wrote technical books on solid-state physics, solid-state physics for metallurgists, and X-ray determination of electron distributions. Toward the end of his career he focused on optical-engineering applications and optical fibers. He wrote extensive semi-popular and popular articles on science both for broad audiences of scientists and for the public.

The book would have benefited from thorough and careful editing (a common observation for otherwise good books from this publisher), but finally, the typographical and grammatical errors are not of great consequence. If you read it, I expect you'll enjoy the ride, as I did – and as Richard Weiss surely did!

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Jeremy Bernstein, *Nuclear Weapons: What You Need to Know*. Cambridge: Cambridge University Press, 2007, xii + 299 pages. $27.00 (cloth).

When you open a book by Jeremy Bernstein, you expect to find graceful writing, lucid science, insightful thumbnail biographies, and quirky personal anecdotes. All of these are on display in abundance in this important book. Well, not exactly abundance. It's a compact package of 299 pages into which Bernstein has crammed a great deal of science and a great deal of history. It is efficiently written. It doesn't drag.

Bernstein begins in the middle of the nineteenth century, with the Geissler tube (predecessor to the cathode ray tube and the neon sign). It played a role in the discovery of the electron, which, in turn, helped to open up the atom, leading, in 1911, to the discovery of the nucleus and the later realization that the enormous per-atom energy of radioactivity, already discovered, resided in that nucleus. He ends in 2007 with a sobering chapter on nuclear proliferation. In between are Rutherford and Bohr, Heisenberg and Hahn and Meitner and Frisch, Einstein and Szilard, Feynman and Fermi and Bethe and von Neumann, Serber and Oppenheimer, Ulam and Teller, Chadwick and Tuck, Fuchs and Greenglass and Hall – and A. Q. Kahn. There also are clear discussions of fission and fusion, uranium and plutonium and lithium deuteride, the ways that bomb material can be manufactured, and the ways that bombs are designed.

Even though I worked in nuclear physics, including a two-year stint on the H-bomb design team in 1950-1952, I learned new things in reading this book. I did find a couple of minor errors, but it would be churlish of me to detail them, given the overall impression of meticulous research and a welter of interesting facts – historical, physical, and some political.

Why do I call this book "important"? Because the facts it sets out can't help but make the reader think more deeply about the absurdity of nuclear weapons. Bad enough to have them in the possession of the nations forming the "nuclear club." Now they may fall into the hands of what the international affairs experts quaintly call "non-state actors." Bernstein makes clear that multi-kiloton weapons can't be built in a backyard or a terrorist training camp, but, with the help of stolen or purchased components, some kind of formidable nuclear weapon could still be fashioned in the shadows. Even a "fizzle" could be vastly destructive. This book underlines the simple principle that the only logical policy concerning nuclear weapons is a policy of total abolition.

Bernstein's subtitle is "What You Need to Know." But who is the "you"? Who needs to know? The average person unskilled in science might think that all of the history and all of the science in this book are hardly necessary to understand the magnitude of the menace. Perhaps. Yet it does sharpen one's thinking to be informed about allotropes of plutonium, not to mention the international bazaar in centrifuges and the sweep of history that got us to where we are. At the minimum, our political and diplomatic leaders need to know. It would be good if the voters know, too.

A final comment about style. Bernstein keeps telling us what he's going to tell us. A high-school English teacher might return the manuscript with the notation, "Don't tell me what you're going to say. Say it." I find the relentless telegraphing ahead a little off-putting myself. Yet it serves a purpose. It makes the reader feel that he or she is being personally addressed. It makes the book seem more like a conversation and less like a pontifical lecture. If it helps the sometimes-daunting content go down more easily, who's to say it's not a good stylistic trick.

Recommend it to your friends, be they politicians, diplomats, or voters.

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Dieter Hoffmann and Mark Walker, ed., *Physiker zwischen Autonomie und Anpassung: Die Deutsche Physikalische Gesellschaft im Dritten Reich*. Weinheim: Wiley-VCH Verlag, 2007, xii + 675 pages. EUR 99.00 (cloth).

