Recently Katcoff[5] has shown that I^{129} has an exceedingly long half-life, at least of the order of 10^7 years, unless its beta-rays should be too weak to be detected. Originally, according to a general rule[6] it must have been about as frequent as the stable isotope I^{127}. If the half-life of I^{129} is as long as about 2.10^8 years, demonstrable traces of this isotope must still exist. Indications, though no definite proof, of this fact were indeed obtained by Katcoff.

After the concentration of the original xenon in our atmosphere had fallen to its present low value, the Xe^{129} formed by beta-emission from the I^{129}—which at that time had a much higher concentration—in the iodine of the earth's outer crust and of the ocean, mixed with the small rest of the original xenon. This was sufficient to give to this single isotope its abnormally high concentration.

1 W. Wefelmeier, Ann. d. Physik **36**, 373 (1939).
2 A. O. Nier, Phys. Rev. **52**, 933 (1937); M. Lounsbury, S. Epstein, and H. G. Thode, Can. J. Research (in press).
3 H. N. Russel and D. M. Menzel, Proc. Nat. Acad. Sci. **19**, 997 (1933); V. M. Goldschmidt, Geochem. Verteilungsgesetze 9. Skr. Norsk Vid. Ak. Oslo. Mat-Nat. No. 4, 18 (1937).
4 C. F. Weizsäcker, Physik. Zeits. **38**, 623 (1937); A. Bramley, Science **86**, 424 (1937).
5 S. Katcoff, Phys. Rev. **71**, 826 (1947).
6 J. Mattauch and S. Flügge, *Nuclear Science Tables* (Interscience Publishers, Inc., New York), p. 104.

On the Use of the Kurie Plot

F. N. D. KURIE
Department of Physics, Washington University, St. Louis, Missouri*
March 29, 1948

THERE have been a number of examples in recent literature where, in the mind of this author, the Kurie plot has been somewhat overzealously applied. The method was originally suggested by Kurie, Richardson, and Paxton[1] as a method of examining experimental data for their compliance with either the Fermi or the Konopinski-Uhlenbeck theory of β-decay. In applying the method to data, which we now know to be poor, they found a number of cases (Cl^{38}, K^{42}) in which deviations between theory and experiment were very wide. They showed that, by assuming that these substances emitted two groups of β-particles, a closer consonance between theory and data was obtained.

Because of the continuous distribution of the energy of β-particles there is no straightforward experimental method of ascertaining whether a β-spectrum represents a single β-transition or several. Because of this the Kurie plot has been widely used to aid in this examination. If it were clearly established that a simple spectrum was represented in detail by the Fermi theory, this method of plotting would be a very powerful tool, because, in principle, it is capable of disentangling a complex spectrum to give the upper limits and intensities of all its components. However, at the present stage, the application of the Kurie plot for this purpose is always suspect, since there is no case where the plot is linear down to low energies. Konopinski[2] has given a good summary of the existing data and has pointed out that in the particularly careful work of Lawson and Cork on In^{114} and of Tyler on Cu^{64} there are deviations from the linear Kurie plot below energies corresponding to between $\frac{1}{3}$ and $\frac{1}{2}$ of the maximum energy. Thus, even in the most painstaking work and for allowed transitions, agreement between theory and experiment seems to be good only near the upper limit of the β-spectrum. There appears to be no case in which even so optimistic a statement can be made for forbidden spectra.

It is not proposed that the Kurie plot method be abandoned, for there is no other method available for examining a spectrum for complexity. Rather, it is proposed that an argument based on such plots *alone* is not sufficient to establish complexity, and that upper limit values of the lower energy β-particles, derived from such an analysis, should be accepted with some scepticism.

On the other hand, if the Kurie plot gives evidence of complexity, and if there is demonstrated the existence of gamma-rays of energies nearly equaling the differences of these upper limits, and if coincidence counting gives data consistent with the implied complexity, then there is strong evidence in favor of the disintegration scheme proposed.

* Under Contract N6ori-117, T.O.1.
1 F. N. D. Kurie, J. R. Richardson, and H. C. Paxton, Phys. Rev. **49**, 368 (1936).
2 E. J. Konopinski, Rev. Mod. Phys. **15**, 209 (1943).

Achromatization of Debye-Scherrer Lines*

H. EKSTEIN AND S. SIEGEL
Armour Research Foundation, Chicago, Illinois
April 2, 1948

THE ultimate limit of precision in lattice parameter measurements by the Debye-Scherrer method is given by the spectral width of the primary characteristic radiation, which causes an irreducible width of the line even with an infinitely narrow collimator.** The line could be sharpened by monochromatization of the primary beam, but the elimination of all but a small fraction of the spectral band of a characteristic line would result in a prohibitive loss of intensity.

One can sharpen the diffraction line by achromatizing the characteristic radiation, i.e., by causing all rays of wave-lengths belonging to a spectral line to converge to a focus after diffraction. In Fig. 1 a point source of x-rays, A, radiates a polychromatic beam toward the crystal $QTUR$ so that the central ray AC satisfies the Bragg condition for diffraction by the lattice plane dd' and for the most intense wave-length λ of the spectral band. After diffraction the rays diverge from an apparent source A' so that every ray has only one definite wave-length. A polycrystalline sample P is mounted normal to the central ray $A'E$. All rays diffracted by P will come to a focus N. The distance $CE=V$ is given by

$$V=F\left(1+2\frac{\tan\theta}{\tan\theta_m}\right)\left(-\frac{1}{\cos 2\theta}\right)+l\frac{\cos(\theta_m+\alpha)}{\cos(\theta_m-\alpha)},$$

where $F=NE$, $l=AC$, $\theta_m=\sphericalangle ACd$, θ is the Bragg angle