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EA7. Acoustic Flux Density for Ray Propagation in Discrete Index Media and in Gradient Index Media. D. G. BURKHARD and D. L. SHEALY, University of Georgia --General formulas are derived for the energy per unit area per unit time over an arbitrary receiver surface for acoustic ray propagation in discrete index media and in gradient index media. The equation of the deflected ray coupled with the equation for the deflecting surface and the equation for the receiver surface provide a transformation which maps an element of deflecting area onto the receiver surface thereby enabling one to calculate the flux density over the receiver surface. A formula for the flux density along a ray path is obtained as a special case. An equation for the caustic surface is obtained from the latter.

EA8. Flux Density for Ray Propagation in Discrete Index Media. DAVID L. SHEALY and DONALD G. BURKHARD, University of Georgia.--A general formula is derived which specifies the illumination (flux density) over an arbitrary receiver surface when light rays are reflected by or refracted through a curved surface. Results are expressed in terms of the intrinsic geometry of the deflecting surface (the Gaussian, the mean, and the normal curvatures), the angle of incidence, the distance from the source to the deflecting element, and the distance from the deflecting element to the receiver element. The method leads to a direct calculation of the loci of energy concentration or caustics. The basic ideas and areas of application will be described.

EA9. Multi-Dimensional Extensions of the Chebyshev Polynomials. RICHARD O. HAYS, Floyd Junior College.

SATURDAY MORNING AT 9:00 SESSION EB NS&M ROOM 115

(Joseph H. Hadley presiding)

Solid Surfaces and Electron Optics

EB1. Angular Distribution of Atomic Photoelectrons. Steven T. Manson, Georgia State University. (30 min.)

EB2. Space Charge Modifications in the Kinetics of Oxide Film Growth on Metal Crystals for Transport by Thermal Electron Emission and Ionic Diffusion. R. B. MOSLEY and A. T. FROMHOLD, JR., Auburn U.

EB3. Electron Beam Retardation Contact Potential of Single Crystal Cuprous Oxide. RYAN LINDLE, and R. J. KOMP, Western Kentucky University, Bowling Green, Kentucky--Single-Crystal Cu_2O was prepared from OFHC copper equilibrated at 1090°C and at atmospheric pressure. The contact potential of Cu_2O (using Au as a referece) was measured in a Bakeable ultra-high vaccuum system using a modified versior of Nelson's electron beam retardation method. In addition to a discussion of the contact potential, the electron affinity and the position of the fermi level of cuprous oxide will be discussed.

EB4. Laser Induced Surface Damage by Plasma Instabilities. H. C. MEYER, J. LYNN SMITH, and R. A. SHATAS, Redstone Arsenal.

EB5. A Study of GaAs(111) Using LEED and Flash Desorption. L. R. Bedell and E. D. Miller, Northeast Louisiana University.

EB6. Mobility of Sulfur on a Ni(100) Surface. P. N. PETERS, Space Sciences Laboratory, Marshall Space Flight Center.

EB7. The Origin of Anomalous Structure in Field Ionization Energy Distributions.* ANDREW J. JASON and ALBERT C. PARR, The University of Alabama.--The proposed mechanism for structure observed in field ionization energy distributions[1] has been reinterpreted in recent articles.[2,3] The two models are compared and the Resonance Tunneling model[1] is shown to explain the experimental results when kinetic factors are included in the original rate calculations. The Plasmon creation model[2,3] fails to account for aspects of the observed distributions. In particular H_3^+ distributions and spectra from small substrate samples exclude the possibility of plasmon effects. Further interpretation of the plasmon model obviates some of theoretical difficulties.

*Work supported in part by the University of Alabama Research Grants Committee.

[1]A. J. Jason, Phys. Rev. 156, 266 (1967)
[2]A. A. Lucas, Phys. Rev. Letters 26, 813 (1971)
[3]A. A. Lucas, Phys. Rev. B4, 2939 (1971)

EB8. Optical Constants from Photoelectric Yield.* MARY W. WILLIAMS, R.N. HAMM, and E.T. ARAKAWA, Oak Ridge Nat'l. Lab.--A method has been developed for obtaining the refractive index, n, and extinction coefficient, k, of a photoemitter and the attenuation length, L, of the photoexcited electrons in the photoemitter from measurements of the photoelectric yield as a function of angle of incidence. The yield is a maximum very close to θ_c given by $n = \sin\theta_c$, and its magnitude at this angle is very dependent on k. Both quantities are virtually independent of L for $L \leqslant 20$ Å. In practice, we make a least squares fit of the data to the theory,[1] using n, k, and L as adjustable parameters. This method for obtaining optical constants is most sensitive when n is close to, but less than, unity and k is small. These are just the conditions generally found in the soft X-ray region where it is hard to obtain accurate optical constants from reflectance measurements.

*Research sponsored by the U. S. Atomic Energy Commission under contract with Union Carbide Corporation.

[1]E. Coquet and P. Vernier, C.R. Acad. Sc. Paris 262, 1141 (1966). S.V. Pepper, J. Opt. Soc. Am. 60, 805 (1970).