The last several years have seen a great deal of activity that is centered on scientific organizations in National Socialist Germany. One reason for this, surely, is the quantity of archival material, some of which has only recently been unearthed or made available to researchers. More important, perhaps, is that scientists and historians, especially in Germany, have acquired the distance they need from the Nazi era and also from the myth-making and collective silencing of the postwar generation. With that generation gone, many universities, scientific institutions, and professional societies have for the first time undertaken studies of their own institutional histories in the National Socialist period. Among them is the German Physical Society (Deutsche Physikalische Gesellschaft, DPG), which in 2001 commissioned a research project that resulted in this volume, a collection of contributions by German and American scholars. The book provides a critical history of the DPG and with it, the larger physics community in the Third Reich and the postwar period.

The book's title, *Physicists between Autonomy and Adaptation*, refers to the desire for professional independence and the instinct for political conformity that is discussed in nearly every contribution. Mark Walker notes that the DPG was largely unaffected for some time after Hitler came to power in 1933, in that it selected its own officers and retained control of its publications, and it was permitted to keep its Jewish members for several years. This apparent autonomy was due in part, as Stefan L. Wolff shows, to the DPG's ready accommodation to Nazi racial policies. At no time, for example, did the society's officers protest, or even publicly discuss, the dismissals of Jewish physicists from academic positions; even physicists like Max Planck and Max von Laue, who deplored the purge and privately tried to help individual colleagues, considered open protest on racial matters to be "political" and therefore damaging to the profession. Others, including DPG president Jonathan Zenneck, welcomed the dismissals, but the society nonetheless made an effort to retain its Jewish members, for financial reasons and to preserve the society's international reputation (the exception was Albert Einstein, whose membership was cancelled by the DPG in 1933). In 1938, however, when scientific organizations were required to enforce racial criteria for membership, the only real arguments within the DPG were how quickly and enthusiastically to comply; the role of Peter Debye, who was president at the time, remains controversial. By then, as Wolff notes, the DPG was no longer able to take from German Jews anything they had not already lost.

During the war the DPG took the initiative in integrating science and technology into arms development and the war economy. The result, according to Dieter Hoffmann, was a classic collaboration relationship in which physicists placed their expertise at the disposal of the state in return for its support and a measure of autonomy. Hoffmann outlines the activities of Carl Ramsauer, president of the DPG from 1940 to 1945, who successfully allied the DPG and the physics community with the highest levels of military, industrial, and political power in the Nazi state. Later, Ramsauer would claim that his efforts were nothing more than a completely unpolitical effort to advance science, but Hoffmann documents his wartime military and political connections and his postwar efforts to deny and conceal them.

One of the best-known examples of confrontation between physicists and National Socialist ideologues had to do with *Deutsche Physik*, the reactionary attack on modern physics, Einstein, and Jews (not necessarily in that order) that first appeared after World War I. In his essay on the scientific climate in Weimar Germany, Paul Forman describes academic scientists as conservative, nationalistic, and insistently apolitical, a mindset that permitted them to oppose the scientific claims of the anti-Einstein group but not its politics of extreme nationalism and anti-Semitism. In 1933 *Deutsche Physik* resurfaced with a vengeance when Johannes Stark, one of its leaders, moved to take control of the DPG. He was outmaneuvered by the society's leadership, most publicly by Max von Laue, who won the admiration of the international physics community for his courage in speaking out. According to Richard H. Beyler, these events are best understood as scientific elites defending the boundaries of their traditional professional prerogatives, including decisions about what constitutes valid science, and not as resistance or political opposition to Nazi power. On the whole, the DPG carefully calibrated its accommodation to the regime, as explored by Beyler, Michael Eckert, and Hoffmann in an essay on the Planck Medal and by Gerhard Simonsohn on the society's research meetings and publications. Eckert takes the *Deutsche Physik* story through the National Socialist period, showing that the movement was never cohesive – even the term *Deutsche Physik* was hardly used – and that after 1937, when Stark lost his political backing, mainstream physicists did not consider *Deutsche Physik* to be a threat and in any case the DPG did not directly oppose it. According to Eckert, the notion of *Deutsche Physik* became significant only after the war, when Ramsauer and other physicists whitewashed their résumés by claiming that the DPG fight against "Party-physics" "rescued physics" in Germany, formulations that Eckert regards as maneuvers by the DPG leadership to deflect attention from their actual collaboration relationships and complicity with National Socialism.

