Bull. Amer. Phys. Soc. 16, 347 (1971)

CB 3. Precision Spectroscopy Using Laser Saturated Molecular Absorption at 3.39μ.
R. L. BARGER, *Joint Institute of Laboratory Astrophysics.* (30 min)

Spectroscopic studies will be described for the methane saturated absorption line at 3.39 microns. Parameters investigated include pressure broadening and shift, frequency stability and reproducibility, wavelength, and Zeeman effect. Pressure effects will also be given for a line of ethane, located 35.5 Mc blue from the methane line.

CB 4. Laser-Induced Fluorescence of Alkali Dimer Molecules.
RICHARD N. ZARE, *Columbia University.* (30 min)

Alkali dimer molecules have been investigated using the technique of laser-induced fluorescence. Information has been obtained concerning their structure and the excitation transfer processes they undergo.

TUESDAY MORNING, 30 MARCH 1971 (D. MATTIS presiding) WINDSOR BALLROOM AT 9:00 A. M.

Semiconductors, Amorphous II

CC 1 Impurity Screening in Amorphous Semiconductors. WERNER BRANDT and JULIAN REINHEIMER,* New York University. - The properties of the wave vector and frequency dependent dielectric response function of amorphous semiconductors are studied and compared with those of their crystalline forms, in terms of an isotropic and homogeneous model substance with a valence and a conduction band. The electronic structure is characterized parametrically by the electron density and a band gap parameter ϵ_g. In this picture, the principle distinctions between the amorphous and the crystalline forms are the absence of umklapp processes and a reshaping of the density of states distribution which effectively increases ϵ_g. The amorphous semiconductor response to fields set up by impurity atoms hardens in the sense that, aside from the increase in ϵ_g, the disappearance of umklapp processes reduces screening. The Friedel oscillations of the electron density are damped even more than in the crystalline phase. Positron annihilation rates could serve as a spot test for these results because they are predicted to be less in a homogeneous amorphous phase than in the crystalline phase of the same density.

*Permanent address: The Aerospace Corporation, San Bernardino, California.

CC 2 Amorphous Semiconductors I: Short Range Order.* N.J. SHEVCHIK, Harvard Univ. - A computer routine has been developed which simulates the atom by atom buildup of a monoatomic tetrahedrally coordinated solid. Using an approximation in which only the atom being placed is allowed to move, a cluster of 1000 atoms was generated and from it the radial distribution function and X-ray scattered intensity were computed. By giving preference to different dihedral angle distributions, various amorphous forms could be constructed while maintaining the fourfold coordination within 5%, the density within 10% of the crystalline value, and a rms bond distortion less than 10 degrees. The best fit to the experimental rdf of electrolytically deposited Ge occurred when preference was given to a completely flat dihedral angle distribution. This is strong evidence that the structure of amorphous Ge is that of the continuous random network.[1]

*Work supported by ONR and ARPA.

[1]W.H. Zachariasen, J. Am. Chem. Soc. 54, 3841 (1932)

CC 3 Amorphous Semiconductors II: Effect of Pressure on the Absorption Edge and Refractive Index of a-Ge and a-Si.* G.A.N. CONNELL and W. PAUL, Harvard Univ. - Electron-beam evaporated and electrolytic a-Ge and electron-beam evaporated a-Si[1] were studied to hydrostatic pressures of 10 kbars. The absorption edges of the two types of Ge were displaced for $h\nu \lesssim 1$ eV, the absorption coefficient of electrolytic films being approximately five times smaller than that of evaporated films and less than that of the crystal in the region between 0.8 eV and 1 eV. The edges, however, had identical pressure shifts of $(+ 2.8 \pm 0.5) \times 10^{-6}$ eV bar^{-1} for $100 < \alpha < 30{,}000$ cm^{-1}. The shift for Si was $(+ 0.2 \pm 0.5) \times 10^{-6}$ eV bar^{-1} for $800 < \alpha < 30{,}000$ cm^{-1}. These coefficients are not characteristic of any of the gaps of the corresponding crystal. The logarithmic decreases of the refractive indices, $(- 0.7 \pm 0.2) \times 10^{-6}$ bar^{-1} for Ge, and $(- 0.05 \pm 0.15) \times 10^{-6}$ bar^{-1} for Si, are however not dissimilar to the crystalline values.

*Work supported by ONR and ARPA.

[1]The Si samples were kindly provided by Dr. Brodsky of IBM.

CC 4 Amorphous Semiconductors III: Correlation of Structural, Optical and Electrical Measurements.* W. PAUL, G.A.N. CONNELL and N.J. SHEVCHIK, Harvard Univ. - X-ray, optical, and resistance measurements have been carried out on as-prepared electrolytic and evaporated a-Ge and also after anneals to asymptotic behavior of resistance. Small angle scattering results demonstrate clearly that only the evaporated material possesses a considerable ($\sim 10^{18}$/cc) density of macroscopic (~ 20A°) voids, while both have many smaller vacancies or atomically light defects. The absorption edges (see II), ρ vs T relations, change of α and ρ under anneal, and recrystallization temperatures show considerable differences. Thus, after anneal, the room temperature absorption tail and the resistivity of electrolytic Ge had both decreased considerably. On partial recrystallization (Debye-Scherrer) near 190°C, the absorption edge shifts to lower energies, the resistivity drops an order of magnitude, and the 0.23 eV peak disappears. In contrast, the room temperature ρ of evaporated Ge increases after anneal before dropping several orders on recrystallization near 300°C.

*Work supported by ONR and ARPA.

CC 5 The AC Conductivity of Disordered Systems. T. M. HAYES*, Xerox Research Laboratories, Rochester, N. Y., and J. L. BEEBY†, AERE Harwell, Didcot, Berkshire --The AC conductivity, $\sigma(\omega)$, of an electron moving in a finite array of atoms is discussed briefly. The Pollak and Geballe treatment appropriate to two well-separated atoms[1] is extended to account for larger, but