

by placing the chamber in a magnetic field, which would aid greatly in the interpretation of each track. E.W.C.

A Large Cloud Chamber Using Rear Illumination. By E. W. Cowan. *Rev. Sci. Inst.* 20: 492, July, 1949.

Hearing Thunder

Thunder is seldom heard at distances greater than about twenty-five kilometers from the point of origin. Lightning without thunder is often referred to as "heat" or "sheet" lightning, although the physical characteristics of heat lightning and lightning accompanied by thunder seem to be identical. The relatively short range of audibility may be explained by the refraction of sound rays to be expected within and near mature thunderstorms. Calculations, based on theory due to Rayleigh, show that the normal vertical temperature gradient in the neighborhood of thunderstorms results in bending the sound rays away from the earth so that thunder which originates at an elevation of four kilometers is audible at the ground only within a radius of twenty-five kilometers. Recent observations of wind velocity within and near Florida thunderstorms indicate that the vertical wind shear is directed toward a thunderstorm in its lower portion and calculations show this results in reducing further the range of audibility on all sides of the thunderstorm.

R.G.F.

The Audibility of Thunder. By Robert G. Fleagle. *J. Acous. Soc. Am.* 21: 411, July, 1949.

Visual Color Standard

Catesby and Edwards in the early 18th century, and others since then, have made serious attempts to describe and record colors, feeling that color holds important information for the biologist. The means they employed was not properly standardized and gradually came to be questioned. Ridgway considered the problem and in 1912 introduced his standards and nomenclature which were widely adopted and used for published descriptions by biologists in many parts of the world, particularly by those of the United States, Canada, and Great Britain. Unfortunately, these widely used standards must now be replaced, for it has been discovered that they can not be republished precisely as originally issued.

The failure of the Ridgway Color Standards to be permanent standards gave rise to two questions: could a key be devised which would enable individuals to translate Ridgway color names into some system of permanent reference? and, why had biologists preferred the Ridgway Standards rather than other color systems?

The first question has been answered by the publication of key to a single copy of the Ridgway Standards since it can not be assumed that all copies of these standards are completely alike. This means that whenever the key is used it must be kept in mind that the Ridgway Standards used may have differed or been illuminated in different ways; hence it will not be possible to obtain an exact description of the original color.

The second question is partly answered by answers given to a Canadian questionnaire on the subject and

by the commonly expressed preferences of biologists which indicate that they have found the Ridgway Standards and Nomenclature more useful than others. This is apparently due to two factors: the standards contained a very high proportion of colors wanted by biologists and also the colors were named in a way now widely adopted by other systems.

This paper, together with two papers published in *Science* on June 17 ("Robert Ridgway's Color Standards," by D. H. Hamly, and "Color Standards for Biologists," by W. E. K. Middleton), indicate that there is great need for a special series of permanent color standards so described that they can be reproduced at any time and be referred to by one of several different methods.

D.H.H.

The Ridgway Color Standards with a Munsell Notation Key. By D. H. Hamly. *J. Opt. Soc. Am.* 39: 594, July, 1949.

Molecular Symmetry Coordinates

In 1923 C. J. Brester showed, by elementary but cumbersome mathematical methods, that the normal vibrations of molecules or crystals can be classified in terms of their symmetry. Seven years later E. Wigner successfully applied group theory to the same problem. More recently E. Bright Wilson and others have developed techniques for calculating molecular vibration frequencies which still depend heavily upon the finding of suitable symmetry coordinates. No general method has been known for obtaining such coordinates, and except for the simplest molecules the process has usually involved considerable trial and error. The present paper describes a direct algebraic method for finding symmetry coordinates which is closely related to a procedure sometimes used in quantum mechanics for obtaining wave functions. The method is applied to a simple example both with Cartesian and internal initial coordinates.

J.R.N.

A General Method of Obtaining Molecular Symmetry Coordinates. By J. Rud Nielsen and L. H. Berryman. *J. Chem. Phys.* 17: 659, July, 1949.

Pulse Height Analyzer

In nuclear experiments where conditions may change rapidly it is desirable to obtain simultaneously a number of points on the pulse height distribution curve, which is a plot of the number of particles given off in the experiment versus their energy. Previous experimenters have developed multi-channel pulse amplitude discriminators to record several points on the distribution curve using ordinary vacuum tubes. Experience has shown that these analyzers must be recalibrated frequently, perhaps as often as twice a day. The use of a large number of tubes increases the probability that a tube failure will throw the whole system out of operation.

To overcome these limitations, a new method of multi-channel discrimination has long been sought. A beam deflection tube used for switching and multiplexing by the Federal Telecommunication Laboratories was suggested

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