EB9. Vibrational Determination of Crystal Structures. JOHN M. SPRINGER and E. SILBERMAN, Fisk University and Vanderbilt University, Nashville, Tennessee, and HENRY W. MORGAN, Oak Ridge National Laboratory*, Oak Ridge, Tenn.-Raman spectra of very small crystals and of oriented polycrystalline films have been obtained with laser excitation. The techniques for producing crystals at low temperatures, from the vapor and the liquid phases, and of orienting the samples will be illustrated. The series of crystals POX_3 and PSX_3 (X = halogen) have been studied by infrared absorption and by the Raman effect at temperatures down to 4°K. Analyses of the band splittings, frequency shifts between Raman and infrared spectra, Raman polarization data, and density-close packing factors have provided structural data on the crystalline phases. The structures are in agreement with the few previous studies made by X-ray, and indicate that a vibrational study may uniquely determine crystal structure.

*Research sponsored by the U.S. Atomic Energy Commission under contract with Union Carbide Corporation.

SATURDAY MORNING AT 9:00 SESSION EC NS&M ROOM 119

(Jesse W. Beams presiding)

Biological Physics, Quantum Mechanics, Gravitation and Relativity

EC1. Statistical Mechanics of Biological Systems. Ronald Fox, Georgia Institute of Technology. (30 min.)

EC2. Bioacoustical Influences on Seed Germination.* SANDRA SHOAF and REBECCA J. BOSLEY, U. North Carolina, Greensboro.

EC3. Multiple Light Scattering in Dilute Suspensions. W. FARTHING and PAUL LATIMER, Auburn U.

EC4. Light Scattering-Optical Properties of Synchronous Cells. B.P. PYLE and PAUL LATIMER, Auburn U.

EC5. Electromagnetic Scattering from Spherical Mammalian Cells. (introduced by H. E. Carr) A. BRUNSTING, Auburn U. - The light scattering intensity distributions (intensity vs. scattering angle) for concentrically coated spheres have been computed. The coated spheres model many types of nearly spherical mammalian cells whose nuclei (~7 μm diam) have a low relative refractive index (~1.05) and cytoplasms (~10 μm diam) have a slightly lower relative refractive index (~1.03) with respect to water. Analysis shows that diffraction accounts for most of the light scattered in the forward lobe, whereas at larger angles information concerning the interior of the cells is present in the intensity distribution. A unique light scattering photometer was built to test the analysis. If the size distribution of the nearly spherical CHO, mammalian cells was relatively narrow, then there was experimental agreement with the theory.

EC6. Monitoring Cardiac Output Nonintrusively.* J. G. CASTLE, JR., R. R. LATTANZI, and MICHAEL SHARECK, UAH.

EC7. General Quantum Mechanical Point Transformations and the Associated Canonical Transformed Momenta. NORMAN M. WITRIOL, Redstone Arsenal.

EC8 Proposed Method of Measuring Small Variations in the Gravitational Constant G.* J. W. BEAMS, U. of Virginia--Theory predicts a possible decrease in G with time ($\Delta G/G \sim 10^{-10}$ per year). A laboratory method for observing such change is discussed. Essentially it consists of an improved type of Cavendish torsion balance mounted on a constant speed rotary table all maintained about 1°K and shielded by superconductors. The small mass system (2 Kg) is supported by a special torsion free magnetic suspension while its gravitational interaction with the large mass system is balanced by a small torsion fiber or alternately by diamagnetic interaction with a permanent magnet. Both mass systems are gold plated and maintained in a vacuum. Exploratory experiments indicate that the relaxation of a magnetic stainless steel fiber would essentially vanish at 1°K and spurious torques introduced by the magnetic support should be below the noise level. The uncertainties introduced by the magnetic suspension, variations in the mass systems and in temperature, variations in the earth's fields, etc. will be discussed.

*Supported in part by N.S.F. and by AROD-Durham.

EC9. Equations of Motion for a Gyroscope in General Relativity. J. R. RAY, and E. R. BAKER, IV, Clemson U.

EC10. Vθ-Sector of an Extended Multi-θ Lee Model. A.L. Choudhury, Elizabeth City State University, Elizabeth City, N.C.

EC11. Analysis of Real Motion of Circumnavigating ^{133}Cs Clocks. H.C. DUDLEY Univ of Ill Med. Ctr. Chicago. -^{133}Cs clocks on jet aircraft (1) agreed with predicted relativistic changes, referred to restricted fixed frame (R). Real resultant in galactic coordinates of 3 motions produces elongated spiral, with galactic velocity of ~160 Km/sec. Velocity difference, C. and R clocks of ± 0.2% cannot account for observed frequency changes. Postulate this to result from interaction of neutrino sea as generalized subquantic medium (2). This translates to terrestrial physics some aspects of cosmic neutrino physics (3)(4).

