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The origins of PHYSICS TODAY

David Kaiser

In 1945 leaders of the American Institute of Physics conceived a bold experiment: a magazine that would help unify an increasingly balkanized discipline.



This month *PHYSICS TODAY* celebrates its 70th anniversary. The magazine was founded soon after the end of World War II, during one of the most disruptive periods in the history of physics. Struck by the fast-paced changes, leaders of the American Institute of Physics (AIP) grew concerned that newfound pressures might rend the discipline apart. While research journals like *Physical Review* swelled as never before and physicists' research agendas focused more narrowly on specialized topics, AIP leaders hoped that a new type of publication could restore some measure of social and intellectual cohesion.

Anniversaries provide an opportunity to pause and take a longer view of practices, such as physicists' communication habits, that might otherwise seem routine, even inevitable. After all, back in Galileo's day scientific journals were a novelty. Their format only began to resemble today's publications well after James Clerk Maxwell had discovered his electromagnetic equations, and conventions for peer review had not yet been standardized during Albert Einstein's lifetime.¹

The years after World War II were a particularly turbulent time for scientific publishing. Nearly everything seemed up for grabs, from the procedures for reviewing and organizing journals' contents to how new information should be delivered to readers. Some scientists wondered whether research journals should be scrapped altogether, replaced by some system of direct-mail offprints, as paper and labor shortages threatened production of conventional journals, page counts



57 EAST 55TH STREET in New York City, home of the American Institute of Physics in 1948, when PHYSICS TODAY was born. (Courtesy of the AIP Emilio Segrè Visual Archives, PHYSICS TODAY Collection.)

for individual issues swelled beyond what existing bindings and glue could hold, and individual readers focused more narrowly on disjoint research specialties. Few aspects of scientific communication seemed to be settled or permanent.²

Anniversaries also provide an opportunity to look forward. Although some of the pressures that physicists faced when they launched PHYSICS TODAY may seem familiar, much has changed—not just in how physicists communicate with each other but in how they view and are viewed by the broader society. Who could have imagined in 1948 that today's research articles in *Physical Review* would carry scores that track each reference to the article in blogs and tweets? Or that depictions of physicists in broader US culture would shift from sober consultants on nuclear policy, to unhinged madmen like Stanley Kubrick's Dr Strangelove, to bumbling nerds like Sheldon Cooper, lead character of the television sitcom *The Big Bang Theory*? As physicists' worlds continue to evolve, so too will their forms of communication and the way in which they are perceived.

Growing pains

Speaking in his native Chicago at an October 1951 AIP meeting, Karl Darrow stared out from the podium and announced the dawning of a new age. Or rather, he declared the passing of an earlier one. The nephew of trial lawyer Clarence Darrow of Scopes trial fame, Karl had earned his PhD at the University of Chicago in 1917 under Robert Millikan, just a few years before Millikan received the Nobel Prize in Physics. Darrow built his career in atomic physics at Western Electric and Bell Labs and became a prolific author, writing both for his fellow physicists and for broader audiences. Since 1941 he had also served as the powerful executive secretary for the American Physical Society (APS), a position he would hold until his retirement in 1967.

Darrow was a natural choice to deliver a special lecture at the Chicago meeting, which commemorated the 20th anniversary of the founding of AIP. The institute's leadership had asked Darrow to deliver a keynote address under the title "The Whole of Physics." (The text of the talk appears in the November 1951 issue of PHYSICS TODAY.) Darrow found the task impossible. "The last man who could probably have done this was Hermann von Helmholtz," Darrow began. "It interests me to realize that there are people still living who studied under Helmholtz; they are the last of our contacts with the age of omniscience."