The self-exculpatory denials and "forgetting" of the postwar period are recurrent themes in this book. In his examination of the mentality of physicists in the first years after the war, Klaus Hentschel describes their distrust of the Allied occupation, bitter protests against the Allies' "denazification" attempts, and an unrealistic degree of self-pity. Gerhard Rammer documents the DPG and the physics community's remarkable postwar solidarity, which brought together those who had despised National Socialism with those who had supported and perpetrated it. These two contributions are among the most disturbing in the volume, raising questions about the persistence of National Socialist ideology into the postwar years.

The volume concludes with comparative essays by Volker Remmert on the Deutsche Mathematiker-Vereinigung and by Ute Deichmann on the Deutsche Chemische Gesellschaft and the Verein Deutscher Chemiker. Altogether this is an exceptionally interesting and important volume, which will, I hope, eventually appear in English translation.

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Kristine Larsen, *Stephen Hawking: A Biography*. Amherst, New York: Prometheus Books, 2007, 215 pages. $16.95 (paper).

Although the scientist-as-rock-star is not an innovation of our celebrity-crazed era, there is good reason for the public to take a breather every now and then from its absorption with Anna Nicole Smith and Britney Spears by turning its attention to the cosmologist and astrophysicist Stephen Hawking. More than an inspiration for handicapped people around the world, Hawking, in the forty-five years since he was diagnosed with ALS with a prognosis of death within two years, has done science of the highest caliber. Among many other awards, he has garnered both the Wolf Prize in Physics (1988, together with Roger Penrose) and the Copley Medal of the Royal Society (2006). Even if the public cannot wrap its collective mind around the advances Hawking has made in black-hole theory or in our understanding of the Arrow of Time, the mere exposure to such cosmological issues is surely salubrious. Though it is unknown how many of the 200 million people who reportedly bought his book *A Brief History of Time* actually read it, Hawking has taken over from Carl Sagan the public role of Scientist No. 1.

Stephen Hawking is hardly the first physicist to be both lionized and hounded by the media. After Pierre and Marie Curie shared the Nobel Prize in 1903, the French press insisted it was only doing its job in quoting the Curies' daughter Irène, and photographing her and her cat, Didi, during her parents' absence from home. The following year Pierre and Marie were caricatured in *Vanity Fair*. A popular cabaret act featured actors impersonating them, who crawled around the stage ostensibly in search of some lost radium. In 1911–1912, the French press demonized Marie, by then a widow for some years, for her romantic involvement with her married colleague Paul Langevin. The intrusion into her personal life drove her into a deep depression, which, along with acute kidney problems (possibly a symptom of radiation sickness), led her to withdraw from her laboratory for over a year.

Kristine Larsen, a professor of physics and astronomy at Central Connecticut State University, has written this short book-length biography of Hawking, seemingly in the attempt to improve on the spotty and often inaccurate coverage provided by the popular press. Published in December 2007, the book is actually a second edition, not so much revised as merely expanded, with a new Afterword, bringing Hawking's story up to date through February 2007 from 2004, when the first edition's epilogue ended. (Even so, the About the Author note is from before her 2002 promotion to professor from associate professor, though the back cover has her position right.) The sales of the first edition must have been substantial enough for the publisher to decide to issue a new one. So it was with some disappointment that, even though we look forward to the third edition she promises after Professor Hawking flies into space, we found significant shortcomings in this generally valuable book.

