Paul Halpern is a professor of physics at the University of the Sciences in Philadelphia. He is the author of *Einstein's Dice and Schrödinger's Cat* (2015) and *The Quantum Labyrinth: How Richard Feynman and John Wheeler Revolutionized Time and Reality* (2017).

ALBERT EINSTEIN, celebrity physicist

Paul Halpern

In Einstein's later years, although his contributions to physics became increasingly marginal and abstract, the press continued to trumpet his far-flung unification schemes as if they were confirmed scientific breakthroughs.

What is a scientific revolution? The answer depends on whom you ask. According to most historians of science, true revolutions or major breakthroughs are rare—something as profoundly distinctive as quantum mechanics would likely make the cut, but countless other developments would fall short. On the other hand, the press has maintained its own ideas. Driven by the pressure for headlines, journalists have advanced their own notions of what is important and newsworthy. In the case of Albert Einstein (see figure 1), who became a familiar household name in the 1920s, practically anything he said or did publicly drew headlines.

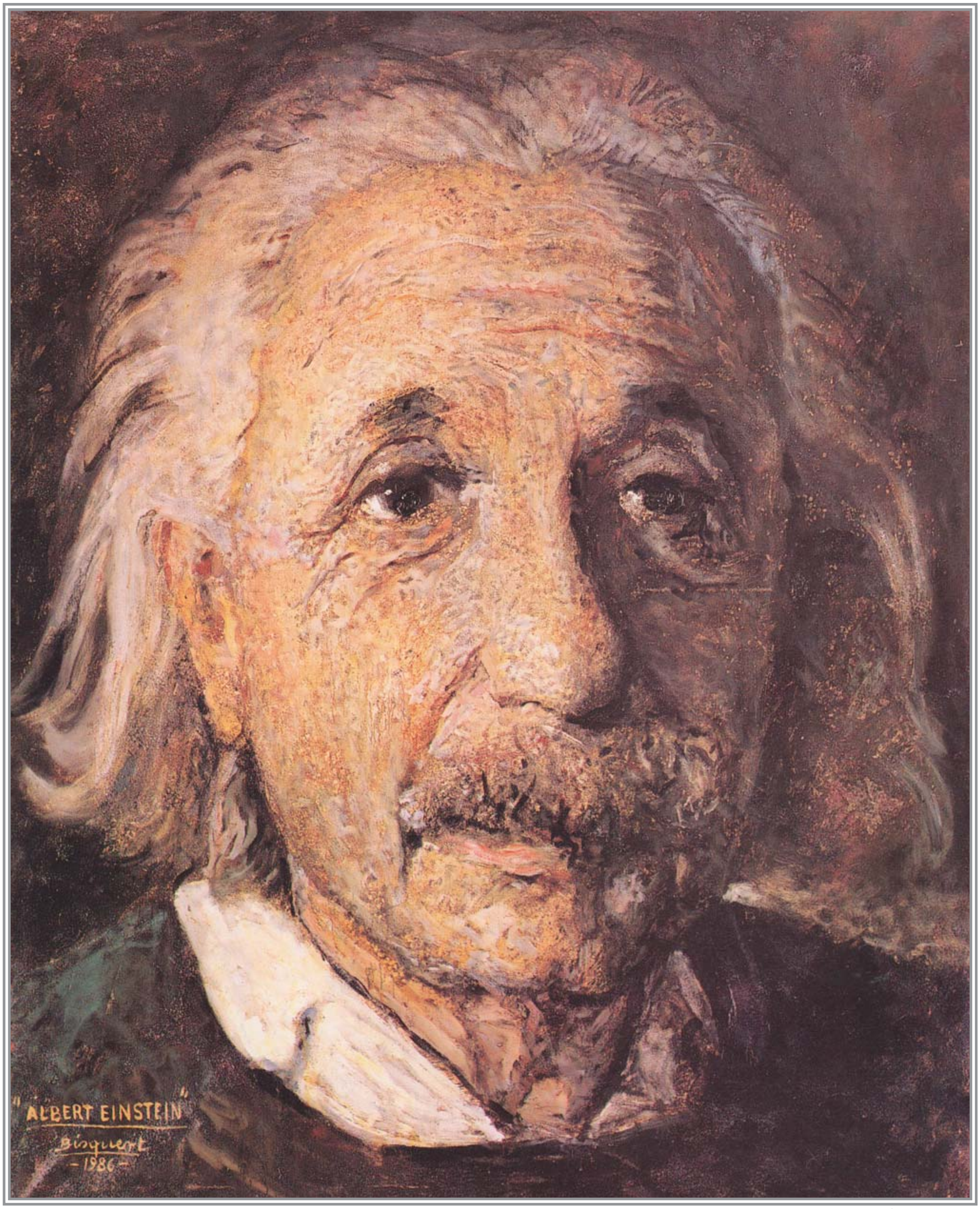
Early in Einstein's career, the press attention he garnered was an outgrowth of a true breakthrough: the eclipse observations of 1919 that helped confirm his general theory of relativity. The scientific community and the press agreed that Einstein's work altered perceptions of space, time, mass, energy, and gravitation. Moreover, during a time of xenophobia, globally minded Americans gravitated to him as an outspoken foreign scientist expressing an international outlook.[1] From that point on, Einstein was a celebrity, heralded for his quirky personality and passionate activism in addition to his scientific achievements.[2]