1. Hafele and Keating, Science, 177,168, 1972
2. Dudley, Nuovo Cimento, 4B,68, 1971
3. Dudley, Nuovo Cimento Lett. In Press, 1972
4. Kuchowicz, Cosmic Neutrinos, Nucl. Info. Ctr. Warsaw Poland (In English) 130 pp. 1972

EC12. Development of the Concept of the Uncharged Electron (e°). H.C. DUDLEY Univ. of Ill. Med. Ctr. Chicago.-Previously it was predicted that an uncharged particle equivalent in rest mass to e^- would be isolated. (1) Backenstoss et al have demonstrated the muon neutrino, with upper limit rest mass 0.6 mev (90% confidence limit)(2). This appears to be the uncharged electron (e°)(proposed name neuon) and a component of the neutrino sea (3). The e° is postulated to be the causal agent initiating radioactive decay by parametric excitation of those nuclei which are linear resonant systems (4). The significance of these new parameters in particle physics will be discussed.

1. Dudley, Bull Amer Phy Soc.7,568,609,1962
2. Backenstoss et al, Phy Lett.36B, 403, 1971
3. Dudley, Physics Lett. In Press 1972
4. Dudley, Nuovo Cimento Lett. In press 1972

SATURDAY MORNING AT 9:00 SESSION ED NS&M ROOM 221

(Arthur A. Broyles presiding)

Chemical Physics, Atomic and Molecular Transitions, Lasers

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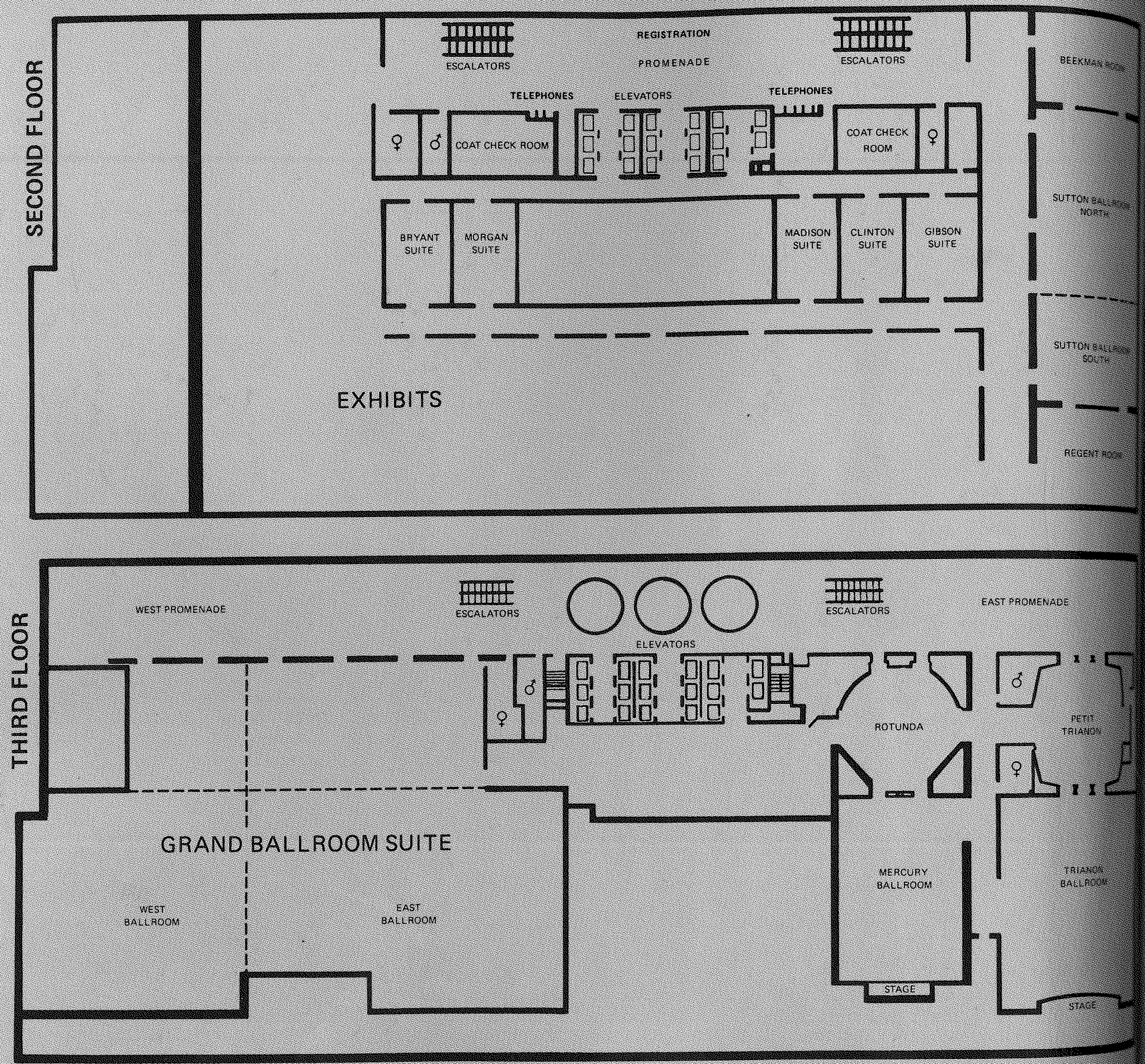

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