After the development of optics and relativity, we introduce quantum mechanics by building on the student's newly acquired knowledge of waves and the idea of Lorentz invariance. (The Schrödinger equation is neither needed nor used.) The ideas of energy and momentum are developed in an unconventional but logically defensible fashion. Classical mechanics is treated as the "geometrical optics limit" of quantum mechanics.

At the end of the first semester, the students end up with a mathematically simple, but conceptually nontrivial, acquaintance with relativity and quantum mechanics, the two legs upon which modern physics stands. They have also had the chance to grapple with some of the most exciting and mysterious ideas advanced by modern science and have made a start in understanding classical mechanics. Ample time for such other subjects as electromagnetism and applications of classical mechanics is available in the second semester.

Perhaps the biggest lesson we have learned so far is that optics and relativity may indeed be more effective than mechanics as an entrée into physics for beginning college students. The strong interest in the subject matter shown by the students in the pilot section of this course encourages us to believe that we are on the right track.

We have had to produce extensive course notes for the students, as most of the course material course is not covered satisfactorily in traditional physics texts. This material is available on the World Wide Web in the form of Postscript documents linked to an html backbone: http://www.physics.nmt.edu/raymond/phl2x/phl2x.html.

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AMATO REPLIES: The objections raised by Jones, Daniels and Chasnov to nontraditional introductory physics texts and curricula are important and understandable. Their concerns mirror my own immediate reactions to proposed reforms in, say, mathematics or chemistry education.

I was introduced to physics through the use of a traditional text, and I believe it served me well. But readers of PHYSICS TODAY are not typical of the students currently enrolling in our introductory physics classes. Education researchers have demonstrated incontrovertibly that there is often a shocking disparity between what we think we are teaching our students and what they carry away from our classes. Coverage is not the same as learning, and, in the traditional text, physics fundamentals are often drowned out by details. Indeed, it is for precisely this reason—that the traditional approach obscures fundamentals—that these new texts and teaching strategies have been devised.

Furthermore, it is well known by educators from elementary school through college that organizing subject matter around an easily identifiable theme enhances teaching effectiveness by heightening student interest and motivation to learn and by promoting integration of the various course topics. The new texts do that admirably, without sacrificing the treatment of the principles of, say, classical mechanics or electromagnetism.

I do not agree that the introductory course should purposely serve as a "filter," or that it should be a primer for the engineering curriculum. The primer strategy has led to the inexorable swelling of the traditional text and, as reported by education researchers, to the pedagogical decline of the introductory course. The fundamentals of physics are eminently applicable and transferable to the other sciences and engineering, and our mission should be to highlight these principles and make them as understandable and accessible as possible.

I regret that I learned of Sherwood and Chabay's supplemental materials on waves only after my article was in press. In that article, I also criticized Randall Knight's treatment of statistical physics in his *Physics: A Contemporary Perspective* as being "uncharacteristically complicated and [in] need [of] revision." I based my criticism on the "preview" edition of his text. The "preliminary" edition, which I received too late to review, contains a substantially revised treatment that is very much improved.

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Cat Tales Reveal Footnotes to History that Give One Pause

On behalf of the late F. D. C. Willard and myself, I would like to congratulate Beatrix Ottoline Sophia von Schnurr on having joined the select ranks of uncredentialed authors who have received a byline in a leading physics publication. Of course, as made evident in her "Memoirs of Schrödinger's Cat"—as told to Daniel Kleppner (PHYSICS TODAY, November 1996, page 11)—Schrödinger belonged to her, not the other way around, and she was a domineering genius who more than lived up to her initials.

My professional relationship with Willard was quite different. In 1975, I wrote a paper on a proposed model for the spin exchange in solid helium-3, with the objective of submitting it to *Physical Review Letters*. When I showed it to another member of the Michigan State University physics department, he said, "Yes, it's a fine paper, but they will send it right back"—his reason being that I had used "we" everywhere and there was only one author. I called PRL and was told, "No, we'll just change the 'we' to 'I' everywhere." Now I understood the inexplicable use of "I" by some authors! To avoid that fate and also a complete rewrite of the paper, I hit upon the idea of simply adding a second author. I chose Willard, and the coauthored and peer-reviewed paper was duly published.[1]

Shortly thereafter, a visitor to MSU asked to talk to me, and when told I was unavailable, asked to talk with Willard. Everyone laughed, and soon the cat was out of the bag. You see, Willard's full name was Felis Domesticus Chester Willard (my cat Chester having been sired one summer by Willard, probably the scruffiest cat in Aspen).