That celebrity status inspired the media to continue publicizing Einstein's theoretical meanderings, even when they had little support from other scientists. The scientific community largely ignored his idiosyncratic search for a unified field theory, which increasingly veered from the mainstream consensus and which other physicists came to view as unproductive and outré. The press, however, continued to trumpet his supposed breakthroughs, depicting Einstein as the quintessential eccentric scientific genius.

The relationship between Einstein and the press is a case in which a scientist's fame triumphed over the substance of his work. Einstein's unified field theory attempts were discredited again and again because of the lack of viable solutions, let alone experimental evidence. But they received far more coverage than many of the important experimental and theoretical results by other physicists during the same period, such as advances in nuclear and particle physics. Exaggerated reporting misled readers about the value of Einstein's research.

The eclipse that changed the world

Aside from a few brief stories about his advocacy of pacifism during World War I, the first mention of Einstein in the international press coincided with the announcement of the solar eclipse results obtained on 29 May 1919. Two British


"ALBERT EINSTEIN"
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expeditions went to observe the eclipse: one to Sobral, Brazil, and the other to Príncipe, an island off the coast of western Africa. Noted astronomer Arthur Eddington headed the latter group.

At a meeting on 6 November of that year, the Royal Society deemed both teams' findings consistent with the gravitational light-bending predictions of Einstein's general theory of relativity. The next day, the *Times* of London trumpeted the results with the front-page headline, "Revolution in science. New theory of the universe: Newtonian ideas overthrown."

The story soon spread around the world. The first *New York Times* story, with the relatively subdued headline "Eclipse showed gravity variation: Diversion of light rays accepted as affecting Newton's principles. Hailed as epochmaking," appeared on 9 November. But it was followed by a piece on 10 November with a more alarming headline, "Lights all askew in the heavens: Men of science more or less agog over results of eclipse observations. Stars not near where they seemed or were calculated to be, but nobody need worry." More than a dozen other articles or reports about Einstein and his work appeared later that month in the *New York Times*, mainly debating whether the results were valid, if they affected daily life, and whether they were understandable by mere mortals.