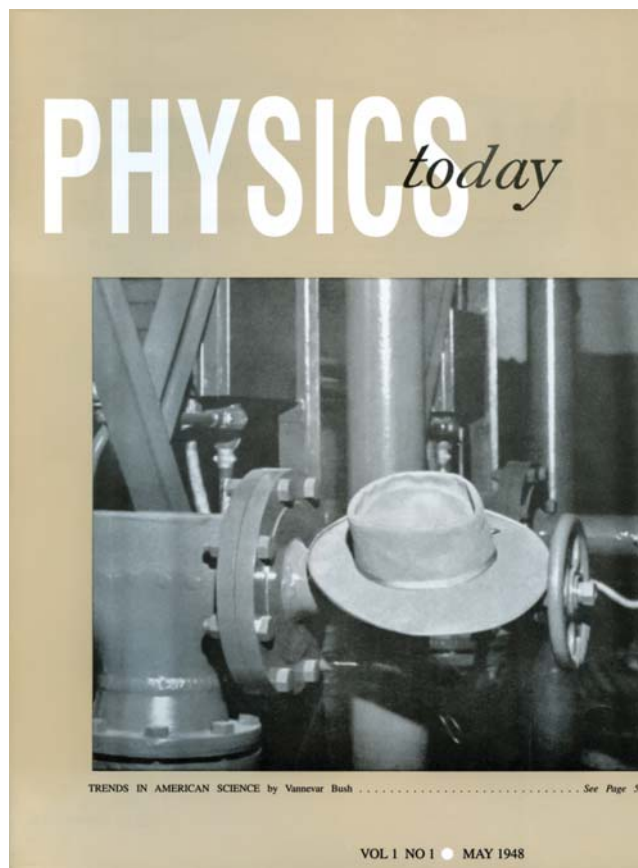
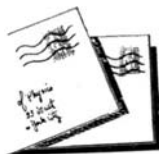
Darrow wasn't the only physicist after the war to note—often with alarm—the passing of an "age of omniscience." In fact, the pressures of specialization had been building for decades. Not long after APS had been founded in 1899, factions

had crystallized around research topics and in places of employment. By the 1920s and 1930s, for example, many industrial physicists balked at what they considered an overemphasis by their academic colleagues on abstruse topics like quantum theory and nuclear physics. Meanwhile, physicists in both academia and industry tended to focus their research more and more narrowly within specialties. During the early 1920s, more than half of the physicists who published on solid-state topics also published on other areas of physics. By the mid 1930s, that proportion had fallen to less than one-third; after World War II it would slip further,

to about one-sixth. (See reference 3 and the article by Spencer Weart, PHYSICS TODAY, July 1988, page 38.)

The 1931 founding of AIP, whose anniversary Darrow helped to celebrate, was a response to such pressures. As groups like the Optical Society of America and the Acoustical Society of America splintered off from APS, leading physicists aimed to pool resources—increasingly scarce as the Great Depression wore on—and find some cost savings in journal publishing and maintaining membership rolls. More than budget lines were at stake. Throughout the 1940s, even as World War II raged on, leading physicists debated how best to stem the balkanization of the discipline. They tinkered with constitutional fixes and new bylaws for various topical groups within APS and AIP, trying to find some sweet spot that would enable the discipline to expand without losing some core identity.

The nature of the challenge shifted dramatically after the war. By the time Darrow addressed the AIP anniversary conference in 1951, the field of physics—and its place in wider society—had been transformed. Wartime projects, including the atomic bomb and radar, had thrust US physicists into the spotlight in a way that no group of researchers had experienced in the country. "Physical scientists are the vogue these days," wrote Joseph Jones in a May 1946 *Harper's* article. "No dinner party is a success without at least one physicist."⁴



PHYSICS TODAY'S FIRST COVER IMAGE juxtaposed cyclotron piping with J. Robert Oppenheimer's iconic porkpie hat. The artwork scattered throughout this article and the advertisement on page 38 come from volume 1 of the magazine.



HENRY A. BARTON served as director of the American Institute of Physics from the institute's inception in 1931 until July 1957. (Photo by Blackstone Studios Inc, courtesy of the AIP Emilio Segrè Visual Archives, Barton Collection.)

The newfound cultural prestige, combined with unprecedented funding from the federal government, had an immediate effect on physics enrollments in the nation's colleges and universities. Graduate-level enrollments across all fields of higher education grew rapidly after the war, spurred in part by funding made available to veterans by the GI Bill. Physics grew fastest of all; its annual enrollment doubled nearly twice as quickly as the average pace across all fields of study. In 1950 US physics departments produced three times as many PhDs as in any prewar year. That number would climb still higher, by another factor of three,⁵ following passage of the 1958 National Defense Education Act, a response to the Soviets' launch of the *Sputnik 1* satellite in October 1957. (See also reference 2, page 280.)

Research journals such as *Physical Review* struggled to keep pace with the huge influx of new submissions coming from all those freshly minted PhDs. As the journal saw its annual page count rise by 20% for several years in a row, its managing editor, Samuel Goudsmit, received complaints from longtime readers who had to "cope with scientific literature by the ton." A few years later, Goudsmit conceded that the physics community had "long ago passed the psychological limit above which the subscriber is overwhelmed by the bulk and looks only at the few articles in his own narrow field" (reference 2, page 293).

