INTEGRALS AND SYMMETRY

Homology and Feynman Integrals
By Rudolph C. Hwa and Vigdor L. Teplitz. (Mathematical Physics Monograph Series.) Pp. xi + 331. (New York and Amsterdam: W. A. Benjamin, Inc., 1966.) n.p.

Unitary Symmetries and their Application to High Energy Physics
By M. Gourdin. Pp. xi + 303. (Amsterdam: North-Holland Publishing Company, 1967.) 86s.

(1) ANALYTIC properties of collision amplitudes play a central part in the study of strong interactions of elementary particles. Some of these properties can be derived rigorously from quantum field theory and some can be obtained from an axiomatic approach to S matrix theory. By far the largest amount of information about analyticity has been obtained, however, from the study of Feynman integrals in perturbation series for collision amplitudes. The basis of the approach is due to Cauchy, whose theorem on complex integration provides a method for the analytic continuation of Feynman integrals as functions of the relativistically invariant energies that describe the collision. This method fails when singularities of the integrand cannot be avoided by the contour of integration, and this may be a singularity of the Feynman integral. When there are several complex variables of integration, it is difficult to ascertain whether singularities of the integrand actually meet the (several dimensional) contour of integration so as to make the Feynman integral singular. This difficulty provided the motivation for developing and applying homology to Feynman integrals.

In this book the authors first describe the classical methods of studying the problem that are based on what a physicist would regard as the obvious extensions of Cauchy's theorem. They then outline homology theory and show how it converts the problem of the geometry of Feynman integrals into an algebraic problem. Their account of the theory is a valuable addition to the reprints of some of the main papers on this subject that are included in the second half of the book.

The book is recommended for graduate students in theoretical physics who have strong mathematical interests and abilities.

(2) The importance of the unitary group SU(3) for describing the symmetries of elementary particles was recognized very soon after the classic papers written in 1961 by Gell-Mann and by Ne'eman. Subsequent generalizations have encountered difficulties in formulating symmetries in a fully relativistic manner, but various procedures have been established, based on an algebra of currents that incorporate both angular momentum symmetries and SU3 symmetries.

The first two-thirds of *Unitary Symmetries and their Application to High Energy Physics* presents a mathematical description of the physics of symmetries. It begins with the essential features of Lie groups and the classification of the strongly interacting particles using the group SU3. This is followed by applications to strong, electromagnetic and weak interactions. The group SU6 is then introduced and some of its consequences are investigated. There is a chapter on current algebra, but this covers only a small fraction of the very extensive literature on the subject that has appeared in the past eighteen months.

The last third of the book describes the mathematical formulation of Lie groups and Lie algebras. It is likely that an increasingly important part in the theory of elementary particles will be played by Lie groups. This book is a good introduction to the subject of Lie groups and elementary particles at a level that is suitable for graduate students in theoretical physics.

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MORE GAS FOR BURNING

Natural Gas
A Study. By E. N. Tiratsoo with an Introduction by Sir Harold Hartley. Pp. xvi + 386. (London: Scientific Press, Ltd., 1967.) 70s.

THE publication of this excellent and comprehensive study on natural gas is greatly to be welcomed. The author is a geologist, but he has successfully "tried to widen the scope and interest of the book for the non-geological reader by including chapters on utilization and transportation, as well as an historical background". In fact, there is hardly an aspect of this great field of human endeavour on which the author has failed to provide more complete and significant information than has hitherto been conveniently available. The British reader, thrilled with the discovery of important natural gas reserves in the North Sea Continental Shelf, will perhaps be particularly grateful for chapters eleven to sixteen which deal with the methods of locating, measuring and exploiting gas reserves; the transportation and storage of gas; and the uses of natural gas and the economic considerations involved, with particular reference to the problem of converting the existing distribution system and burning appliances to the new fuel. "The problems of conversion for 12–13 million households are obviously formidable, and much depends on the composition of the natural gas to be used." As these problems are described by the author, it becomes very clear that the amount of natural gas likely to be used in Britain in, say, 1970—36 months from now—will depend primarily on the speed at which conversions can be carried out and new uses developed, and only secondarily on the quantity of gas reserves found. The Canvey Island conversions, an experimental enterprise on a small scale in a community conveniently isolated from other gas users and close to the methane terminal, have shown that it is not an easy matter to get the thing right, so that the consumer is really satisfied, and the idea that conversions at the rate of 600,000 to 1,200,000 per annum could be achieved in the near future will have to be treated with some caution.

The author's discussion of the problems of leakage, pipe failures and gas-borne dust, which arise when natural gas at high pressures is sent through old low-pressure coal gas distribution systems, is extraordinarily interesting and of the greatest practical importance, and so is his analysis of the storage and transportation problems. No one concerned with national fuel policy matters in Britain or abroad will fail to be grateful to Dr. Tiratsoo for placing his encyclopaedic knowledge at their disposal.

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VOLCANIC ROCK IN RUSSIA

Tufflavas and Ignimbrites
A Survey of Soviet Studies. Edited by Earl F. Cook. Translated from the Russian by Miriam Carty. Pp. xii + 212. (New York: American Elsevier Publishing Company, Inc.; London: Elsevier Publishing Company, Ltd., 1966.) 60s.

IGNIMBRITES include the most impressive rock-bodies that volcanoes are capable of producing. The largest are the consequence of gigantic eruptions during which, in the space perhaps of hours or days, tens or hundreds of cubic kilometres of rock-melt are converted to small fragments which flow as a turbulent suspension in gas away from the volcano. The flow incinerates, and the resulting deposit buries, everything over an area that can be measured in thousands of square kilometres, and in