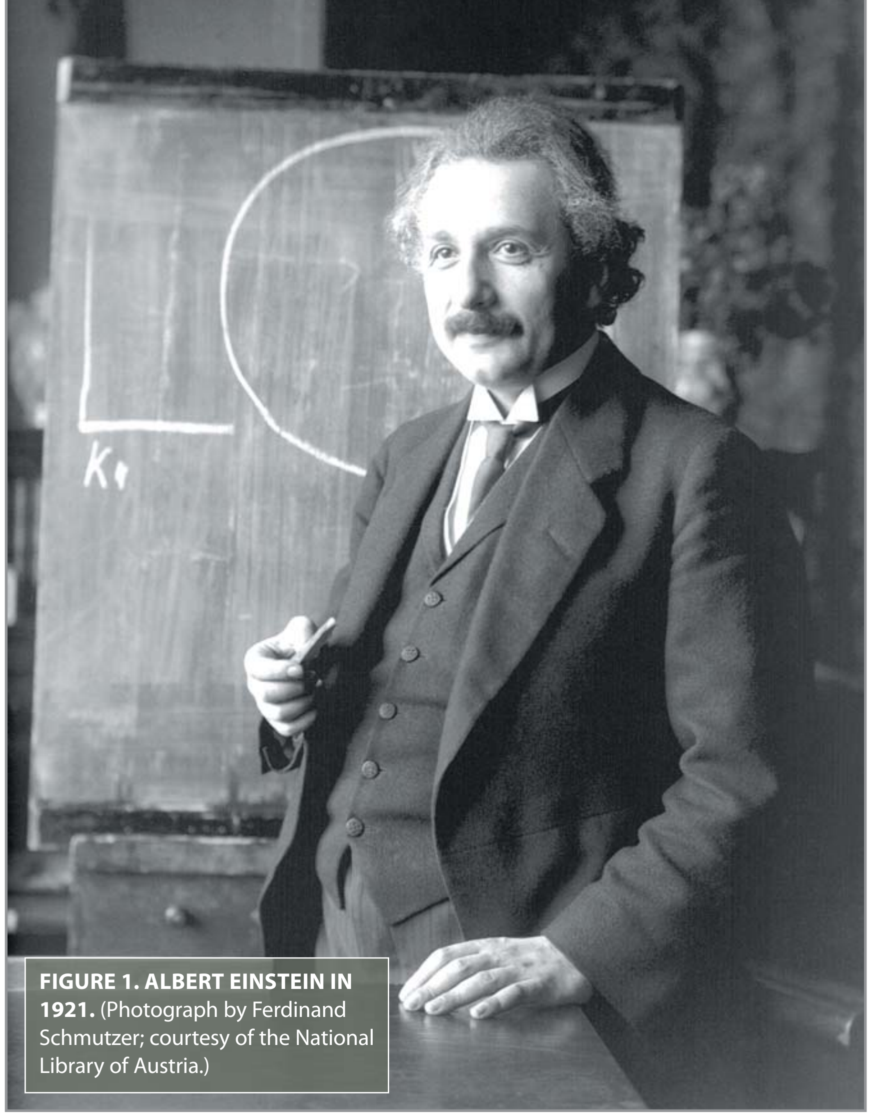

FIGURE 1. ALBERT EINSTEIN IN 1921. (Photograph by Ferdinand Schmutzer; courtesy of the National Library of Austria.)

After the war, science coverage in general had dramatically increased in the US mainstream press. Although specialized science publications such as *Scientific American* and *Popular Science Monthly* had attracted readers for decades, the rise of chemical warfare and other military uses of science had spurred a push among scientists for greater newspaper reporting of its benevolent side. In 1919 the American Chemical Society started its News Service, which began issuing press releases about the field.

Two years later newspaper publisher E. W. Scripps and noted biologist William Ritter launched Science Service, an agency designed to promote a positive image of science through news stories and photos.[3] By 1927 the *New York Times* had hired its first designated science editor, Waldemar Kaempffert, lending even greater prestige to that branch of journalism. Science journalism had become an integral part of press coverage, and Einstein's rise to fame coincided with a greater hunger for science pieces.

But almost no science journalists were schooled in contemporary theoretical physics. How could they get a handle on Einstein's more abstruse work? In practice, they couldn't, so they needed to improvise. They touted the importance of Einstein's theories while only vaguely interpreting them for the public. Readers began to perceive Einstein's work as fundamentally enigmatic—not even fully understandable by science journalists. That mystique bolstered his fame even further.

Einstein's celebrity status landed him many speaking engagements around the world, including a spring 1921 visit to the East Coast of the US. He spoke at Columbia, Princeton, and other universities and was invited to the White House to meet with President Warren Harding. Princeton University Press published a popular book, *The Meaning of Relativity*, from the scientific talks Einstein delivered during that tour. The 1921 Nobel Prize in Physics only added to his reputation as a superstar.

What affine, fine theory!

By the early 1920s, Einstein had already started to consider extensions of general relativity, including three variations proposed independently by Hermann Weyl, Theodor Kaluza, and Eddington. The goal was to combine electromagnetism and gravitation into a unified field theory that would geometrize both phenomena. As historian Jeroen van Dongen has written, Einstein hoped to extend the mathematical methods he applied so successfully to gravitation and develop a single set of equations describing a geometric field theory.[4]

After pondering the three theories, Einstein became most intrigued by Eddington's so-called affine theory, which changed the definition of the Christoffel connection (also known as the affine connection), the mathematical entity that represents how parallel lines are transported through spacetime along a curved manifold. That definition gave the connection additional flexibility, hypothetically allowing it to describe electromagnetic potentials.

Finding Eddington's model incomplete, Einstein aspired to develop his own version. In March 1923 Einstein submitted a draft of his new theory, which he had developed on a sea voyage to Japan, to the Prussian Academy of Sciences in Berlin. The *New York Times* trumpeted his submission in a 23 March article, "Einstein to announce theory 'surpassing even relativity.'" The piece falsely suggested that Einstein had found a way of explaining terrestrial magnetism, a complex mechanism that was not fully understood at the time.

Einstein worked on the affine theory for two more years. By the end of 1925, he realized that he could find no singularity-free solutions (a singularity is a point or region at which physical parameters become infinite) to the field equations he had developed. He decided to scrap his extension of Eddington's work. For the next several years, he explored different options, including an investigation of Kaluza's theory.

