two conduction electrons per atom, the corresponding breadths for Ross' cases are 8.4 X.U. and 6.36 X.U. respectively. It seems, therefore, safe to conclude that Ross' resolution of the doublet in the shifted radiation is for the conditions of his experiment not necessarily inconsistent with either the author's theory of Compton shifted line structure or with his published experimental observations.

At the present writing the author, in collaboration with Mr. H. A. Kirkpatrick, has just succeeded in obtaining photographic spectrograms of the Compton shifted line, using Mo $K\alpha_1$, α_2 scattered at 90° from graphite with a maximum inhomogeneity of scattering angle of less than one degree. The unmodified doublet is completely resolved on the negative and the Compton line appears very broad and diffuse. This work is being done with the fifty-crystal spectrograph described in Review of Scientific Instruments, Vol. 1, No. 2, February 1930.

The author believes that this new instrument at last affords the possibility of investigating the whole question of Compton modified radiation under adequately pure conditions of scattering angle and spectral resolution. We feel that we can now announce with complete assurance that the Compton shifted line is more diffuse than the lines of the primary radiation.

J. W. M. DUMOND

California Institute of Technology, Pasadena, California, June 20, 1930.

The Raman Effect in Trimethylethylene

In some experiments made a year ago on the Raman effect in trimethylethylene several diffuse modified lines were found. The stronger correspond to infrared wave-lengths $3.44 \pm 0.05\mu$ and $8.4 \pm 0.2\mu$. Several fainter lines were found between these two. An anti-Stokes line corresponding to 8.4μ was also faintly seen excited by the mercury line 4358A. It seems probable that all these lines can be matched by absorption lines belonging to the group CH although no absorption line was found recorded as long as 8.4μ .

Accidental contamination with rubber added a continuous scattering, with a marked denser band beginning near the position of the strongest line, ca 4600A. A continuous spectrum was obtained in about the same position when a little rubber was dissolved in carbon tetrachloride, making it probable that the effect was due to the rubber and not to a change in viscosity of less than one percent. In this case a suggestion of a second very broad band with maximum about 5500A was also found. If these bands were due to Raman scattering it would be necessary to think of the exciting mercury lines as 4046A and 3650A. The light appeared to be partially polarized.

DOROTHY FRANKLIN

E. R. LAIRD

Mount Holyoke College, June 14, 1930.

Photoionization of Salt Vapors

The chief interest presented by the photoionization of the vapors of various compounds is that it may afford additional information regarding the structure of molecules. As far as I am aware no such work with the vapors of simple inorganic salts has as yet been done.

In an investigation undertaken by me on these lines with the vapors of halides of various metals, a marked photoionization of these vapors was observed. The illumination was produced by intense ultraviolet light of wave-lengths longer than 1850A. The photoeffect from the electrodes and the walls was negligibly small as compared with the photocurrent from the vapor, in some cases the latter was a hundred times as great as the photocurrent which could be produced by direct illumination of the electrodes.

On raising the temperature of the salt thermal ionization currents could be observed without illumination, an effect which has been previously extensively studied by G. C. Schmidt and his co-workers (Ann. d. Physik **82**, 664 (1927) **2**, 313 (1929)). The photoionization begins generally at much lower temperatures than the temperatures at which the thermo-current is noticeable.

The salts studied first were TII, TlBr, TlCl. It has been previously shown in this laboratory (Butkow and Terenin, Zeits. f. Physik 49, 865 (1928), Butkow, ibid. 58, 232 (1929)) that the excitation energy of the first electronic level of these molecules coincides very closely with the corresponding value for the Tl atom; the figures (in volts) are as follows: 3.4 for TlI, 3.6 for TlBr and 3.8 for TlCl as against 3.3 for Tl. It seems therefore that the Tl atom has to some extent an individual existence in the molecule and can be excited by light absorption independently of the other component, a view consistent with the fact that these molecules are "atomic" ones.

There arose naturally the question, whether the value of the ionization energy of the molecule would coincide with the ionization potential of Tl. The experiment showed, in fact, the existence of a strong photoionization of these vapors, the active wave-lengths lying on the short wave-length side of certain limits, which are 2140A for TlI and 2070A for TlBr. Expressed in volts this gives for the assumed ionization potentials of TlI and TlBr, 5.8 and 6.0 respectively, whereas the ionization potential of Tl is 6.1 V.

The agreement is sufficiently good to support the view that at these wave-lengths the ionization of the TIX molecules sets in, as the result of the liberation of an electron from the Tl atom. An explanation of the photocurrent by the dissociation of the TlX molecules into ions Tl+ and X-, improbable in itself, would give other threshold values than is the case here. It must be noticed that the range of ionizing radiation overlaps to some extent the range of wave-lengths producing the dissociation of the TIX molecules with subsequent emission of certain Tl lines, which has been thoroughly studied before (Terenin, Zeits. f. Physik 44, 713 (1927); Butkow and Terenin, loc. cit.). The wavelength thresholds of these two processes are. however, quite different.

From the known equation: $D_m + I_a = I_m + D_{m+}$, where I_a , I_m are the ionization energies of the Tl atom and the TlX molecule respectively, D_m , D_{m+} —the dissociation energies of the neutral and the ionized molecule,

the value of D_{m+} can be computed to be 2.8V for TII⁺ and 3.3V for TIBr⁺. As the dissociation energies D_m of the neutral molecules are 2.5 and 3.2V respectively, it may be concluded that the molecular ions TIX⁺ are more stable than the corresponding neutral molecules; this fact, interesting in itself, is consistent with other known data.

For TlCl the threshold was found to be 1860A, but this value is not quite certain owing to a dubious origin of the salt used in the experiment.

A marked decrease of the photosensitivity in the sequence TII, TIBr, TICI was noticed.

On raising the applied voltage from 50 to 600 V, the appearance of Tl arc lines could be observed in TII, but only during the illumination of the vapor. This can be explained as an excitation of the Tl atoms always present in the vapor, by the photoelectrons liberated from the molecules and accelerated by the field applied. There is, besides, the possibility of various dissociation and excitation processes induced in TII by these electrons.

Other volatile halides, e.g. AgI, PbI_2 , $PbCl_2$, BiI_3 , were also investigated, but they gave much smaller photoionization currents, than the Tl halides. In HgI_2 and CdI_2 no measurable effect could be observed.

The possibility of a photoionization seems to be dependent chiefly on the magnitude of the ionization potential of the metallic atom in the molecule, which must fall within the range of the ultraviolet frequencies used. The photoionization is more pronounced in the iodides and decreases in magnitude in the chlorides.

The magnetic mass analysis of the ions produced under various circumstances will facilitate, I hope, to a great extent the interpretation of the underlying processes.

A. TERENIN

Optical Institute, Leningrad, Russia, May 24, 1930.

The Raman Effect in Solutions of Sodium Nitrate of Varying Concentration

Experiments suggested by those of Rao on HNO_3 (Nature, **124**, 762 (1929)) have been made on the Raman spectrum of NaNO₃ at concentrations of 5, 10, and 30 percent and saturated. Exposures were made varying approximately inversely with the concentration from 39 hours down. The source of light

was a glass mercury arc, and the spectrograph a Hilger D78. The Raman line with frequency difference $1049 \pm 6 \text{ cm}^{-1}$ was found excited by the mercury lines 4358, 4077, and 4046, approximately equally strongly in the different cases, and no new lines were found either in the more dilute or in the saturated solution.