Sir Wilfried Le Gros Clark's 1949 articles on the structure of the retina and the lateral geniculate nucleus. In all these there is much that is as valid and stimulating today as it was when it was first written.

MacAdam has assembled an excellent collection of writings. Every worker in the field of color will find it fascinating and instructive to follow the development of the foundations of spectrophotometry and colorimetry and of visual theory, which we so often take for granted today. It is a pity that several important works, notably those of Goethe and of Hering have been omitted, but translations of these are available elsewhere. But it is not only historical interest that this book provides. The research worker of today will find, too, that there are many stimulating ideas that may provoke him to new lines of research.

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The reviewer, a physicist, has worked in the fields of color measurement and color vision since 1962, first at the Imperial College of Science and Technology, London, UK, and since 1966, at the National Research Council of Canada in Ottawa.

Equations of Mathematical Physics

By V. S. Vladimirov
418 pp. Marcel Dekker, New York, 1971. \$19.75

A member of Moscow's Steklov Institute of Mathematics, Vasilij Vladimirov is well known in mathematical physics for his important monograph on analytic functions of several complex variables and for his work (with Nikolai Bogoliubov and with A. A. Logunov) on analyticity questions in quantum field theory.

His present book, one hastens to add, is of a much less forbidding nature. "Mathematical physics," as Solomon Mikhlin claims in his own recent book on related topics, "can be regarded as an aspect of the general theory of partial differential equations." (And what can't, after all?) Much in the same spirit, Vladimirov's *Equations of Mathematical Physics* primarily deals with the wave equation, the heat equation and the Laplace, Poisson and Helmholtz equations. They figure, respectively, as representatives of the hyperbolic, parabolic and elliptic types or, in physics terms, of vibrational, diffusion and steady-state problems.

After a short but very readable review of material related to Lebesgue integration and a few remarks on linear operators there is an introductory section on linear second-order partial differential equations, their classification by types and the corresponding boundary-value problems. There also is a short discussion of correctness classes, within which solutions exist uniquely and depend continuously on the data, thus ensuring stability with respect to small variations or uncertainties in, for example, the source term or the boundary conditions.

The advent of generalized functions meant dramatic progress in the field of differential equations. Freed from all kinds of bothersome smoothness and growth conditions one now has a well defined framework for the consideration of singular sources and boundary values, of solutions exhibiting sharp wavefronts or otherwise nondifferentiable in the classical sense and so forth. Consequently Vladimirov devotes much space to a careful exposition of basic distribution theory, after which the discussion of fundamental solutions and of the classical and generalized Cauchy problem for the wave and heat equations becomes elegant and simple.

The solution of the Dirichlet or Neumann problem for the Laplace equation is complicated by the fact that only the function *or* its normal derivative are given on the boundary. Therefore Green's formula cannot be used directly because it would require the knowledge of both. For smooth (Liapunov) boundaries the problem may be reduced to an integral equation for the density of a double or single-layer potential. Vladimirov backs this up with a chapter on Fredholm equations and a nice introduction to classical potential theory.

Finally, the method of energy integrals is applied in a short discussion of classical and generalized solutions of "mixed" problems—hyperbolic and parabolic equations with initial conditions and spatial boundary values.

Since it is well written and because of a very careful selection of the material, this book should present no problem to the first-year graduate student. Based on equations from physics, it is a text of modern mathematics and will be welcomed as such especially by those who are annoyed with the practice of having to study the same mathematical structures twice, three times or more with slowly increasing rigor in the application-oriented courses of various levels.

Ludwig Streit
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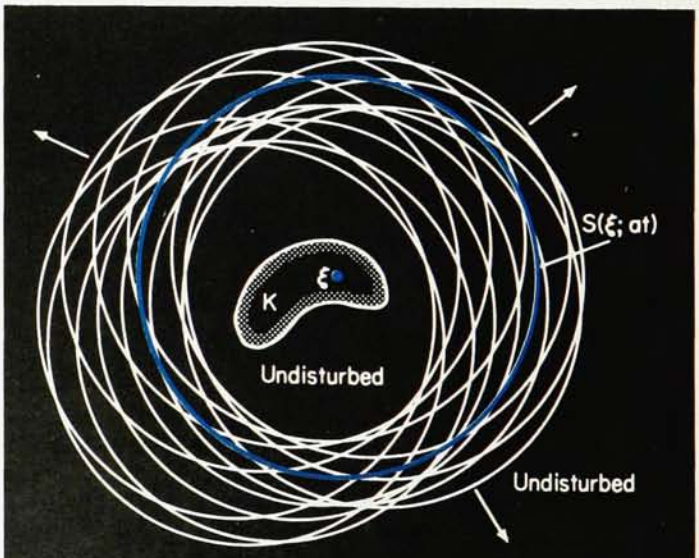


Wave disturbance generated by a solid source. The colored wavefront originated at the point ξ; from *Equations of Mathematical Physics.*

Physics Demonstration Experiments, Vol. 1: Mechanics and Wave Motion, Vol. 2: Heat, Electricity and Magnetism, Optics, Atomic and Nuclear Physics.