Kaluza's work added a fifth dimension to Einstein's field equations. An extra mathematical restraint, called the cylindrical condition, forbade direct observation of it. But that undetectable fifth dimension allowed room in the equations to house electromagnetic terms. Those components could be shown under certain circumstances to obey Maxwell's equations and thus offered tantalizing hints of unification. However, the theory was not invariant under general transformations of coordinates, and having to impose a particular coordinate system for the theory to work seemed artificial. It also didn't have physically realistic solutions. Nevertheless, motivated in part by Swedish physicist Oskar Klein's publication of an independent five-dimensional unification attempt, Einstein spent parts of 1926 and 1927 exploring ways to bring Kaluza's notion to fruition.

Distant parallelism

In 1928 Einstein was diagnosed with heart disease and his physician urged him to rest. As he recovered, he worked on an idea for unification called distant parallelism, which proposed an independent web of connections between each point in spacetime that supplemented the standard relationships of general relativity. In early January 1929, Einstein submitted a paper to the Prussian Academy and issued an announcement. Though the paper was extremely preliminary, lacking any inkling of experimental evidence, the *New York Times* published a front-page story about it on 12 January, proclaiming that "Einstein himself considers it by far his most important contribution to mankind—scientifically more important than his original theory."

Einstein's article "Zur einheitlichen Feldtheorie" ("On unified field theory") was published in *Sitzungsberichten der Preussischen Akademie der Wissenschaften* (*Proceedings of the Prussian Academy of Sciences*) on 30 January. Within three days, the first printing of the journal offprint—a thousand copies—sold out, and another thousand copies were soon printed. Soon thereafter, *Nature*'s News and Views section published a more accessible account of the work, including a quote by Einstein: "Now, but only now, we know that the force which moves electrons in their ellipses about the nuclei of atoms is the same force which moves our earth in its annual course about the sun, and is the same force which brings to us the rays of light and heat which make life possible upon this planet."[5]

With Einstein's 50th birthday approaching, his new idea rapidly caught fire, at least in the popular press. The *New York Times* published almost a dozen articles that year about distant parallelism, rivaling its coverage of the 1919 eclipse results. Although by then the bulk of the physics community was focused on quantum mechanics and related fields and had no interest in Einstein's attempts at unification, reporters managed to gauge the reaction of at least a few physicists. Harold Sheldon, chair of New York University's physics department, opined that "such things as keeping airplanes aloft without engines or material support, as stepping out of a window into the air without fear of falling, or of making a trip to the moon … are avenues of investigation suggested by this theory."[6]

One of the few knowledgeable physicists who kept up with Einstein's unified models was Wolfgang Pauli (see figure 2). Einstein saw Pauli as an important sounding board—honest, thorough, critical, but often right. To Einstein's dismay, Pauli found many flaws in distant parallelism, including its inability to match key predictions of general relativity, such as gravitational light bending. It also did not match the expected features of electromagnetism as mapped out by Maxwell's equations. Finally, it did not take into account key electron properties gleaned from the Dirac equation.

In December, Pauli wrote to Einstein, "I would take any bet with you that you will have given up the whole distant parallelism at the latest within a year from now, just as you had given up previously the affine theory. And I do not want to rouse you to contradiction by continuing this letter, so as not to delay the approach of the natural decease of the distant parallelism theory."[7]

Privately, Pauli told Pascual Jordan, "Einstein is said to have poured out, at the Berlin colloquium, horrible nonsense about new parallelism at a distance. The mere fact that his equations are not in the least similar to Maxwell's theory is employed

