on a local causal order, a topology, a pseudometric, a coordinatization, an affine connection and a material distribution, each of which may in special cases be determined by the preceding. The work is too rich in geometrical ideas to summarize here. It is mathematical in content (Definition, Theorem, Proof) with frequent appeal to physics for motivation, and overlaps Busemann's book, which appeared a little earlier. Pimenov deals with Newtonian kinds of kinematic space, in which the causal relation tells little about the geometry, as well as Einsteinian, where the causal relation tells much about the geometry. This leads him to the more general conception of semi-Riemannian geometry, where the metric need not fully determine the affine connection and signals may propagate instantaneously in some directions, a degenerate limit of Riemannian geometry. One of the most interesting models of this kind he calls an "electrodynamic space." It is a plausible five-dimensional model of electromagnetism, with significant advantages over the Kaluza kind of model. Other internal degrees of freedom of current interest besides electric could also be modeled interestingly in semi-Riemannian spaces.

His frequent bibliographical discussions show Pimenov knows the work of other relativists well, but my informal survey suggests that the reverse is not true; and I find ideas I published as virgin were his long before. This is not entirely surprising because he has been confined for much of his career, and is in prison now; a consequence, it seems, of unofficial publication, and the cause of a deplorable lack of contact with the scientific community. But the resulting deprivation is not Pimenov's alone.

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Worked Examples in X-Ray Spectrometry

***By* R. H. Jenkins, J. L. DeVries**
127 pp. Springer-Verlag, N. Y.
1970. 5.80

This little volume is clearly designed to accompany and supplement the authors' earlier work on x-ray spectrometry and their forthcoming work on x-ray diffractometry. Worked examples, carefully selected and clearly explained, can obviously be of great help to beginners and to those to whom suitable academic training is not readily available. Both authors have had extensive experience in teaching students in various schools and seminars organized by N. V. Philips Co. of Eindhöven, Holland. Problems in the book have been selected with care and have been organized in a reasonable fashion. There are five sections dealing with spectra, instrumentation, counting statistics, quantitative analysis and "miscellaneous." A relatively small number of problems are of a general type; others deal with x-ray spectrometry and diffractometry in approximately equal numbers. The problems are graded in order of increasing difficulty. So far, so good.

Unfortunately, the book is marred by an intolerable number of typographical and other errors. A random check of some 20 problems revealed serious errors in almost every one. Also, the figures accompanying the text are often unclear. Explanatory texts directly beneath each figure would be of help to the reader, as would concise and meaningful titles for the many Tables.

In its present form this work cannot be recommended. It could, however, be recommended and serve a useful purpose if adequate care is taken in the preparation of a second edition.

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Theoretical Physics: An Advanced Text, Vol. 1: Theory of the Electromagnetic Field Theory of Relativity

***By* B. G. Levich**
395 pp. Wiley, New York,
1971. $15.50

Here we see the first volume in a series of four books on theoretical physics written for undergraduates and beginning graduate students in physics who are not able to cope with texts of the Landau and Lifshitz calibre. The author, Benjamin G. Levich, is associated with the Institute of Electrochemistry of the Soviet Academy of Sciences, and these books, published in Russia in 1962, have evidently found wide appeal as texts. Volume 1 of Levich's course deals with electrodynamics of classical systems, and might be compared with the third volume of the famous Sommerfeld lecture series. As might be expected, there are few surprises in the choice of material and exposition in Levich's text.

One good feature of this book is its treatment of radiation theory, which the student will find quite detailed. As an example, a nice derivation of the quadrupole radiation formula, $1 = (\ddot{D}_{\alpha\beta})^2 / 180c^5$, is given on page 133. Another good chapter is that dealing with the motion of particles in electric and magnetic fields, drift of particles in crossed **E** and **H** fields, and magnetic

mirroring in nonuniform fields. The writing is clear, accurate and pedagogical in style. As might be expected, the topics described above are not covered in great depth.

The section on scattering of particles deals not only with Coulomb scattering, but also with scattering by a general central force described by the potential $U(r)$. The angle of scattering as a function of impact parameter is deduced for arbitrary $U(r)$. An unusual aspect is Levich's discussion of how $U(r)$ may be deduced from experimental data on the differential cross-section for scattering. The implicit formula for $U(r)$ assumes a pleasingly simple form when the energy of the particle greatly exceeds U.

The final part of the book is a rather conventional exposition of relativity theory. Here a student can find simple examples of the decay of elementary particles, pair production by gamma quanta, and pion production in proton–proton collisions, all treated by dealing with the invariant $E^2 - p^2c^2$ before and after collision.

Although one cannot say that Levich's text fills a great need, its compact size would allow a student to cover all of its contents in a one-semester course, although the instructor would have to supplement the text with problems of his own choosing. A trivial criticism of the text is that some misprints on the value of electronic charge occur at least three times.

The inadequacy of "classical" electrodynamics at high field strength is well known. It will be interesting to see how the connection to quantum theory is made in the succeeding volumes of this series.

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Fundamentals of Physics

***By* D. Halliday, R. Resnick**
827 pp. Wiley, New York, 1970. $13.95

This is a calculus-level textbook designed for use in the standard introductory course for students of science and engineering that is taught in the majority of colleges and universities. It is not at all innovative, and indeed is not meant to be, but it is well organized and well written, and it should prove very satisfactory for its intended purpose. In fact it is surely one of the best of the currently available books of its kind.

It should be said at once that *Fundamentals of Physics* is not an entirely new book. It is essentially a somewhat briefer version of *Physics*, by Halliday and Resnick, which has been familiar to many students and teachers of phys-