H. F. Meiners, *ed.*
1394 pp. Ronald Press, New York, 1970. \$30.00

The last 30 or 40 years have seen dramatic changes in the undergraduate physics curriculum, most of them for the better. The obvious examples are provided by the migration of relativity and quantum mechanics from the second year of graduate school to introductory and intermediate-level undergraduate courses. Lectures at all levels are much more sophisticated than in former years. But one has the feeling (backed up by no questionnaires) that along with these changes, our undergraduates do fewer laboratory experiments and that they see many fewer lecture demonstrations.

Obviously new material must crowd out old; there isn't time for everything. And yet one may ask whether something has been lost. Most of us became physicists because we were intrigued as children by the way things work, by rainbows and radios and dry cells and thermometers. Later we were equally delighted by lecture demonstration experiments that worked—and even by some that didn't work. Then, in a third level of delight, we found joy in the mathematical formulations that helped us to fit all these experiences together—or more or less together—in something called "physics."

The pressure to "cover material" (and perhaps our impatience) has made many of us try to take our students on a shortcut. We try to take them, even in elementary courses, directly to the joys of the blackboard and the text. For some students this works admirably. But for others we should not be surprised if they react, eventually, by wondering whether physics is really very much fun after all, or very relevant.

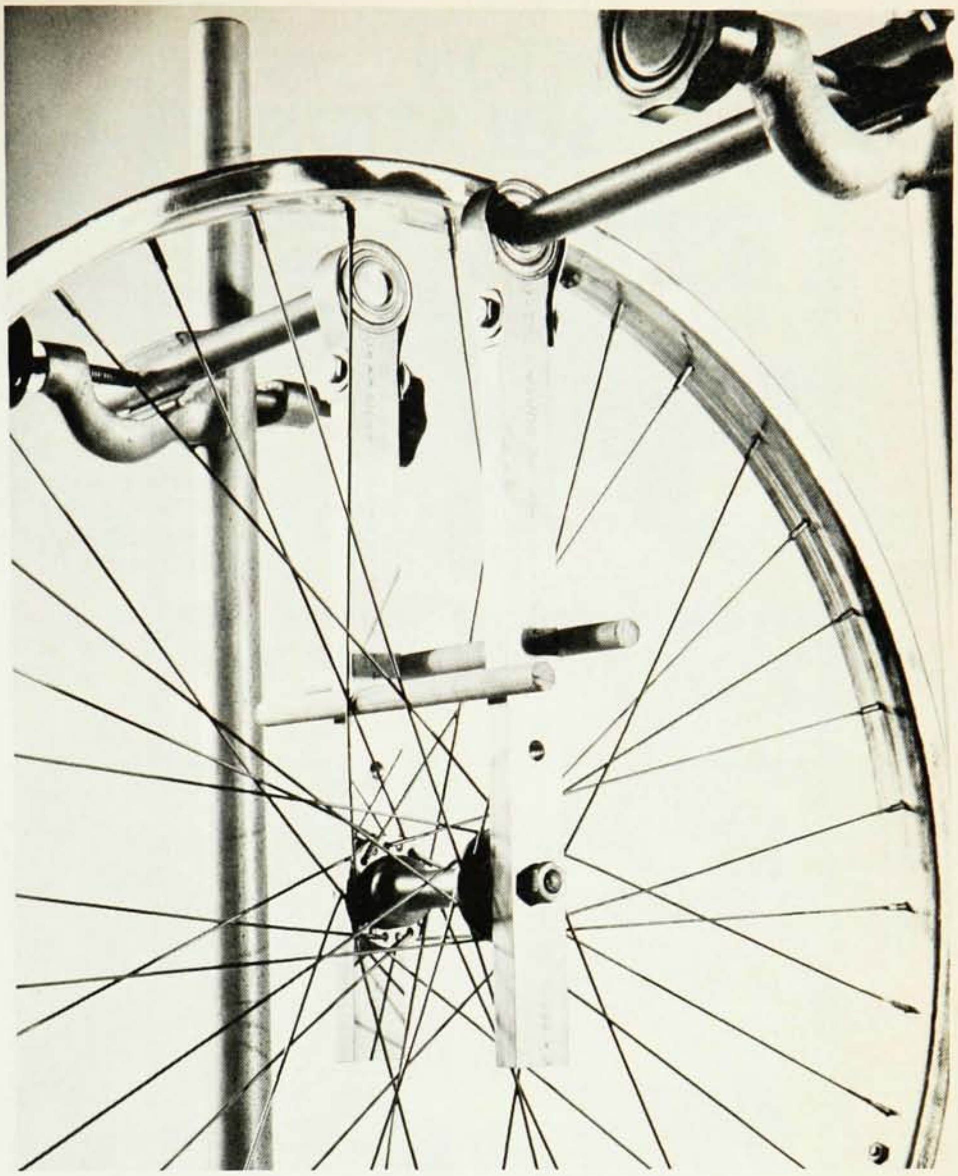
Physics Demonstration Experiments is a massive (1400-page) effort to revive lecture demonstrations. The product of many years of labor by a distinguished committee of the American Association of Physics Teachers, with support from the National Science Foundation, and ably edited by Harry F. Meiners, these two volumes should be available in every physics department, alongside Richard M. Sutton's *Demonstration Experiments in Physics,* which is still in print (McGraw Hill, New York). Sutton's classic experiments were purposefully *not* duplicated in this new work.