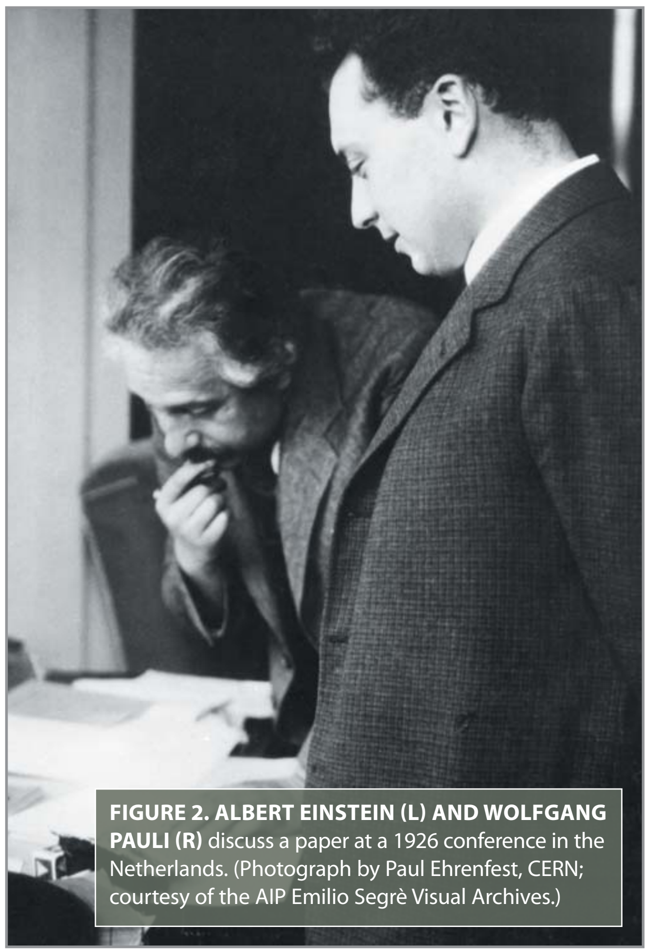

FIGURE 2. ALBERT EINSTEIN (L) AND WOLFGANG PAULI (R) discuss a paper at a 1926 conference in the Netherlands. (Photograph by Paul Ehrenfest, CERN; courtesy of the AIP Emilio Segrè Visual Archives.)

by him as an argument that they are somehow related to quantum theory. With such rubbish he may impress only American journalists, not even American physicists, not to speak of European physicists."[8]

Pauli's perceptions that American journalists would be the ones most interested in Einstein's work were right on the mark. More than in European journalism, there was a tradition in US journalism of using hype to sell papers. Newspapers in the US did not even seem to notice the failure of Einstein's earlier attempts at unification, their lack of viable solutions and experimental evidence, or the other problems with his theories. Journalists placed them in virtually the same category of general relativity, which had actually passed several key tests. Although Pauli maintained a continued interest in unifying the natural forces, he remained cynical about the way such ideas were represented by the press—later mocking, for example, the overblown press treatment of a similarly undeveloped and unsupported unification model Werner Heisenberg advanced in the late 1950s.

Einstein thought at first that Pauli was too harsh about distant parallelism and that he failed to see its elegance. However, after about another year of exploring the concept, he had to concede that Pauli was right. Throughout the 1930s and early 1940s, Einstein explored further variations of the Kaluza idea. On 23 January 1931, the *New York Times* took note of his new direction, without ever mentioning the failure of the old and the rudimentary state of the new. After Einstein gave a Caltech seminar on one of his fledgling ideas—a five-dimensional projective geometry—the paper reported,

> A key to the innermost secrets of nature has been presented to a class of distinguished physicists and mathematicians by Albert Einstein in the latest and greatest creature of his world-famed brain, the unified field theory.
>
> Theoretical physicists proclaimed it as the most simple theory that will explain all the secrets of space and the universe. . . .
>
> Dr. Einstein explained that the fundamental equation is presented for mathematicians to proceed and work out equations for experimental work. Experimental proof of his unified field theory is already at hand, he revealed, in its application to laboratory results with weak electro-magnetic and gravitational fields.

In other words, the article asserted that Einstein had developed a litmus test involving charged particles acting under electromagnetic and gravitational fields. In fact, he had not. That story represented yet another example of hyped coverage of a mere attempt at grand theoretical unification.

The hermit at the IAS

In 1933, when the Nazi regime took power in Germany, Einstein took a position at the Institute for Advanced Study (IAS) in Princeton, New Jersey (see figure 3). There, he dropped projective geometry and pursued different five-dimensional unification attempts with various assistants, including Walther Mayer, Peter Bergmann, and Valentine Bargmann. IAS director Abraham Flexner zealously guarded Einstein's privacy and relatively few news stories about him and his research appeared in the mid to late 1930s.

Such isolation was a marked contrast with Einstein's previous visits to the US, when numerous public talks and tours brought him into far more contact with photographers and reporters. Even in Berlin during the late 1920s, reporters were so eager to interview him that one sought him out at the private estate where he had wanted to celebrate his 50th birthday quietly.

In March 1939, close to the end of Flexner's directorship, Einstein celebrated his 60th birthday. By then readers were curious about his progress toward his lifelong quest. Louis Levick, a New York journalist representing the National Association of Science Writers, managed to snag an interview. Einstein told him that with coauthors Peter Bergmann and Valentine Bargmann, he was close to a final theory. Levick's report was cited in a *Christian Science Monitor* piece, "Einstein nears discovery of new theory," on 14 March 1939.