PHYSICS TODAY launches

The trends toward numerical growth and research specialization were evident within months of the war's conclusion. As early as December 1945, leaders of AIP thought the answer may lie with the print medium. Publishing need not only drive specialization, they argued; perhaps it could fight it as well. In a groundbreaking move, AIP leadership proposed that the institute launch its own publication rather than merely acquire journals from its member societies. First and foremost, the new magazine should foster unity among physicists and their societies.

An essential step toward that goal, argued AIP's Policy Committee, was to find some way to finance the new venture so that all the 7000 people who paid dues to at least one mem-



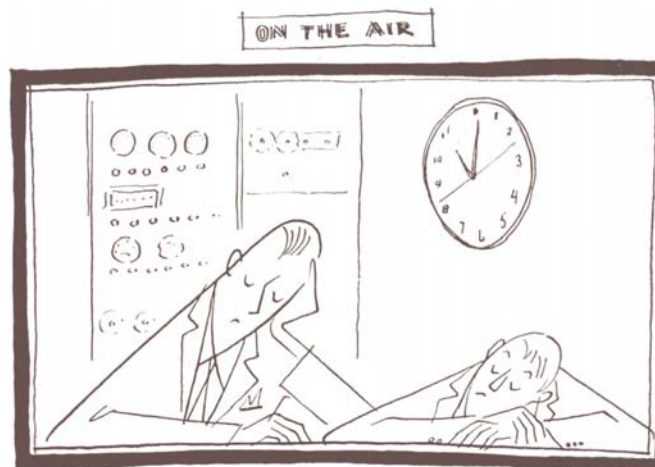
ber society under the AIP umbrella could receive the magazine for no additional cost.

During the next year and a half, even as committee members debated formats and financing—should AIP produce "a modest mimeographed dodger" or "a slick newsstand competitor of the national weeklies"?—they remained resolute about the new magazine's purpose: It should provide a "bond of unity" for the nation's physicists and serve as a magnet to attract those who had "strayed from the fold." Over the course of 1946, the institute's leadership battled around several names for their new publication, including *Atom*,

The Nucleus, *Matter and Energy*, *Atomic Era*, *Atom Progress*, and even *The Magazine of Progressive Physics*. Finally, they settled on *PHYSICS TODAY*.⁶

Giving the magazine a name was one thing; figuring out how to pay for it was quite another. At the time, research journals depended on page fees paid by authors (increasingly from external grants) to offset publication costs.⁷ But *PHYSICS TODAY* was not a research journal, so some other financing scheme was needed. Early in 1947 a special "Committee on Financing New Journal" wrote to the presidents of more than 600 physicist-employing companies throughout the country to plead for donations. *PHYSICS TODAY*, the committee argued, would be the natural culmination of AIP's aim to integrate industrial and academic physicists. In just three months, nearly \$20 000 came in (more than \$270 000 in 2018 dollars), about one-third of the needed startup funds. Other appeals went to advertisers. No other magazine, AIP director Henry Barton noted, could get into the hands of all the nation's physicists at once.^{8,9}

To physicists themselves, the magazine's backers explained their main goal: to "inform physicists of general trends in fields outside their own specialties" and thus to contribute to "a sense of professional unity and morale." Leading physicists, explained



PHYSICS TODAY ORIGINS

a leaflet prepared by Barton to announce the creation of the new magazine, had long seen the need for a new publication to knit US physicists back together—some common venue over and above their specialized research journals. PHYSICS TODAY would be the answer. It “will be reportorial, non-technical, and will present its information in an attractive form and in a comfortable style. Fundamental concepts rather than technical details will be emphasized. Each article will be written for the reader outside the subject under discussion.”^{8,9}

The new editor, David Katcher, hit the same notes in an editorial he wrote for the inaugural issue of the magazine. “There is sectionalism in physics as in any field of human endeavor,” he began; physicists naturally had their own “group loyalties and skepticisms.” Yet those group loyalties had assumed a new dimension after the war. “Another compartmentation is appearing. Slowly, as fields of research become more and more specialized, the knowledge shared by research workers in their technical journals is becoming a secret understood only within the specialized field.” The time had come to stem that tide.