Over a thousand demonstrations are included. They range, in concept, from the utterly elementary to the highly sophisticated, and, in construction, from utmost simplicity to remarkable complexity. (Appendices with detailed instructions are provided when necessary.)

Each volume is introduced by general articles on the purpose and general techniques of lecture demonstrations, by such experts as Anthony French, Gerald Holton, Eric Rogers, Robert Pohl, Sir Lawrence Bragg and Rosalie Holt. These chapters should be required reading for young physicists teaching their first courses—and for all the rest of us at five-year intervals, at the least.

Volume I covers a vast array of demonstrations in mechanics, including the behavior of fluids and of waves. The second volume includes heat, thermodynamics, kinetic theory, gas laws, electricity and magnetism, optics and atomic and nuclear physics. Obviously not all of the demonstrations are of equal merit, and there are many duplications. But the diversity and even the duplications are of value, because they provide the flexibility that is needed.

It is, of course, relatively easy to find points about which to quibble. Significant details of construction are not always clear in the diagrams or discussions, but a reasonably clever physicist or instrument maker will have few real difficulties. A more important problem



A bicycle-wheel pendulum used to demonstrate the parallel axis theorem; from a chapter on rotational kinematics and dynamics in *Physics Demonstration Experiments.*

is presented by the absence of any titles or names at the beginning of each description of an experiment. Each experiment has a number, but (except in the index) none has a name. The diagrams and figures also lack descriptive captions, so one cannot brouse easily. It is no doubt ungracious to complain about this lack, since the editor has obviously done a heroic job. But perhaps appropriate titles and captions can be inserted when there is a second edition. One might also hope that a chapter on safety could be added. (Haven Whiteside's excellent chapter on lasers has a note on hazards, but other chapters suggest the use of such familiar materials as mercury and carbon tetrachloride without any hint that there may be dangers involved.)

One wonders if the editor and his committee had tongues in cheeks when they recommended absinthe as a diffusive element in a demonstration of the rotation of the plane of polarization in a sugar solution, and a silver half-dollar for a neutron-activation experiment. Alas, neither absinthe nor *silver* half-dollars are easily available any more. And to ask the National Geographic Society's "Bell Room" for "unbiased" information about Reis's claim to have invented the telephone is rather naive.

On a more serious level, one may ask whether many of the experiments do not violate the important rule laid down in the introductory chapters, that demonstrations should not include mysterious "black boxes" except under unusual circumstances. The purpose, function, and construction of each component should be easily apparent to the students. Yet some of the more elaborate demonstrations do call for a complex array of electronic or mechanical equipment. Such demonstrations are probably more effective as part of a laboratory course. This is not so much a complaint as a way of saying that many readers will find the book a gold mine, not only for simple, direct, and beautiful demonstration equipment for use in lectures, but also for complex resources for laboratory exercises.

Meiners and his committee are to be congratulated on the production of a work that will take an honored place alongside Sutton's classic book.

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Mathematics of Classical and Quantum Physics, Vol. I and II

By F. W. Byron Jr., R. W. Fuller
310 pp. and 659 pp. Addison-Wesley, Reading, Mass., 1969. $11.95

Textbooks on the mathematical methods of physics are a staple item on every scientific publisher's list. The faculty member who is assigned to teach the standard potpourri of mathematical techniques to beginning graduate students and advanced undergraduates finds himself confronted by a bewilderingly long shelf of textbooks. Obviously, some of these are better than others, but too many of them are indistinguishable if not undistinguished.

Happily, once in a decade or so, the list is upgraded by the publication of an interesting and original addition. The examples of Richard Courant and David Hilbert (1924 and 1930) and of Philip Morse and Herman Feshbach (1953) come to mind as landmarks of the past. More recently, the pragmatic book by Jon Mathews and Robert Walker, based on Richard Feynman's course at Cornell, has advanced the cause of the no-nonsense school of teaching mathematical techniques to physicists.

The two volumes on the *Mathematics of Classical and Quantum Physics* by Frederick Byron and Robert Fuller are destined to join the select group of books in this field that have significantly elevated the tone of instruction. In the wake of the improvements in mathematics education in the past 15 years, an overhaul of the traditional mathematical physics course was due. By designing a course that leads the student into, rather than merely to the threshold of, a number of interesting and important advanced mathematical topics, Byron and Fuller have taken a big step toward modernizing the curriculum. However, their style is still solidly rooted in the traditions of the mathematical physics of the past 50 years, with the impact of the "new math" only barely felt.

To be sure, many of the conventional items that used to be the stock-in-trade of a mathematical methods course are not elaborated in this book. Presumably, the reader already knows all he needs about power-series solutions of differential equations and about the