ters for "group-oriented chiefdoms"; Burl appears to disagree on p. 71, but to agree on p. 139.

On the other hand, Burl mentions in a number of places recent or current folklore and folk customs associated with sites, and place-name evidence (for example, p. 241) suggestive of their original purpose. On pp. 79–80 he approvingly cites evidence suggesting continuity from the later Neolithic to the Iron Age culture of the Celts. These scattered suggestions indicate that there was a coherent body of scientific and technological knowledge, albeit partly obscured by "religious" symbolism, continuing from the third millennium B.C. to the advent of Christianity and even, less coherently, beyond. It was not the purpose of his book to do so, but it is a pity that Burl did not pursue this in the framework of his suggestion (p. 86) that "primitive" or "simple" material culture is not necessarily incompatible with intellectual interests or abstract thought, for in many ways these inferences and observations are more important than the anthropologically inspired problem of attempting to identify sociopolitical forms. For the authority of respected astronomers (such as Hawkins and Hoyle) and engineers (such as Thom) has persuaded many archeologists that supposedly supine and uncouth "barbarians" practiced quite sophisticated astronomy, surveying, planning, and construction. From this it is reasonable to infer, further, that these societies must have had some effective medium for transmitting precise information over considerable periods of time and, presumably, some well-developed, well-understood, and coherent system of symbols.

These implications derive in no way from "anthropological theory," but from essentially empirical observation of actual sites and inductive reasoning from the data. Nor do they have any necessary relationship to this or that "type" of sociopolitical organization. Indeed, it is becoming increasingly clear that several major innovations were made by "barbarian" rather than "civilized" societies, and archeologists must come to understand that their traditional obsessions with the so-called "early civilizations" will not provide all the keys to the major human achievements of the past five millennia or so. This book takes us a little further in the right direction toward a reevaluation of traditional "cultural evolution."

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Plasma Physics

Theory of Turbulent Plasma. V. N. TSYTOVICH. Translated from the Russian edition (Moscow, 1971) by David L. Burdick. Consultants Bureau (Plenum), New York, 1977. xviii, 536 pp. $45. Studies in Soviet Science.

Plasmas support a wide variety of collective oscillations, and the term plasma turbulence has come to mean strong, broad-band excitation of one or more of these modes of oscillation. The present volume is a comprehensive review of the subject by an author who has made a number of contributions to the development of the theory of turbulent plasma. With the exception of the final chapter, which covers developments in the theory of strong Langmuir turbulence (cavitons and solitons) during the period 1972–1975, the book covers what was known about the topic of nonlinear wave-particle and wave-wave interactions prior to 1972. The general outline of the theory was well developed by that time, and, although the material is now five years old, it is not seriously out of date.

Although the bulk of the material discussed in the book is already available in the research literature, the explanations are more detailed than those found in a typical research paper, and the book could well serve as a reference text for an advanced seminar. It begins with a brief review of the linear dispersion relations of the more important plasma modes of oscillation and proceeds to a development of correlations, quasilinear theory, and resonance broadening. The treatment of these topics follows what are by now well-developed lines. This section is followed by a short, but very clear, treatment of the excitation and dissipation of turbulent fluctuations. The discussion is limited to the major types of destabilizing effects, beams, constant electric fields, and anisotropies of the distribution functions. The information contained in the introductory chapters is then applied to the problem of determining the spectrum of stationary plasma turbulence.

The remaining half of the book is devoted to several processes that result from plasma turbulence, stochastic acceleration, enhanced radiation output, and the scattering of electromagnetic radiation. Not only are these subjects of importance in laboratory plasma physics, they may well be intimately connected to the energy output of some of the more exotic astrophysical objects.

This monograph is an excellent successor to the partially dated and much slimmer volume on the same subject by Kadomtsev. At some points one might wish for a bit earlier recourse to numerical evaluations and less emphasis on the more restricting analytical approximations, but this is a minor point. The book should be of interest to those concerned with either laboratory or astrophysical plasma turbulence.

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Dendroclimatology

Tree Rings and Climate. H. C. FRITTS. Academic Press, New York, 1976. xiv, 568 pp., illus. $35.

Since the pioneering work of A. E. Douglass, the founder of the Laboratory of Tree-Ring Research in Tucson, dendroclimatology has become a major source of information about climatic change on the time scale of decades to centuries. Replicated tree-ring chronologies from over 50 locations in the western United States are yielding maps of the past climatic patterns from the eastern Pacific Ocean and North America.

The production of these maps is largely the result of a 15-year research program directed by H. C. Fritts and his colleagues V. C. LaMarche, C. W. Stockton, and T. J. Blasing. Their research has involved three phases of analysis in working from the development of a data base to the final calibration of the data in climatic terms.

First, Fritts assembled tree-ring chronologies from a geographic array of trees located at climatically sensitive sites.

The second phase focused on biological studies of the relation of tree-ring widths to both the aging of trees and the changes in external climatic variables. Fritts developed computer programs for standardizing his data in order to account for the allometric decrease in ring widths as a tree ages. He then constructed response models that show what combination of temperature and precipitation variations causes changes in the standardized widths.

In the final phase, Fritts adapted multivariate statistical techniques in order to estimate past climatic values from dendrochronological data. Maps of these estimates show the synoptic patterns of climates for selected years, pentads, and decades during the past 300 years.