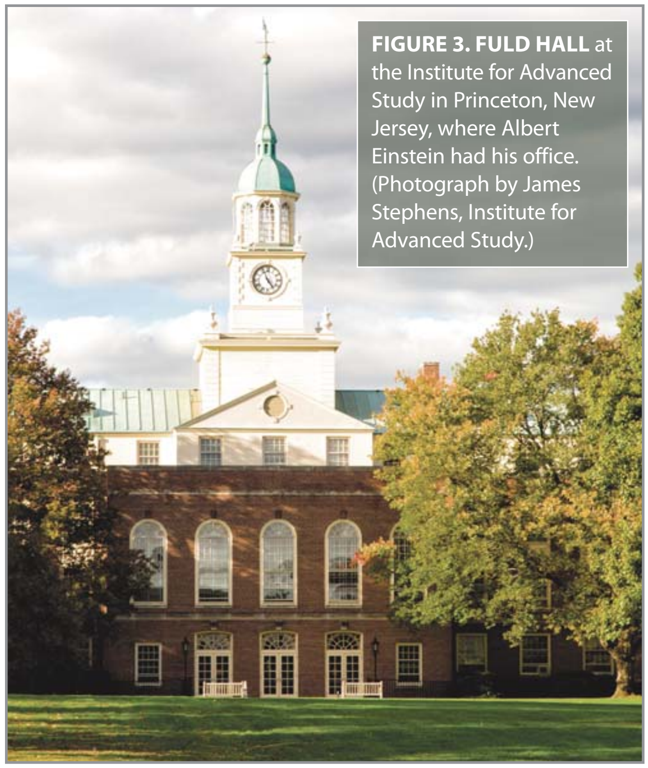

FIGURE 3. FULD HALL at the Institute for Advanced Study in Princeton, New Jersey, where Albert Einstein had his office. (Photograph by James Stephens, Institute for Advanced Study.)

Einstein's confidence did not last long. In 1945 he collaborated with Pauli, who was visiting the IAS, on a paper that suggested that five-dimensional theories lack singularity-free solutions. That conclusion quashed Einstein's passion for five-dimensional theories once and for all. It was back to the drawing board.

Two years later one of Einstein's friends and collaborators, Erwin Schrödinger, turned into a competitor. He was living at the time in Ireland, and he announced his own supposed unification breakthrough to the Royal Irish Academy. The international press trumpeted Schrödinger's theory; "Dublin man outdoes Einstein," the *Christian Science Monitor* announced on 31 January 1947.

When a journalist asked Einstein to respond, he issued this revealing statement about press sensationalism: "Such com-

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This WORLD of OURS -by- Claire Burke Brokaw

FOR MEN ONLY

Constantly Expressive—Einstein Warms Up to His Subject

ATOM ENERGY HOPE IS SPIKED BY EINSTEIN

Efforts at Loosing Vast Force Is Called Fruitless.

SAVANT TALKS HERE

Now Indicates Doubt Of Relativity Theory He Made Famous.

FIGURE 4. A 1934 HEADLINE associated Einstein with efforts to harness atomic energy. (© Pittsburgh Post-Gazette; courtesy of the AIP Emilio Segrè Visual Archives.)

muniqués given in sensational terms give the lay public misleading ideas about the character of research. The reader gets the impression that every five minutes there is a revolution in science, somewhat like the coup d'etat in some of the smaller unstable republics. In reality one has in theoretical science a process of development to which the best brains of successive generations add by untiring labor, and so slowly leads to a deeper conception of the laws of nature. Honest reporting should do justice to this character of scientific work."[9]

The theory of a lifetime

After World War II, Einstein's status as a superstar ascended even higher after the public learned that it was Einstein and Leo Szilard's letter to President Franklin Roosevelt in 1939 that had helped persuade the US government to initiate the Manhattan Project. He was widely credited with anticipating the massive power of atomic weapons with his mass–energy conversion formula. But that same association tarnished some of Einstein's saintly credentials. He had become, for better or worse, one of the scientists most associated with the start of the nuclear age (see figure 4).

One of the figures he became linked with in the public eye was J. Robert Oppenheimer, the scientific director of the Manhattan Project, who after the war became the third director of the IAS. Although Oppenheimer was far more practical than Einstein, he had a mystical side, too, such as his interest in Hindu scripture and his lone treks through the desert, qualities that, as historian of science David Hecht has demonstrated, similarly brought Oppenheimer considerable press attention as a "scientific icon."[10]

Oppenheimer, however, was known for solid, mainstream science and was lauded as an effective administrator. In contrast, Einstein's unified field theory work was abstruse, impractical, and disconnected from experimental results, which only bolstered his image as a mystical figure. The more esoteric and remote Einstein's mathematical meanderings grew and the more disconnected his results were from mainstream research, the more robust his popular image as a lone seeker of truth came to be.

