PHYSICS

Chairman: Ralph A. Llewellyn, Physics Department,
Indiana State University, Terre Haute, Indiana 47809

Malcolm E. Hults, Physics Department, Ball State University,
Muncie, Indiana 47306, was elected Chairman for 1971

ABSTRACTS

Low Cost Bridgmen Furnace for Growing Crystals—A Laboratory Experiment. C. C. Sartain, Department of Physics, Indiana State University, Terre Haute, Indiana 47809.——In the Bridgman technique for growing single crystals, a sample is slowly lowered through a vertical tube furnace so that the sample melts, then solidifies from one (tapered) end of a cylindrical sample holder. This is a good experiment for a materials or solid state laboratory.

A very simple, low-cost apparatus of this type has been built from equipment obtained from the Indiana Surplus Warehouse. It consists of an electric tube-furnace, a fused quartz liner, a Variac, a temperature indicator, a sample holder and a three-dollar electric clock for lowering the sample.

Changing Face of Radio Astronomy. Newton G. Sprague, Department of Physics, Ball State University, Muncie, Indiana 47306.——The area of science known as Radio Astronomy is not yet 40 years old. Many of the original researchers are still active. Most of the telescope systems have been revised and expanded; in America—a 30-foot dish, to many 85 foot dishes, to the "Mars 210"; in England—the Mark I, II, and III with extended baseline studies with Green Bank and Arecibo; an enormous diversity of structure—in Australia the Mill Cross and Christiansen Cross, at Cambridge the Mullard mile long scanner, at Vermilion River a 400-foot parabolic cylinder, and at Arecibo a 1000-foot fixed dish with moveable feed. Wavelengths now studied range from 1 centimeter to 15 meters.

Sunspot "K" Number Determination. Allan Wood and Newton G. Sprague, Department of Physics, Ball State University, Muncie, Indiana 47306.——The Sun's activity can be represented by the relative sunspot number defined as $R = k(10g + f)$ where f is the number of individual sunspots, g the number of spot groups, and k a number chosen to make the result agree with that of other observers, since observations differ due to altitude, size of telescope, etc. Using a 102 millimeter and a 60 millimeter refractor observations were made by tracing a projected image and by direct photography, respectively. Results were compared with the data published by the Swiss Federal Observatory and tentative "k" numbers were established: 1.2 for the 102 millimeter refractor and 2.0 for the 60 millimeter refractor coupled with a 35 millimeter camera body. To obtain better correlation of data the formula R = (10g + f) + k is proposed for the relative sunspot number.

Physics and Research at Twelve Midwestern Universities of Intermediate Size. EDWIN C. CRAIG, Department of Physics, Ball State University, Muncie, Indiana 47306.——Ball State University granted the author a leave of absence during the spring quarter 1970 to visit 12 emerging universities located in Illinois, Indiana, Kentucky, Ohio and Tennessee. The research activities of each department of physics were investigated. The individual research laboratories were visited and photographed and the current use of the equipment for research was discussed, in most cases, with an individual engaged in that research. Other items, such as teaching load and the number of graduate assistants, that affect research activities were also investigated and reported.

The Time-of-Flight Method—A Modern Physics Lab. T. ALVÄGER, J. STEPHENS and E. WHITE, Department of Physics, Indiana State University, Terre Haute, Indiana 47809.——The time-of-flight method to determine velocities of particles is of great importance in various areas of physics, from high energy physics to mass spectroscopy. In a Modern Physics Laboratory Course at Indiana State University this method was demonstrated in a laboratory experiment to measure the velocity of light. A light source produces short light pulses (pulse width about 4 nanoseconds). Each pulse is split by an optical system into two pulses that travel different path lengths before being detected by photomultipliers. The difference in arrival time is registered by use of a conventional time-to-pulse height analyzing system.

NOTE

Calibration of Modulation Amplitudes using their Effects on Lineshapes of Resonance Absorption. JOHN F. HOULIHAN, Department of Physics, Pennsylvania State University, Sharon, Pennsylvania 16146, and L. N. MULAY, Materials Research Laboratory, Pennsylvania State University, University Park, Pennsylvania 16802.——The principles and experimental techniques of magnetic resonance are well known. However, one frequently encounters problems concerning the calibration of appropriate parameters. This paper reports an easy technique for calibrating the modulation amplitudes, h_m, for an electron spin resonance spectrometer (Alpha 320 megahertz) which can be easily extended to other electron spin resonance and nuclear magnetic resonance spectrometers. The common phase sensitive detector technique usually requires very small values of h_m compared with the linewidth of the absorption curve; this is usually given by

$$h(t) = h_m \text{sine } wt.$$

The degree to which the phase sensitive detector gives an accurate reproduction of the true derivative of the absorption depends upon h_m (1). The effects of the modulation on Lorentzian and Gaussian lineshapes were discussed by Smith and Wahlquist (2, 3). This paper outlines an experimental procedure for calibrating h_m by using a sample of known line width and by studying quantitatively the "distortion" produced by h_m. The procedure is especially useful in those cases where an accurate determination of h_m at the actual sample site is required.

Literature Cited

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3. WAHLQUIST, H. 1961. Modulation broadening of unsaturated Lorentzian lines. J. Chem. Phys. 35:1708-1710.