In essence, Professor Larsen is a physicist, not a biographer. The book is really a chronology of Hawking's movement, interactions with people, and scientific topics; it does not succeed in presenting a portrait of Hawking. For a physicist like one of us, the book provides interesting detail about a known scientist and is even potentially useful for emphasizing to students that "black holes have no hair" as well as other important ideas about black holes and cosmology. For a biographer like the other of us, or for people with no prior desire to know about Hawking, the book is not satisfying to read. To scientists, finding out about the current successor to Isaac Newton's Chair at Cambridge is intrinsically valuable; general readers may not be as moved by the thought.

The main problem is that the reader never feels the author has an intimate knowledge of her subject. In the Introduction, Larsen tells us of her excitement at having a face-to-face conversation with Hawking at an impromptu party held in his Chicago hotel room at the Texas Symposium of Relativistic Astrophysics in December 1986. This exchange – about her grandmother and his children – seems to be the only time she ever spoke to him. Nor does she appear to have spent time interviewing his colleagues, friends, and family members. An examination of Larsen's footnotes reveals that, rather than unearthing personal and professional correspondence and other documents that biographers routinely rely upon along with interviews to get real insight into the life and work of their subjects, she seems to have relied for information upon articles in newspapers, news magazines, and popular-science journals. Given that Larsen decries the press's coverage of Hawking in such comments as "Journalists seemed as fascinated by his physical limitations as his physics, and the resulting articles seemed to put these two facets into curious juxtaposition," (p. 77) it is hard to understand her decision to circumscribe her research to the kinds of journalistic sources she deplores.

Larsen is guilty of "curious juxtapositions" of her own, often relying upon awkward rhetorical flourishes to bridge Hawking's professional work with his private life. Thus, a quotation from a former student complimenting Hawking on his open-mindedness in matters such as supersymmetry and supergravity segués into an ominous chapter-concluding sentence: "Hawking's open-mindedness concerning his personal life was about to face a serious challenge." (p. 92) In another awkward segué, we learn first that in 1997 Hawking's daughter, Lucy, "gave birth to her parents' first grandchild, William," followed immediately by the announcement that "Stephen was busy giving birth to a project of his own." (p. 124) A few pages later we similarly learn that a 1999 operation allowed Hawking "greater enjoyment of meals," which is followed in the next sentence by the observation, "That same year he also enjoyed two more awards." (p. 132) (He sure has a lot of awards, and it seems that they are all listed.)

An editorial advisor also could have helped with the level of personal detail Larsen supplies. We don't really have to know not only his secretary's name but also her relation to the "entire relativity group" or a particular workshop. (p. 88) And we are willing to believe that Hawking has entered popular culture without needing the name and circumstances of seemingly every television appearance.

A second edition of a book should be an opportunity not only to update the contents but also to improve on deficiencies of the first, whether factual or stylistic. The reader thus wonders, for example, why the decoding of the original meaning of CERN, once an acronym, remains so garbled on p. 96 ("the Conseil European pour la Recherché Nucleaire," not the correct original "Conseil Europeén pour la Recherche Nucléaire"); or why no editor caught her use of the nonstandard "Irregardless," a double negative, on p. 55. The publisher's copy editor could have helped with "tracheotomy," (pp. 97, 102) which also appears as "tracheostomy"; (p. 98) also, the last two digits of 1028 (p. 61) and 1060 (p. 119) should be subscripted. The Reverend John Michell, who foresaw Newtonian (but not relativistic) black holes during the 1700s, got an extra "t" in his name. (p. 46)