From the start, PHYSICS TODAY was a hybrid, neither club newsletter nor research journal. Its cousin journals published by AIP featured plain, no-nonsense covers, but PHYSICS TODAY's editors wanted to strike a more personal tone. The inaugural

issue featured a striking image on its cover:

J. Robert Oppenheimer's famous porkpie hat placed jauntily amid cyclotron piping. A clever combination, the cover captured in one frame what Barton called the relation of the civilian headgear to atomic energy, two instantly recognizable symbols of US physicists' postwar world. On 4 May 1948, soon after the issue appeared, a relieved Barton wrote to Oppenheimer, glad that AIP's “slight gamble on your good nature” had been received well by Oppenheimer himself.⁹

Inside the covers, the differences between PHYSICS TODAY and the AIP journals widened further. Early issues included several regular columns: a one-page “Institute doings,” in which Barton described the latest official news from AIP; “News and views,” which offered informal updates on physicists' activities and awards; “Washington letter,” on the latest science policy developments; “Notes from abroad,” on colleagues overseas; and “Journal notes,” specially prepared

brief descriptions of a handful of articles that had appeared in the regular research journals.

But the real meat of PHYSICS TODAY consisted of its feature articles. The brief articles were written by experts who attempted to explain to the nonspecialist what was most exciting in their corners of the discipline. Katcher strove in the early issues to solicit feature articles across the spectrum of physics, from central fields like high-energy physics, solid-state physics, and low-temperature physics to border areas such as medical physics, astrophysics, and geophysics.

Early reactions

Initial reactions were mixed. A lengthy review of the new magazine published in the August 1948 issue of *Mechanical Engineering* noted approvingly that “the reader will find no mathematics and no five-dollar words.” But few seemed to know what type of publication PHYSICS TODAY was meant to be. Some readers, complaining bitterly about the need to put up with so many advertisements, found it an uncomfortable mix of genres

between high-end glossy magazines and technical journals. Others complained that the new magazine was “too gossipy.”^{9,10}

The biggest challenge was finding the right level of technical discussion. If the main target audience was to consist of professional physicists, then the feature articles need not be as simplified as those in, say, *Scientific American*. Yet if the publication really was to serve as a counterweight to specialization, then the articles had to be pitched at a less detailed level than those in *Physical Review*.

No obvious templates existed for that broad middle ground. For one thing, *Scientific American* presented something of a moving target. In 1948, the year PHYSICS TODAY first appeared, three entrepreneurs had bought the century-old *Scientific American* and conducted a thorough makeover. Rather than continuing to rely on journalists to write celebratory puff pieces on the latest scientific and technical gadgets, the new editorial team began soliciting articles from working scientists, asking them to explain their research in accessible terms. Their strategy, in other words, shifted much closer to the one being hammered out for PHYSICS TODAY.

Differences certainly remained. *Scientific American* still aimed, as an early editorial had put it, at the shop-floor worker along with the factory president, the farm hand as well as the agricultural college graduate. But the differences between the two magazines seemed increasingly to be differences of degree. For better or worse, *Scientific American* no longer provided AIP officials with a clear-cut example of what not to do.¹¹

The problem of finding the right technical level came to a head in the fall of 1949, after A. E. Benfield, an assistant professor of applied physics at Harvard University, complained to AIP's Executive Committee that the feature articles in PHYSICS TODAY seemed to have been written “for a juvenile audience.” Katcher was put on the defensive. In a memorandum to Barton, he once more explained his editorial vision: “We advise our authors to write for an hypothetical intelligent person who does not have command of the terminology current in the field being discussed.” The goal was to publish articles that would appeal across specialists' boundaries. Katcher continued, “The value





of the material is supposed to increase as distance from the specialty under discussion is increased. This is exactly opposite to scientific publishing and is the foundation of this experiment. Our hope is that, since

a reader is specialist in fewer subjects than his [sic] is non-specialist in, that he will find, in the magazine as a whole, a useful and informative content."¹⁰

Barton forwarded a brief version of Katcher's response to Benfield, but the young professor remained unconvinced. The magazine's intended readership was still too broad, Benfield wrote back.

