optical constants q_{1111} and q_{1122}. However, no quantitative success was achieved. The prism-deviation method described for $SrTiO_3$ (2) was used with the additional requirements of the infrared image converter tube. A description of the prism used is given in the section on Specimen Preparation.

The collimated light beam from a 0.025 cm. wide vertical slit was di-

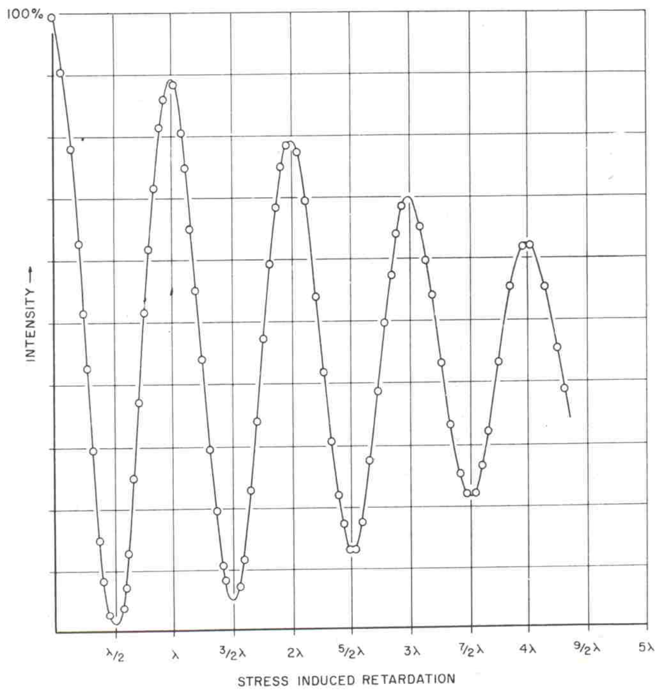

FIG. 6. The observed relationship between the relative transmission intensities and orders of stress-induced retardation for a uniformly stressed crystal when using poorly monochromatized infrared light.

rected to the prism at normal incidence. This orientation was established by observing the back reflection of the incident light ray. Stress was applied to the (100) right trapezium prism faces. A nicol polarizer, oriented with the vibration direction parallel to the direction of compression, was used in the attempt to evaluate q_{1111}. The vibration direction was oriented normal to the direction of stress for evaluation of q_{1122}.

A prism to detector distance of 3.25 meters was used and stresses up to approximately 600 kg./cm.^{2} were applied to the crystal. This type of measurement is an extremely difficult one. The magnitude of the measurements is approximately of the same order as the sensitivity of the measuring apparatus. A detailed discussion of the sources and magnitude of error involved can be found in reference (2). Additional difficulties encountered are the following: 1) wide band pass, 2) poor resolution of the image converter tube, 3) working with light that cannot be seen.

The experiment was repeated 15 times. Due to the serious inconsistencies in the results, no further attempts were made. However, the averaged values indicate the following approximate ratio of change in the index of refraction:

$$\Delta n_{11}:\Delta n_{22} \backsimeq (-)3:(+)2.$$

The minus sign indicates the index of refraction parallel to the direction of stress decreases, whereas that normal to the direction of stress (positive) increases. Indications are, therefore, that silicon becomes a negative uniaxial crystal under a compression stress directed along [100]. If one tentatively accepts the above approximate ratios for Δn_{11} and Δn_{22}, indications of the values of the stress-optical constants q_{1111} and q_{1122} may be obtained from the stress-optical difference constant $(q_{1111}-q_{1122})$, namely, $q_{1111} \simeq -9\times 10^{-14}$ cm.^{2}/dyne and $q_{1122} \simeq 6\times 10^{-14}$ cm.^{2}/dyne.

Discussion of Results

Since silicon and diamond both possess *m3m* symmetry, have similar structures, and are both elemental materials, it should be of interest to compare their respective piezobirefringent behavior. It is desirable, however, that the following differences in physical properties and experimental conditions be tabulated first:

1) Diamond is transparent from the ultraviolet region of the spectrum to the near infrared.
2) Diamond possesses an absorption cutoff in the ultraviolet region of the spectrum at approximately 3000 Å (10, 11, 12).
3) Silicon is opaque to visible light.
4) The silicon absorption cutoff is at approximately 10500 Å.
5) The physical strength, therefore, bond strength in diamond, is many times that of silicon.
6) Comparable stress-optical work on diamond to date has been carried out at approximately 5400 Å, which is far removed from the absorption edge.
7) The present work on silicon has been carried out in the vicinity of the absorption cutoff, namely at 11100 Å.

The values of piezobirefringence constants observed by various workers on diamond are given in Table 2, along with the observed values for silicon reported in this paper.

As can be seen, the agreement of the values reported by different work-