Physics of the Earth's Upper Atmosphere. C. O. Hines, et al., eds. 434 pp. Prentice-Hall, Englewood Cliffs, N.J., 1965. $17.35. *Reviewed by Jules Aarons, Air Force Cambridge Research Laboratories.*

The field of upper-atmosphere physics is at a stage where it needs coherence, perhaps even at the expense of not logically explaining all of the data now spewing forth. In the periodical literature we find the fine points examined more finely. We find the reworking of the concept of "dumping" of energetic particles from the radiation belt into the "splash" hypothesis. But the very existence of the belt, the flux, diurnal variation, and precipitation of particles at various energy levels, ought to be turned into a unified picture for the new research worker and student. Even if the data from one particle detector from one space probe at one time do not fit easily into the tale, the story should be told.

From this point of view, *Physics of the Earth's Upper Atmosphere*, edited and written by a group of scientists who are working or have worked at the Canadian Defense Research Telecommunications Establishment, is welcome. It handles the subject ably, emphasizing the program of the group (aurora, topside sounder, and wave motions) but considering the entire field in a comprehensive fashion. It is better rounded than other available texts in presenting amply all aspects of the physics of the atmosphere. The other (fine) work in the field, Ratcliffe's *Physics of the Upper Atmosphere*, is its only competition. The latter is older and contains a series of brilliant reviews but lacks the coherence of the Hines, Paghis, Hartz, and Fejer volume. On the bookshelf now we have the general volume of Ratcliffe, Davies' *Ionospheric Radio Propagation*, and a series of specialized volumes. Six years ago we had only Mitra's *The Upper Atmosphere* (even then aging).

The book's strength is its clarity and unity. It refers to equations and concepts developed earlier in the text; this is common in texts but uncommon in works on ionospheric physics. The book must be used by the lecturer with frequent glances at updating in the periodical literature; for example, the section on the temperature of electrons and ions at high altitudes must be revised with the observations and analysis from incoherent scatter radars. The use of topside-sounder data (of interest to the authors) on occasion goes beyond the available periodical literature but the absence of material on total-electron-content studies by dispersive Doppler and Faraday rotation from satellite transmissions and lunar radar (of interest to the reviewer) is an omission.

This work supplies a serious need in the field and does it well. Once fortified by the coherence of *Physics of the Earth's Upper Atmosphere*, the graduate student and the beginning research worker can face the incoherent world of the periodicals.

Variational Methods in Mathematical Physics. By S. G. Mikhlin. Transl. from the Russian by T. Boddington. 583 pp. (Pergamon, Oxford) Macmillan, New York, 1964. $14.50. *Reviewed by J. Gillis, The Weizmann Institute of Science, Rehovoth, Israel.*

While textbooks proliferate as never before, there are still a few corners of mathematics which lack adequate coverage. The subject of variational methods is one of these, and this translation of an excellent book is therefore timely.

The treatment is careful and thorough, and the classical variational methods are explained and justified in detail. There are a number of worked examples, almost all from problems on elasticity. It is just possible that the book would have made easier reading if many more worked illustrations had been provided.

The discussion is strictly limited to linear problems and no reference is made to recent work (chiefly in the USSR and the USA) on the application of variational methods to nonlinear systems.

There is an interesting final chapter on finite-difference methods. This has only a tenuous connection with the theme and title of the book but is no less useful for that. Its central idea is the "method of straight lines", which has been extensively developed in the Soviet Union. Regrettably little has been published on the subject in English and further exposition of the method would be welcome.

Matter, Earth, and Sky. (2nd ed.) By George Gamow. 624 pp. Prentice-Hall, Englewood Cliffs, N. J., 1965. $11.65. *Reviewed by Michael Danos, National Bureau of Standards.*

Humboldt is supposed to have been the last person who had mastered the complete accumulated knowledge of the Occident. Perhaps this legend is true. The possibility of another such occurrence seems to have been totally eliminated by the almost frightening pace of the development of science and technology in the intervening three-fourths of a century. This growth occurred both in breadth—the number of different specialized fields has multiplied, and in depth—no physicist can hope to know all of physics, and even no atomic physicist can hope to know all of atomic physics. Actually, it has never been possible to know all of a subject; undoubtedly, there existed details in the geography of, say, Switzerland, that were unknown to Humboldt. As for the proliferation of divergent specialized fields, a unification has already set in, and so, in a general sense, Humboldt's feat has again become possible: phenomenology in the different sciences has progressed so far that they have begun to merge by establishing connections with basic principles, say with quantum mechanics, or at least they are close to that stage. The different fields thus fit into a common framework and have acquired a common way of thinking, enabling the crossing of what had been boundaries between