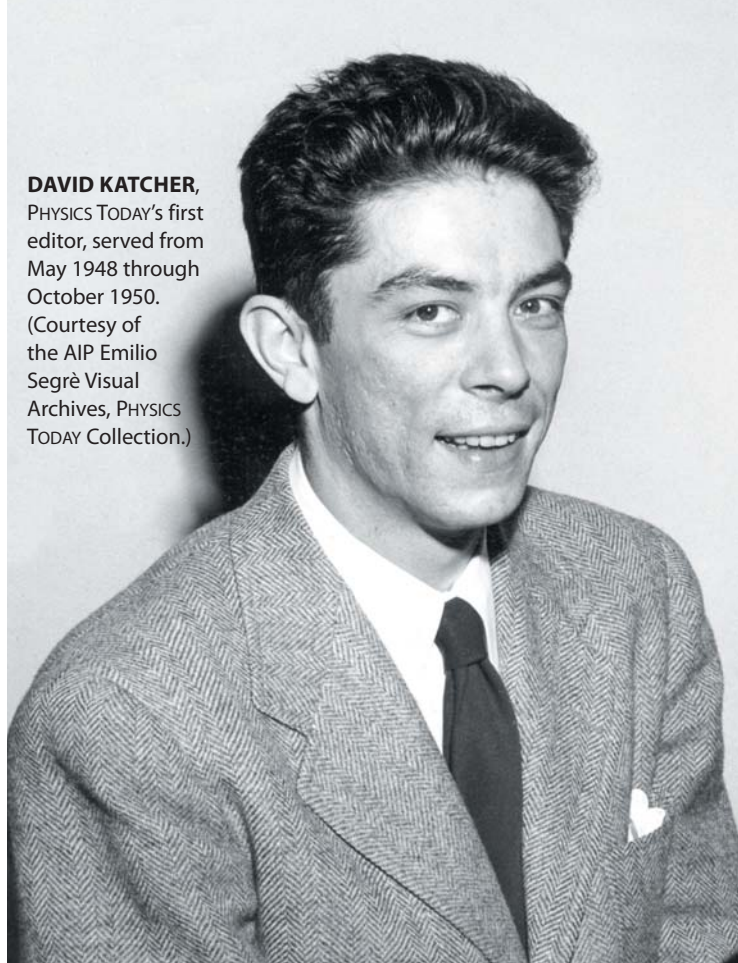
It is as though you were running a summer hotel in the mountains and decided that it would be very nice to organize a day's hike for the guests; everyone is to have a good time. The guests include one or two good rock-climbers, one or two people who like climbing on paths but get dizzy on steep places, and a tired business man with his pregnant wife, twelve-year-old daughter, and four-year-old son. Just where would you take these people and make them *all* happy? I feel that PHYSICS TODAY aims, figuratively speaking, somewhere between the girl and the boy. The rock-climbers and the path-climbers have a pretty dull day. They have to read a "million millionth," for instance, instead of 10^{-12} , to take just one unimportant example. . . . I wouldn't mind reading a million millionth, of course, if the articles did not seem to me to be correspondingly watered down.¹⁰

Benfield was not alone. Katcher reported that he continued to receive mixed messages, some complaining that the magazine was "keyed too low, technically," others that it was "keyed too high, technically."⁹ No one seemed to know how to navigate the new publishing terrain.

The challenges remained unresolved nearly two years into the magazine's existence, when Katcher yet again tried to articulate his vision to AIP leadership: "Put wryly," he wrote to the Committee on PHYSICS TODAY on 15 February 1950, "the aim has been to provide a periodical that would dissatisfy the most people least rather than satisfy the least people most." His had been a "buckshot approach," he continued, "in which we hope to hit individual interests every so often." Only that way, as far as Katcher could see, would PHYSICS TODAY have any hope of fulfilling its principal goal, to foster "unity in the profession by providing material of interest in fields outside the reader's own."¹²

Financial difficulties also kept the magazine floundering. Early advertising revenues fell short of the publication's goals, and it lost money throughout its first year and a half. AIP leadership decided that beginning in 1950, PHYSICS TODAY would be sold by subscription to those in AIP member societies rather than supplied as part of what they get for their dues. Many feared that the turn to subscriptions—especially at the high price of four dollars per year (more than \$40 in 2018 dollars)—would undo the magazine's ability to serve as "a unifying thread for the entire profession," as physicist and Caltech president Lee DuBridge wrote to Barton on hearing of the new decision.¹⁰

DAVID KATCHER,
PHYSICS TODAY's first editor, served from May 1948 through October 1950. (Courtesy of the AIP Emilio Segrè Visual Archives, PHYSICS TODAY Collection.)