Most of my colleagues thought it was a good joke but one or two felt it a bit disrespectful, and one who was an editor did not seem too amused. Nevertheless, Willard's reputation slowly spread.

I made a few reprints labeled "compliments of the authors" and signed by myself (handwritten signature) and Willard (print of inked paw), and I sent copies to a few acquaintances and also to a certain physicist in Grenoble, France. He later told me that at a meeting to decide who to invite to a conference, someone had said, "Why don't we invite Willard? He never gets invited anywhere." The reprint was shown around, and everyone agreed that it seemed to be a cat's paw signature. Perhaps that was why Willard never got invited, and neither did I.

Another physicist told me that whenever a supplicant visited him at the National Science Foundation and the conversation lulled, he would bring out the Willard paper. His habit may have had an effect on my own grant-getting efforts.

Willard's greatest triumph as a

writer of record was probably his becoming the sole author of a paper in *La Recherche*,[2] which also revealed his fluency in French (much to my amazement). What happened was that some of my collaborators were trying to write a popularized version of the spin exchange in solid ^{3}He. They fell to bickering about how to present the ideas and reached a point where no one was willing to sign the finished product. So they simply made Chester the author.

Indirectly, Willard also contributed to our department's collective reputation by enabling the chairman to inflate by one some administration-requested statistic on the department's published authors.

References

1. J. H. Hetherington, F. D. C. Willard, Phys. Rev. Lett. **35**, 1442 (1975).
2. F. D. C. Willard, La Recherche, no. 1, September 1980.

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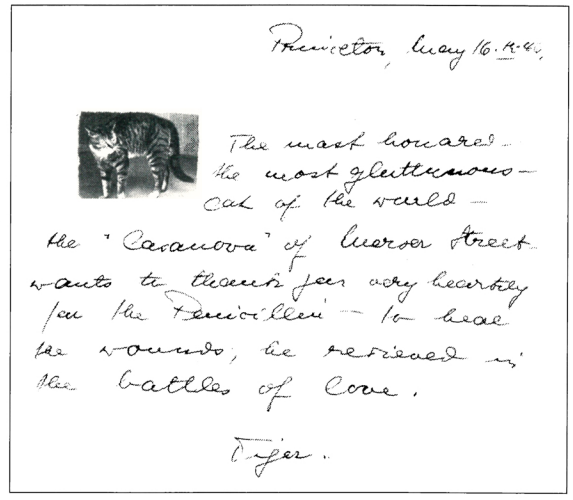
Imagine the possibilities of Schrödinger's cat, Beatrix Ottoline Sophia von Schnurr, getting together with Einstein's cat, formally known as Tiger but also called "the 'Casanova' of Mercer Street." There's no record of any such encounter, and I never met Beatrix, but my family once earned Einstein's gratitude for being kind to Tiger.

When we moved to the Princeton, New Jersey, area in the summer of 1945, my parents contacted Einstein's personal secretary, Helen Dukas, and made her aware of a long-ago personal contact—as a pre–World War I medical student in Freiburg, my father had known Helen's sister.

Subsequently, Einstein's younger daughter, Margot, made several visits to our house, located a mile outside Princeton amid potato fields and pastures, to take in the wonders of nature.

On one occasion, in May 1946, we were invited to Einstein's house for tea. Before going, we learned that Tiger had a skin problem resulting apparently from a fight with another cat. So, when we went for tea, my father, a bacteriologist working on penicillin research at a pharmaceutical company located across Route 1 from our house, took along some hard-to-obtain penicillin ointment for Tiger—and my sister Gabi brought along her prized autograph book.



Einstein drew a little sketch of Tiger in the book, and then autographed it (below left). Today, Gabi values that particular page all the more because on the other side is the autograph of Eleanor Roosevelt.

After our visit, there arrived by mail a thank-you note (above) that was adorned with a photo of a tiger-like cat (presumably the real Einstein Tiger), dated May 16 of that year and signed by Tiger, and that read as follows: "The most honored - the most gluttunous [*sic*] - cat of the world - the 'Casanova' of Mercer Street wants to thank you very heartily for the Penicillen [*sic*] - to heal the wounds, he received in the battles of love."

