

PHYSICS

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ABSTRACTS

A Versatile Biopotential Amplifier Utilizing High-Performance Integrated Circuits. WM. BENTLY, CTS Corporation, Elkhart, IN 46514, JERRY NISBET and EDWIN C. CRAIG, Department of Physics and Astronomy, Ball State University, Muncie, Indiana 47306.—The widespread use of electronic measurement systems in biological and medical laboratories has brought about the need for simple signal conditioning systems which can be used in college laboratories to familiarize students of the life sciences with the basic principles of electronic measurement methods. This paper describes a simple circuit featuring adjustable gain and bandwidth, which can be used to amplify the EEG, EKG or EMG of small animals for display on an oscilloscope or chart recorder. Since it possesses low-noise and low-drift, it can also be used with low level transducers. High accuracy and reliability are obtained through the use of premium integrated circuits offering performance levels previously obtainable only in discrete circuits. The performance of an FET OP AMP input stage is compared to the performance of an input stage using matched bipolar OP AMPS. This general purpose instrument should find wide applicability in both the research lab and classroom.

Physics, the Mind, the Body and the EEG. DARRYL L. STEINERT, Department of Physics, Hanover College, Hanover, Indiana 47243.—Recent research in biofeedback training has found that there are correlates between the electroencephalographic (EEG) activity and emotional and physiological functioning. These correlates range from, for the EEG, broad bandwidth EEG signals with broadly defined terms such as relaxed attentiveness or deep sleep, to correlates between 40 hertz EEG components and problem-solving such as doing multiplication mentally and correlates between 12-14 hertz signals from the sensorimotor cortex and epileptic seizure rates. Since physicists have a long tradition of signal seeking and deciphering, I thought that this research should be brought to their attention.

A Comparison of Patterns of Sulfur Dioxide Concentrations over Anderson, Indiana Determined with Huey Sulfation Plates with those Generated by a Gaussian Plume Diffusion Model.¹ RONALD J. LOSURE*, Taylor University, Upland, Indiana 46989, ROBERT HAZEN, RICHARD OLDHAM, and CHARLES W. MILLER, Department of Physics, Anderson

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College, Anderson, Indiana 46011.—Results of a simulation of sulfur dioxide concentrations with a Gaussian diffusion model correspond well with those measure in July 1974 with Huey sulfation plates. The model shows that under wind conditions similar to those of July 1974 some areas of Anderson, Indiana can expect to have consistently high concentrations of SO_2 . The model also shows that under certain atmospheric conditions, these same areas may experience extremely high concentrations.

A Sulfur Dioxide Survey for Anderson, Indiana.¹ RONALD J. LOSURE, Taylor University, Upland, Indiana 46989, ROBERT HAZEN, RICHARD OLDHAM*, and CHARLES W. MILLER, Department of Physics, Anderson College, Anderson, Indiana 46011.—During July 1975 a thirty-day survey of the sulfur dioxide content of the atmosphere over Anderson, Indiana was conducted. This is a continuation of a project begun in 1974. Huey sulfation plates were exposed at 40 sites over the city during the study. The results of the survey indicate that the level of sulfur dioxide pollution has decreased significantly from the previous year. However, the decrease may be partially due to unusual weather conditions and thus may be temporary.

A Comparison of Sulfur Dioxide Methods: Pararosaniline Method and Huey Sulfation Plates in Anderson, Indiana.¹ BOB HAZEN*, DICK OLDHAM, Anderson College, Anderson, Indiana and RON LOSURE, Taylor University, Upland, Indiana and CHARLES W. MILLER, Department of Physics, Anderson College, Anderson, Indiana 46011.—Thirty-day Huey sulfation plates were exposed at 40 sites covering the Anderson city limits during the summer of 1975 to monitor the sulfur dioxide content of the air. For a check on the plate efficiency the pararosaniline method of SO_2 detection was used at the Anderson College plate site. From the results of nine sampling dates the pararosaniline method preformed relatively consistent. The mean for the pararosaniline method was 0.006 ppm for the 30 days and the mean of the plates was 0.007 ppm.

