short but elegant way, one turns to the orbit theory.

Chapter II discusses the various particle drifts resulting from external forces, non-uniform magnetic fields and time-varying electric fields. Adiabatic invariants are briefly discussed. In Chapter III these drift velocities and currents are combined to investigate the equations of static equilibrium, and in Chapter IV they are ones used to investigate dynamic problems. Exact static solutions (mostly boundary layers) are the subject of Chapter V while Chapter VI discusses small-amplitude plasma waves, including Landau damping, and Chapter VII contains a brief but lucid discussion of hydromagnetic shocks.

In Chapter VIII we turn away from orbit theory and introduce fluctuations in a plasma and Coulomb collisions. Emphasis shifts to the Boltzmann equation in Chapters IX and X as one discusses diffusion in velocity space and in coordinate space. Finally, Chapter XI covers stability theory in clear, but all too short, fashion and the last chapter touches on the coupling of plasmas and radiation.

The strong points of this book lie in the many clear, simple and highly physical derivations of familiar plasma relations. This will make this book a valuable text for a beginning course in Plasma Physics. It would seem to this reviewer to be the logical book to use following Spitzer's book in a basic course. For more advanced work one can turn to Thompson's book as well as Stix's.

There are some weak points as well. Some of the discussions, especially toward the end of the book, seem excessively brief and one hardly begins to touch on an interesting subject before it is over. This is especially true in the last two chapters. Also the coverage is far from being up to date. This is particularly true of stability theory since such things as finite larmor radius theory, resistive instabilities, non-linear, effects, micro-instabilities, universal instability, shear stabilization etc., are omitted or just barely mentioned. There is also no discussion of partially ionized plasmas. Some of the drawings in Chapter II and XI are rather poor and there are a few misprints.

All in all though, it is a very good book and will serve excellently as an introduction to the subject of high-temperature plasma physics.

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Chemical Processing of Uranium Ores. By E. T. Pinkney, W. Lurie, and P. C. N. van Zyl; published by the International Atomic Energy Agency, Vienna, 1962; distributed by National Agency for International Publications, Inc., New York; 77 pages; $1.00. (This book is bound with the one reviewed below.)

This is a small book which touches upon nearly all aspects of the relatively large field of uranium ore processing including mineralogy, physical concentration, crushing and grinding, various leaching methods, solid-liquid separation, various methods for recovering uranium from the leach liquors, a description of several processing plants and a general discussion of process economics. In some ways, it is similar to an annotated bibliography but is much more informative and should be useful to those desiring a general acquaintance with the field, as well as to the experts who wish to refresh their memory on selected subjects. Although the title implies that the principal content deals with process chemistry, much, perhaps most, of the book deals with descriptions of practical process applications. This is intended as an observation rather than a criticism since it is believed that the authors of any highly condensed review article must, of necessity, make a choice of emphasis.

The following more specific comments are offered:

(1) The authors, not unexpectedly, show a greater familiarity with processing practices in their own country (South Africa) than those in others such as the United States and Canada. This is undoubtedly contributed to by the greater diversity of ores and processes utilized in these countries and the lack of publications giving a thorough analysis of relative process merits. In the present book, various remarks, including a tendency to compare the advantages of one process with disadvantages of another, might give the reader the impression that the order of preference in the United States is $(NH_4)_2CO_3$ processing $>Na_2CO_3$ processing $>$ sulfuric acid processing. Actually the reverse is true, as it also is in Canada, for all ores except those of unusually high

lime content. Processing with $(NH_4)_2CO_3$ has never been used on a plant scale. Another misleading comment suggests that vanadium is recovered in the United States by ion exchange resin processes.

(2) To the extent that the book serves as an annotated bibliography, a larger number of references would be desirable.

(3) The discussion of comparative economics of ion-exchange versus solvent-extraction processing is in qualitative agreement with information available to this reviewer. However, in a more quantitative sense, the assumption of solvent losses at 0.07% of the aqueous flow may be questionable since operating plants have reported losses that are lower by a factor of 2 or more. Solvent losses comprise an appreciable portion of the total solvent-extraction costs, and assumption of lower losses would further increase the indicated economic advantage of solvent extraction even on low grade (0.2 g U_3O_8/liter) liquors. It might also be noted that the concentration of uranium in the liquor is not the only controlling factor in choosing between ion-exchange and solvent-extraction processing. For example, process development work on certain uraniferous shales showed a preference for solvent-extraction processing of liquors containing only 10-20 ppm uranium. This was due to the presence of relatively large amounts of molybdenum, phosphate and other contaminants which caused considerable interference with the ion exchange process.

(4) Appendix 1, on the general economics of uranium processing, is an interesting and valuable addition to the book. As a word of warning rather than criticism, the reader should be encouraged to use this information only within the limitations that are already carefully set forth by the authors. Quotation of these costs out of context would be of disservice to the authors and to the painstaking efforts that were obviously expended in accumulating the information.

Several other possible errors of commission, omission or implication might be commented upon, but it is believed that these, as well as those mentioned, do not detract in any large way from the value of the book. It is apparent that the authors are well informed in the field and have, with excellent organization, condensed a prodigious amount of material into a limited space. It should prove to be a worthwhile contribution to the published literature.

Tratamiento de Minerales de Uranio. By L. G. Jodra and J. M. Josa; published by the International Atomic Energy Agency, Vienna, 1962; distributed by National Agency for International Publications, Inc., New York; 54 pages; $1.00. (This book is bound with the one reviewed above).

This is also a small book which touches upon nearly all aspects of the field of uranium ore processing. Consequently, there is considerable overlap with the book by Pinkney, Lurie, and van Zyl. On the other hand, there are some notable differences. For example, in the book by Jodra and Josa, somewhat greater attention is given to such items as physical concentration methods, roasting, ore reception and sampling at the mill and preparation and packaging of the final product. Still more important is the difference in emphasis given to treatment of similar subject matter in the two books. Jodra and Josa devote a relatively large amount of attention to effects of important chemical and physical variables in the several unit operations in ore processing, along with reasons for these effects. Minimal attention is given to specific plant practices or process economics. As a result, they have produced a useful companion piece to the book by Pinkney *et al.*

Since the book by Jodra and Josa has not been translated from the original Spanish, any detailed comments by this reviewer suffer from an extremely low proficiency in that language. It does seem that some questions might be raised concerning:

(1) the suggestion that weak-base anion exchange resins are not useful, whereas it is probably possible to design suitable resins of this type;

(2) the suggestion that $UO_2(SO_4)_3^{-4}$ rather than $UO_2(SO_4)_2^{=}$ is the ion which transfers in the ion-exchange process;

(3) the statement that the structure of the uranyl di(2-ethylhexyl)phosphate complex is not defined, whereas the structure is now well understood;

(4) the quotation of soluble amine losses at 20 to 30 ppm in the aqueous phase, whereas the amines used in practice have much lower soluble losses.

The long reference list is a credit to the book. However, it is noted in several cases that the reference points could have been better positioned for leading the reader more directly to the best source of original detailed information.

However, these criticisms are minor in relation to the total work. It is simply not possible to give complete coverage to so large a field in such limited space, and the authors make no pretense at such an attempt. Little objection can be raised to the authors' particular choice of emphasis. It is evident that they are highly familiar with nearly all of the available literature and that they have succeeded in packing a surprisingly large and well organized amount of information into a small volume. It should prove useful to both the novice and expert in the field.

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