Neither Gabi nor I know for sure who actually wrote the note. It certainly was not Einstein, although he may have dictated it. Possibly it was our visitor Margot.

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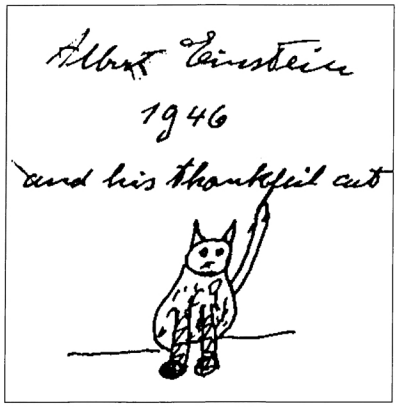

Our Twiggy is an experimental cat, not a theoretical cat like Schrödinger's. Very paws-on and deeply enmeshed in her work, she has put cat's cradle behind her and is now wrestling with the practical applications involved in the integration of chaos theory with multidimensional string theory.

WILLIAM R. HITCHENS
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In an induced state of serendipity after reading the entertaining "Memoirs of Schrödinger's Cat," I spent an hour working on an experiment with interfering catlike photon states.

In essence, I repeated Young's famous double-slit experiment but replaced the slits with two apertures in the shape of cats in two different states of liveliness. (See the accompanying illustration.) Immediately behind the screen, a photon passing through the apertures takes on the shape of a cat—or of two cats if both apertures are unblocked. In the two-cat case the far field shows clear interference fringes, proving that each photon must have taken on the two cat states at the same time.

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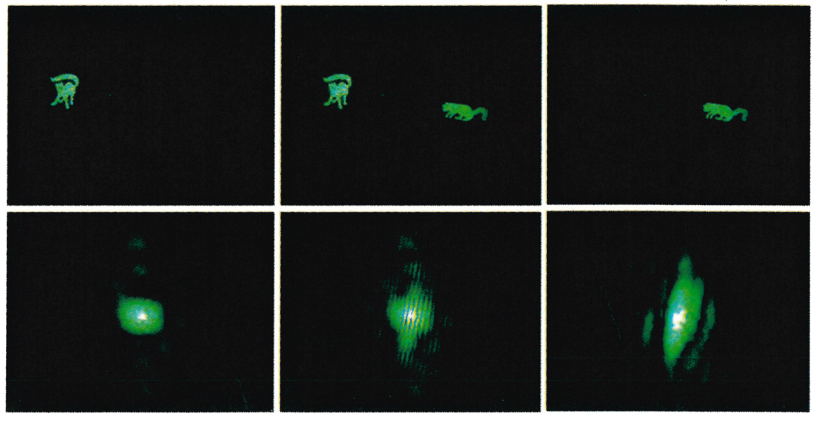

KLEPPNER REPLIES: I was so impressed by the quality of Ted Hänsch's interferogram that I carried out a two-dimensional Fourier transform of it in an attempt to recover the original images. The cats reappeared with such astounding fidelity that the live cat actually started to walk away. To my dismay, it dropped dead after taking a few steps, and the dead cat jumped up and ran off. Apparently I somehow got the phase wrong. Whatever the cause, the moral is clear: Messing around with quantum measurement theory is dangerous.

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Model Needed for West Coast Freeway Traffic Doing the Wave

I enjoyed the "Physics Update" piece on a model for the dynamics of a flock of birds, a school of fish etc. (December 1996, page 9). If it hasn't been done already, such a model should be put together for traffic on the California freeways, particularly those of the San Francisco–Oakland and Greater Los Angeles areas.

Traffic travels like a wave, with the slow parts being just a function of traffic, not of a specific cause (such as an accident). Think of how cars can be traveling along at the speed limit and then, suddenly, for no apparent reason, have to slow down—but later get back up to full speed again. A model would help us to better understand the wave patterns.

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Corrections

March 1997, page 107—Stephen L. Adler's correct e-mail address is adler@sns.edu.

September 1996, page 122—Owing to an editorial oversight, C. E. Mandeville's letter to the editor about Ernest Lawrence and W. F. G. Swann told of their shelving the idea of creating a particle accelerator but failed to mention that Lawrence unshelved the idea "after the advent of efficient diffusion pumps."

January 1996, page 71—A listed book, *The Structure and Bonding in Condensed Matter* by Carol S. Nichols, has been recalled from publication and declared out of print by the publisher, Cambridge University Press. ■