Photographic Study of the Lunar Eclipse of May 24-25, 1975. MALCOM E. HULTS, Department of Physics and Astronomy, Ball State University, Muncie, Indiana 47306.—Time-lapse photography was attempted with the partial phases of the lunar eclipse of May 24-25, 1975. The sequence of shots was as follows: one picture every eight seconds of the partial phase before totality, approximately 10 seconds in "real time" taken of totality, one picture every eight seconds of the partial phase after totality, and approximately 10 seconds in "real time" of the full moon immediately after totality. Visual aids were photographed on the same film and the result was processed into a film loop to be used for instructional purposes.

Photometric Observations of the Star Cluster NGC2141. R. D. BURGESS, Department of Physics and Astronomy, Ball State University, Muncie,

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Indiana 47306.—Photoelectric and photographic observations are presented for the open cluster NGC2141. The data indicate the cluster is of late intermediate age with a main-sequence turn off at $M_v = 3.5$, $(B-V) = 0.40$. A mean color excess of $E_{(B-V)} = 0.30$ and a distance modulus of $m - M = 14.1$ yield ($R=3.0$) a distance of 4.4 kpc.

Acceleration of Gravity Equation. HARRY A. MONEYHUN, 1226 E 18th St., Anderson, Ind. 46016.—Because the acceleration of gravity refers to the acceleration of a secondary relative to a primary, the acceleration of both the secondary and the primary must be calculated for an exact and correct answer. Since the sum of the masses represent the total energy of a two body system, the sum of the masses must be included in the equation for the acceleration due to gravity. The corrected equation is $g = G(M+m)/s^2$.

Investigation of Low Temperature Anomalies in Specific Heat in Irradiated Glassy Carbons. ERIC MICHAEL and BRUCE MYERS, Department of Physics and Astronomy, Ball State University, Muncie, Indiana 47306.—Investigations of neutron irradiated glassy carbons have been carried out below 4.5°K by S. Mrozowski, A. Vagh, et al. Striking anomalies were found. These anomalies extend to and probably far above 4.5°K making investigation of the specific heat above this temperature imperative. To this end apparatus was constructed to measure specific heat of solids from 4.2°K to room temperature. To check the operation of the apparatus preliminary measurements were made at liquid nitrogen temperature. No dependence of specific heat on neutron irradiation was found at this point. Thus further investigation will be concentrated in the range from liquid helium to liquid nitrogen temperature.

General Honors 202—Modern Science A Sophomore General Education Course In Modern Science. L. GENE POORMAN, Professor of Physics, Indiana State University, Terre Haute, Indiana 47809.—This author is teaching a course for sophomores at ISU pre-selected to enroll in the Honors Program by virtue of high academic achievement and College Board scores. The paper deals with content, method, and evaluation of the general honors 202 course. Topical outlines, bibliographies, examples of student interaction constitute the discussion relating to content, method and evaluation.

On the Mobius Transformation and Relativity. W. KRABACHER, Department of Mathematics, Indiana University, Bloomington, Indiana and T. ALVAGER, Department of Physics, Indiana State University, Terre Haute, Indiana 47809.—The Mobius transformation is known to be the most general transformation that can be obtained from the basic, single assumption that the speed of light is constant in all inertial frames. In this study the time-dilation, the equivalent of relativistic mass and other "relativistic" quantities have been derived from the Mobius transformation and confronted with experimental data to test the applicability of the transformation. Of interest has also been a study of the possibility of incorporating the idea of faster-than-light particles into the general framework of the Mobius transformation.

On a Theorem of Eisenhart and Its Importance for Solutions of Schrödinger's Equation. HERBERT H. SNYDER, Department of Mathematics, Southern Illinois University, Carbondale, IL 62901.—The one-particle Schrödinger equation may be solved by separation of variables only in certain coordinate systems, and then only for certain forms of the potential. In a 1948 paper which appears to have been rather neglected, L. P. Eisenhart enumerated those coordinate systems and gave for each the explicit structure of the potential (cf. *Phys. Rev.* 24, 87-89). In the present paper, the author sets forth those systems enumerated in Eisenhart's theorem which seem most useful, and obtains in each case the ordinary differential equations which result upon separation of variables. These equations are discussed for some of the better-known coordinate systems, and some questions of explicit and/or approximate solvability are taken up for certain forms of the potential. The aim of the work is to increase the number of solvable cases of Schrödinger's equation which have physical interest.