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With small currents the scattering of these electrons could be followed in detail and was found to occur principally in several distinct approximately plane regions a few tenths of a millimeter thick. Oscillations in the plasma were studied with a crystal detector and a Lecher wire system in the probe-cathode circuit. Corresponding to each of the regions of scattering there were found distinct regions where periodic oscillations existed, the distance between them being approximately that covered by the primary electrons in one half-cycle. The frequencies (about 10^9) agreed well with those given by the formulae of Tonks and Langmuir,[1] and the results agree with their conclusion that the plasma oscillations cause the scattering. The results show further that the oscillations are due to the passage of the fast electrons through the plasma.

[1] Tonks and Langmuir, Phys. Rev. **33**, 195 (1929).

38. Excitation of the New Nitrogen Line. JOSEPH KAPLAN, *University of California, Los Angeles.*—Since the discovery last spring in high pressure nitrogen afterglows of a new line at 3466.3A agreeing with Bowen's predicted value of 3466.4A for the $^2P-{}^4S$ transition in atomic nitrogen, further studies of this line have been made. The most interesting observation is the remarkably high relative intensity of the line in weak afterglows produced by very weak discharges in nitrogen at about 30 mm, in a tube in which the part showing the glow has a volume of about 100 cc. This is entirely like the excitation of the green auroral line when small amounts of O_2 are added to nitrogen and the afterglow associated with a very weak discharge is observed.[1] The large relative intensity of the new line and the Vegard-Kaplan bands in more intense afterglows in the small tube is also of considerable interest since one would expect radiations from metastable levels to grow weaker as the tube size is diminished. This probably indicates the importance of surfaces for the production of metastable particles. The large relative intensity of the 3466 line points to the high-pressure afterglow as an important source of atomic nitrogen.

[1] Pub. Astronom. Soc. Pac. **47**, 257 (1935).

39. A Self-Consistent Field for Doubly Ionized Chromium. ROBERT L. MOONEY, *Georgetown University.*—A self-consistent field based on Hartree's equations has been calculated for Cr III in the configuration $(3p)^6\,(3d)^4$. The calculations were started by estimating an initial field by a method of graphical interpolation between the results already calculated for other ions. All of the differential equations involved in the computations were integrated numerically with the aid of a calculating machine. Three approximations in the cases of the $(1s)^2$, $(2s)^2$ and $(2p)^6$ groups, and seven approximations for the $(3s)^2$, $(3p)^6$ and $(3d)^4$ groups were made towards self-consistency. Tabulations of the $Z_{n,l}$'s in the last approximations show a divergence from self-consistency of not more than ± 0.004. The normalized wave functions for the individual electrons and the total radial electronic charge density distribution have been plotted as functions of the radius—a spherically symmetrical distribution has been assumed throughout. The results are principally significant in that the self-consistent field for Cr III offers a convenient starting point for calculations of self-consistent fields for singly ionized and for neutral chromium. The tendency toward "over-stability" (in the sense described by Hartree) is strongly marked in the $(3d)^4$ sub-group. Empirical rules are determined for the best method of overcoming the difficulties of the phenomenon of "over-stability."

40. Quantities of Charge Transfers in Lightning Discharges. E. J. WORKMAN AND R. E. HOLZER, *University of New Mexico.*—Five synchronized recording-generating voltmeters developed for indicating electric field intensity under storm conditions (see paper 78) were located at the boundary of a nearly circular area of 25 square miles at Albuquerque. The surface densities of the image charge were obtained from the measured surface field intensities and changes in the contour pattern of the image charge were used to calculate the quantity of charge in observed flashes. More than a thousand discharges of various kinds show on the records of all instruments for the several storms studied. From two to three hundred discharges were observed (visually) as to type and position and may be identified on the records. Seventeen of these discharges were photographed on the high speed lightning camera. Eight simple cloud to ground discharges of one storm have been analyzed and show gross transfers of 26, 54, 50, 37, 100, 30, 33, 29, and 200 coulombs from heights of approximately 1.5 miles. The application of this method to the study of charge development, charge distribution, potential differences, and space charge effects is discussed.

41. Compressibility of Lithium. CONYERS HERRING,* *Massachusetts Institute of Technology.*—Recent calculations of the energy of metallic lithium, made by Bardeen[1] using the method of Wigner and Seitz,[2] yield values for the compressibility which are roughly 15 percent larger than the values observed by Bridgman[3] over a range of pressures. For sodium however the agreement was very good. The most likely source of the discrepancy for lithium seemed to be the failure of the assumption that the energy of an electron with wave vector $\mathbf{k}$ is exactly proportional to k^2. In an attempt to better this assumption, the energies of three excited electronic states have been calculated for a number of values of the lattice constant. To calculate these energies a perturbation method is used starting from free electron wave functions of appropriate symmetry; the convergence is found to be rapid. The correction to be applied to Bardeen's values for the total energy of the electrons can be estimated by interpolation.

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[1] Bardeen, J. Chem. Phys. **6**, 367 (1938).
[2] Wigner and Seitz, Phys. Rev. **43**, 804 (1933); **46**, 509 (1934); Seitz, Phys. Rev. **47**, 400 (1935); Wigner, Phys. Rev. **46**, 1002 (1934).
[3] Proc. Am. Acad. **72**, 207 (1938).

42. The Angular Distribution of the α-Particles from $B+H^1$. R. O. HAXBY[1] AND J. S. ALLEN, *University of Minnesota.*—Measurements have been made of the angular distribution of the α-particles arising from the reactions:

$$ {}_1H^1 + {}_5B^{11} \rightarrow {}_4Be^8 + {}_2He^4 \quad (1) $$

$$ {}_1H^1 + {}_5B^{11} \rightarrow 3\,{}_2He^4. \quad (2) $$