defined by the transformation group. It is difficult to imagine how any condition could arise to limit the size of the body in such a treatment if the group possessed infinitesimal elements, and so could describe rotations with infinitesimal angular velocity.

Although this version of the rotation problem underlay my earlier attack, I have not yet been able to give it an acceptable solution, and may take this occasion to pose it as one needing an answer.

[1] N. Rosen, Phys. Rev. **71**, 54 (1947).
[2] E. L. Hill, Phys. Rev. **69**, 488 (1946).

Remarks on C. Frondel's Letter: "Elastic Deficiency and Color of Natural Smoky Quartz"

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HAVING just seen C. Frondel's interesting letter[1] I should like to make two remarks.

1. Anomalies after irradiation with radium and x-rays have also been observed in the piezoelectric constant of quartz, this constant in some cases being increased by irradiation.[2]

2. The fact that the natural color of smoky quartz is more stable than the color produced artificially in irradiated quartz does not contradict the theory that this natural color is of radioactive origin.

As I have frequently pointed out, only the most stable color and luminescence centers will be produced in nature owing to the very small intensity of the radiation acting during long periods, as compared with the strong artificial irradiation during a short time. I have called this "the principle of natural selection of the most stable."[3]

That colorless or relatively light colored bands in natural smoky quartz are more deeply affected by artificial irradiation shows that they contain more unstable centers than stable ones.

[1] C. Frondel, Phys. Rev. **69**, 543 (1946).
[2] J. Laimböck, Wien. Anz. (May 18, 1928); F. Seidl, Wien. Ber. IIa, **142**, 467 (1933); F. Seidl and E. Huber, Zeits. f. Physik **97**, 671 (1935).
[3] K. Przibram, Zeits. f. Physik **68**, 413 (1931).

The Magnetic Quenching of Superconductivity

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THE only previously expressed generalization regarding temperature dependence of magnetic threshold fields for super conductors[1,2] appears to be the often-quoted statement that the functional relation is roughly parabolic for a given substance. It has been noted that the curves for mechanically "soft" elements (as well as for a few alloys) tend to display smaller initial slopes than those for "hard" elements (and most alloys) of similar upper critical temperature (*vide* infra). More careful examination of the threshold curves for the "soft" superconductors Pb, Hg, Sn, In, Tl, CuS, Au_2Bi, Zn, and Cd indicates that each is reproduced with remarkable accuracy by a law of the form $H_T=A(T_C^{\frac{3}{2}}-T^{\frac{3}{2}})$. Here T_C represents the upper critical temperature—i.e., at zero field, whereas T represents the critical temperature in a longitudinal field of H_T gauss. A remarkable generality is indicated by the fact that the parameter A is found to have nearly the same value for all of the substances listed, the deviations being of the same order as those for the individual curves. For the initial slope at $T=T_C$, one derives

$$(dH_T/dT)_{TC}=-\tfrac{3}{2}AT_C^{\frac{1}{2}}.$$

The practical identity of A for the various substances is most readily verified by use of this corollary law, since the initial slopes are generally measured with greatest accuracy. For the listed substances (with a range of T_C from 7.26 to 0.54°K) the average value of A is some 50 gauss-degree$^{-\frac{3}{2}}$, with a mean deviation of only a few percent. Studies of thin films and wire, as well as of colloidal particles[1,2] of "soft" superconductors, have shown the threshold fields to increase for sufficiently small linear dimensions, by a factor which is the greater, the closer the approach to the critical temperature. This suggests that mechanical sufficient to cause a micro-lamellar, fibrous, or mosaic structure in a massive sample should result in serious deviations from the above law—in the sense of an increase in the parameter A, differentially greater the higher the temperature. The threshold curves for the few "hard" superconductors subjected to careful study seem to bear some such relation to those of "soft" superconductors of similar upper critical temperature, the ratio of initial slopes being much greater than the ratio of extrapolated threshold fields at the absolute zero. It is proposed that the above law represents the limiting "ideal" behavior for a truly homogeneous specimen of macroscopic dimensions. The apparent exceptions displayed by the more numerous class of "hard" superconductors are attributed to irreducible structural inhomogeneities on a micro-scale. The incompleteness of the Meissner effect (expulsion of magnetic flux) in typical "hard" superconductors is further evidence of such structural inhomogeneities.

A law of such simplicity as the above suggests that the electronic nature of the superconducting state may prove to be simpler than has usually been proposed. In particular, a satisfactory model must presumably allow the experimental value of the parameter A to be found by combination of universal constants only.

[1] E. F. Burton, H. Grayson Smith, and J. O. Wilhelm, *Phenomena at the Temperature of Liquid Helium* (Reinhold Publishing Corporation, New York, 1940).
[2] D. Shoenberg, *Superconductivity* (Cambridge University Press, 1938).

Decay of Mesons Stopped in Light Materials

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WE are carrying out an experiment to observe the decay of mesons stopped in different light materials. The preliminary results seem to indicate that there are more decay electrons emitted for each stopped meson if the meson is brought to rest in material of low atomic number than if it is stopped in aluminum or some material with a higher atomic number.