In the last sentence of the Afterword, Larsen anticipates the opportunity to prepare a third edition of the book: "I look forward to writing an update on the next chapter of Stephen Hawking's life, sometime after he attains his goal of reaching space." (p. 170) Since Richard Branson's Virgin Galactic hopes to help Hawking achieve this aspiration, gratis (though Hawking should be able to afford it!) in 2009, readers should not have too long to wait. One hopes that Larsen will not simply write an additional Afterword but will make useful revisions. Two revisions, both relating to the Timeline that precedes the text, (pp. 11-20) would make the book much more reader-friendly. It would be useful to have a separate list of "Major Theoretical Breakthroughs," including dates and publications; as it is, all sorts of material, including the most mundane, is mixed together in the Timeline. The reader's comprehension would be improved if the important dates were more consistently given, as needed, within the appropriate chapters. We found ourselves needing repeatedly to flip back to the Timeline to confirm the chronology. In addition, there is occasional inconsistency with regard to dates. On p. 44, for example, we learn that Stephen first goes in December to the opera with Jane (who will become his first wife). Flipping back to the Timeline, we see that the year of that date must be 1963. The next paragraph seems to take us back to "that spring 1963 term," but according to the Timeline, the June talk that Fred Hoyle gave at the Royal Society took place in 1964, not 1963. Befuddled enough, we become all the more confused when reading the final paragraph on the page: "Later in the summer of 1963, Stephen set off for a famed Wagner festival.…" If readers can't rely on the author to get the dates right, and in a clear sequence, how can we rely on her for factual accuracy in general?

While reading Larsen's life of Hawking was not as satisfying as your reviewers would have liked, we did, all the same, learn quite a lot about the person and his science.

Here is where Larsen's scientific training shows, since the scientific discussions are accurate and good. Larsen ably describes (p. 63) how distant observers can be fooled into thinking particles are radiated from a black hole, as a result of pair creation just outside the black hole. "If one of the members of the pair fell into the black hole, the remaining particle could not annihilate with its partner when the time was up, and the energy debt appears to be unpaid. A real particle or antiparticle has been created, seemingly from nothing, or, rather, it looks to an outside observer as if it leaked from the black hole! But the energy needed to create the particle had to come from somewhere – namely from the black hole itself. In this way, the energy of the black hole, or, better yet, its mass (since mass and energy are convertible, according to Einstein) decreases, and the black hole radiates away."

Hawking's work is clearly brilliant, but we would have preferred more evaluation to a list of prizes. When Joe Silk, himself holder of a distinguished chair of cosmology (at Oxford), says "I have still not completely got to grips with imaginary time," (p. 146) a key concept of Hawking's, then one is left to wonder which of Hawking's later ideas are valid. We would like to know more about Hawking's reputation in the cosmological community at present, without having to do the survey ourselves.

At the same time, we wonder about the details of Hawking's productivity, beyond the scientific thought. If he moves a cursor on his computer by twitching his cheek or his eye, how many words per minute can he output? Does his computer guess letters and phrases? How long does it take him to prepare the synthesized voice for a one-hour lecture? Inquiring minds want to know. How extensive are the contributions to his published works of his coauthors, many of them also distinguished scientists?

We'd be glad to assign Larsen's book, or parts thereof, in an astronomy survey course to emphasize to elementary students how stellar-mass black holes were discovered (given the history of Cygnus X–1) and to back up textbook explanations of naked singularities and Hawking radiation. And we have no qualms about feeding the interest in science of physics and astrophysics majors and of nonscience students alike by having them read about Stephen Hawking's life. We are glad that Professor Larsen has taken on the interesting task of keeping up with Hawking's science, with his personal life, and with his career, merging them into her book.

Next, we personally will look at Hawking's official website, http://www.hawking.org.uk/ (which says that he can get printed or speech output from his computer at 15 words per minute), and read the newest Hawking book, *George's Secret Key to the Universe*, by Stephen with, as first author, his daughter, Lucy.

Answers to some of our questions and an updated view are available in an interview at the website http://www.guardian.co.uk/science/2008/mar/02/stephen.hawking.

The author would be gratified to see her book on prominent display at the entrance to the bookstore at Caltech, where he is in residence for some months each winter, and one of us was pleased to see him passing by.

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