Other senior physicists offered their own advice to AIP leadership. Stop trying to compete with *Scientific American*, several suggested; to be truly useful, PHYSICS TODAY should become a genuine house organ for the institute. It could publish programs of upcoming meetings, abstracts for talks and forthcoming articles, and even letters to the editor sent in to the institute's main research journals, thus alleviating much of the pressure on publications such as the *Journal of Applied Physics*. If the institute were to bring in some "sober people" to "devise a simple economical and final format which can serve these professional needs without fancy flashiness," one correspondent explained, then the magazine could once again be sent gratis to everyone in AIP's member societies. Others reasoned that if the magazine simply settled down a bit and stopped "vacillating" on policies, it would be able to attract a more steady stream of advertisers and carry on with feature articles aimed across the specialties, thereby "promoting unity among the physics family."¹³

By late 1952, after strenuous fundraising efforts by Barton and his colleagues, AIP was again able to send PHYSICS TODAY to all those in member societies for no additional fee. Between the time of Barton's initial fundraising letters of 1947 and his new efforts late in 1952, the rolls of the member societies had more than doubled, to 15000. "A group so large, driven ever to greater specialization," Barton explained in a 12 September 1952 press release announcing the new circulation policy, "can only with the greatest difficulty maintain unity and combine strength in advancing commonly held objectives." PHYSICS TODAY might not be perfect, but it was the best hope the community had for





countering the strong centrifugal pressures. The decision to send PHYSICS TODAY to everyone in a member society was an expensive one; Barton noted

in his annual report that a reserve fund of \$35 000—about \$325 000 in 2018 dollars—had been needed just to cover 1953. But, he said, it was “worth the cost.”¹⁴

Looking ahead

The leaders who launched PHYSICS TODAY aimed for a sort of hybrid, some superposition of research journals like *Physical Review* and popular magazines like *Scientific American*. But neither of those reference points remained static after World War II. PHYSICS TODAY continued to adapt as well, publishing its first letter to the editor in September of its inaugural year and later consolidating sections into staples like “Search and discovery” and “State and society” (see PHYSICS TODAY, May 1998, pages 6, 9, and 24). To this day, PHYSICS TODAY remains a critical resource for historians of science for the way it captures the shifting concerns in the physics community. As advertising revenues rose and fell with the contours of physics funding more generally—up steadily throughout the 1960s, down sharply in the early 1970s, up and then down again during the 1980s and 1990s—the width of each issue waxed and waned.

Meanwhile, the pressures of specialization continued to escalate. As early as 1949, physicists began to suggest that *Physical Review* be split into separate journals that catered to distinct specialties. In 1955, when members of the APS Executive Council scuttled one such proposal, their arguments echoed Katcher’s opening editorial in PHYSICS TODAY. As internal memos noted, the decision was made “for ideological rather than other reasons. Influential Council members deplored any tendency to compartmentalize physics.” That sentiment proved persuasive until 1970, when *Physical Review*’s Goudsmit finally bowed to the realities of continued year-over-year growth and split the journal into four distinct, biweekly journals. Leading journals based in Europe, such as *Nuclear Physics* and *Zeitschrift für Physik*, split into topical journals at about the same time.²

Today APS publishes 11 topical *Physical Review* journals plus *Physical Review Letters* and *Reviews of Modern Physics*; AIP publishes 18 research journals of its own. The frontiers of the discipline continue to evolve. Huge areas of activity such as soft condensed-matter physics and biophysics had virtually no place in Goudsmit’s journal. Emergent fields like nanotechnology and quantum information blur boundaries between physics and neighboring domains of science and engineering. And Goudsmit would likely find today’s pace astonishing: Several subfields on the arXiv preprint server now receive an average of more than one new research paper every hour of every day.

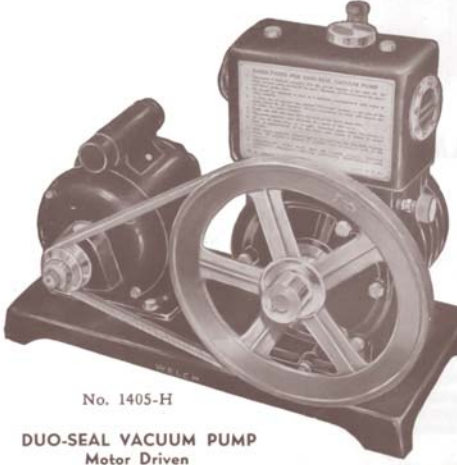
The circulation of PHYSICS TODAY presently tops 120 000, almost 20 times greater than when the magazine began. Daily online content and expanded commentaries complement its monthly print issues. Who knows what features—exploiting



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media that might not even exist today—will help connect far-flung members of the physics community a few decades from now?

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