Beginning in the late 1940s, as he approached the age of 70, Einstein worked on variations of another unified field theory approach, which he called a generalized theory of gravitation. It was a four-dimensional method, not a Kaluza–Klein method, and in some ways a variation of his earlier affine theory. In the January 1948 edition of *Reviews of Modern Physics*, Einstein published one version of his generalized theory, stating without fanfare that it "constitutes a certain progress in clarity as compared to the previous presentations."[11]

In March 1950 Princeton University Press (PUP) planned to release a third edition of *The Meaning of Relativity* to be timed loosely with Einstein's 71st birthday. Einstein was contractually obliged to update his work for each edition. For the third one he agreed to submit a new appendix that would inform readers about the generalized theory of gravitation. The director of PUP, Datus Smith Jr, and its editor, Herbert Bailey Jr, were counting on that appendix, an account of Einstein's latest unification efforts, to boost interest in the work, and hopefully sales as well.

Unknown at first to Smith and Bailey, Einstein had independently made arrangements with *Scientific American* to write an article about the generalized theory of gravitation. In December 1949 Smith and others learned about those plans, which had the potential of deflecting interest from the book to the article.[12] PUP felt compelled to act quickly to protect its association with Einstein's new theory.

The American Association for the Advancement of Science's (AAAS's) Annual Science Exposition, held that year in December at the Hotel Statler in New York, offered the perfect opportunity for PUP to make its own announcement. PUP had reserved a table in the science publishers' section so it could display copies of some of the books in its catalog, including the second edition of *The Meaning of Relativity*. To stake their claim, the editors issued a brief press release announcing that Einstein's final theory would be published in the upcoming third edition. They also displayed a duplicate of Einstein's typewritten manuscript for the new appendix. The press release offered the bold—but wholly unsupported—claim that "this epoch-making paper ranks with the original publication of the Theory of Relativity as a milestone of scientific achievement."[13]

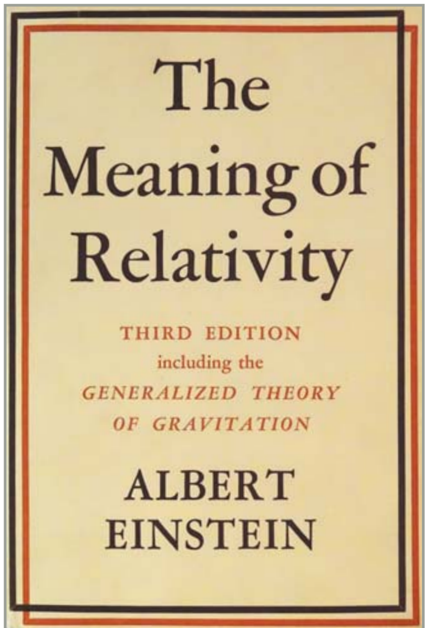

FIGURE 5. THE COVER OF THE THIRD EDITION of *The Meaning of Relativity*. (Photograph by Leo Boudreau.)

Normally, journalists walk by such publishers' tables without taking notice. But since it was Einstein, the international press immediately jumped on the announcements. Reporters were hungry for details. A piece in the *Irish Times* on 2 January 1950 declared that Einstein's new theory was so esoteric that only Schrödinger and a few other brilliant physicists would be able to understand it: "Unfortunately, Dr. Einstein is in a field by himself, and only a handful of men in other parts of the world can succeed even in scrambling through the hedges with which it is surrounded. . . . Ireland is fortunate in as far as one of her citizens, Dr. Schroedinger, belongs to the select band of human beings who may be able to understand and, what is more, to explain some aspects of the new theory."

One noted science writer who happened to be at the AAAS meeting was Lincoln Barnett, author of *The Universe and Dr. Einstein* (1948), a favorable biography of the famed physicist. He took note of the announcement of Einstein's new manuscript and wrote an article for *Life* magazine about the reaction at the AAAS meeting to the announcement of his new theory.[14] To the consternation of the PUP editors, the *Life* piece didn't mention the new edition—for which Barnett ended up apologizing to them.

In early January Einstein decided to revise some of the details of his generalized theory for the appendix. He sent PUP an amended copy of his manuscript, which delayed the production process. A few weeks later, he noticed some typographical errors in the equations and notified PUP. By then it was too late to stop the presses; PUP was forced to print an extra errata page and include it with every copy of the third edition (see figure 5). Ironically, the much-hyped "ultimate" equations turned out to be a moving goalpost, subject to revision after revision.

A *New York Times* article, "Einstein publishes his 'master theory,'" appeared on 15 February 1950. "His latest intellectual synthesis," reporter William Laurence claimed, "may reveal to man vast forces beyond imaginings still hidden from him." As with previous coverage, there was significant hype and little discussion of Einstein's repeated setbacks in his quest for a unified theory.

Finally, Einstein's long-awaited contribution to *Scientific American*, "On the generalized theory of gravitation," appeared in its April 1950 issue. Despite the buildup, only about one-third of the article attempted to explain the rudiments of the new theory. The rest of it was a condensed scientific history of assorted topics such as atomism, optics, Maxwell's theory of electromagnetism, and relativity itself. With a measure of irony, Einstein explained in the article, "As for my latest theoretical work, I do not feel justified in giving a detailed account of it before a wide group of readers interested in science. That should be done only with theories which have been adequately confirmed by experiment."

A cautionary tale

Einstein died on 18 April 1955, with his quest for unification never completed. Nonetheless, the write-up of his final unification attempt was included in the fifth edition of *The Meaning of Relativity*, published posthumously in 1956 and reissued many times since then. There was relatively little mainstream press coverage of Einstein's final theoretical endeavors. However, a *New York Times* article published on 2 May 1955 noted that one of the pages of his notes and calculations was missing and sought by his estate. The piece claimed that the missing notes included an equation of unknown significance.

Einstein's relationship with the press was complex, to say the least. Newspaper accounts brought Einstein fame and allowed him to travel the world, give talks, and promote his causes. Nevertheless, as a lover of privacy, he came to resent the many intrusions of reporters. Even so, he did not cloister himself or refuse to say anything about his work; he enjoyed sharing his ideas with a broad audience, including his perspectives on science, philosophy, religion, politics, and other matters. Einstein himself was generally careful not to overstate the extent of his own progress toward a unified field theory. However, he often placed his work within the context of the history of such attempts, which gave reporters the opportunity to deem his contributions historic breakthroughs, or at least on the verge of being so.

Historians cannot fault Einstein, however, for journalists' propensity to hype his later work while largely ignoring the actual major developments in theoretical physics of the 1930s and 1940s, such as the tremendous progress in quantum electrodynamics and particle theory. Readers, they supposed, wanted to learn about the doings of a familiar genius, not necessarily about the true state of the field in which he made his mark.

Moreover, as Joseph Martin has recently detailed, there has been a marked asymmetry between press coverage of scientific topics perceived as cutting edge, such as high-energy physics and cosmology, and those seen as mundane. One key reason for the gap is that familiarity with earthly, tangible materials makes their inner workings—extraordinary as they may be, such as in the case of certain quantum phenomena—seem less exotic and therefore a reminder of the limitations of this world.[15] Einstein's far-reaching but unproven work thereby drew more attention than more mundane achievements that were grounded in solid laboratory results.

The press's focus on Einstein's solitary work during his later years has had several lingering consequences. Before Einstein, most coverage of science and technology in the mainstream press was limited to the inventions of figures like Michael Faraday, Nikola Tesla, and Thomas Edison, and, starting in the early 20th century, Nobel Prize recipients. Einstein's fame has led to more coverage in general of theoretical physics, albeit with a slant toward fields such as particle physics and cosmology.

On the other hand, Einstein's treatment in the press has led to continued distortion of the way theoretical physics is usually performed and progresses. Journalists have tended to tell stories of single individuals making rapid breakthroughs, rather than ones about incremental efforts involving a number of researchers working either collaboratively or competitively. For example, in the case of black hole thermodynamics, the press extolled Stephen Hawking's work and focused on his achievements throughout his life while largely ignoring the important contributions of Jacob Bekenstein.

Press coverage of Einstein is a cautionary tale of the need for journalists to check their facts, even in the case of the work of brilliant scientists. Readers need guidance in distinguishing experimental verification, or at least testable hypotheses, from hype. While we can thank Einstein for a huge bump in the amount of coverage of theoretical physics in the press, the perception of him as a font of ever-flowing insights prevented a rigorous discussion of his later work. Einstein's fame made the search for a unified theory enthralling—ultimately too dazzling, as time went on, for reporters to step back and critically examine his results.

Thanks to Melinda Baldwin and Alberto Martinez for helpful suggestions and to the Princeton University Library and Archives. This article is adapted from "Celebrity physicist: How the press sensationalized Einstein's search for a unified field theory," Physics in Perspective, *volume 20, page 254, 2018.*

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