R. W. (1954). *The Optical Principles of the Diffraction of X-rays*, p. 462, for a discussion of this work. London: Bell.
Cole, H. (1959). Private communication.
Compton, A. H. & Allison, S. K. (1935). *X-rays in Theory and Experiment*. New York: Van Nostrand.
Curien, H. & Deroche, C. (1956). *Bull. Soc. franç. Minér.* **79**, 102.
Freeman, A. J. (1959*a*). *Phys. Rev.* **113**, 176.
Freeman, A. J. (1959*b*). *Acta Cryst.* **12**, 274.
Freeman, A. J. (1959*c*). *Phys. Rev.* **113**, 169.
Froese, C. (1957). *Proc. Camb. Phil. Soc.* **53**, 206.
Hartree, D. R. & Freeman, A. J. (1957). (Unpublished results).
Hartree, D. R. & Hartree, W. (1948). *Proc. Roy. Soc. Lond.* A, **193**, 299.
Hartree, D. R., Hartree, W. & Manning, M. F. (1941). *Phys. Rev.* **60**, 857.
Hartree, D. R., Hartree, W. & Swirles, B. (1939). *Philos. Trans.* A, **238**, 229.
James, R. W. & Brindley, G. W. (1931). *Phil. Mag.* (7), **12**, 81. Their results are conveniently tabulated in Compton & Allison (1935).
Keating, D. T. & Vineyard, G. H. (1956). *Acta Cryst.* **9**, 895.
Laval, J. (1939). *Bull. Soc. franç. Minér.* **11**, 49.
Laval, J. (1942). *C. R. Acad. Sci., Paris*, **215**, 359.
Learn, A. J. (1958). Ph.D. Thesis, Physics Dept. M.I.T. (unpublished).
Milberg, M. E. & Brailsford, A. D. (1958). *Acta Cryst.* **11**, 672.
Walker, C. B. (1956). *Phys. Rev.* **103**, 558.
Waller, I. & Hartree, D. R. (1929). *Proc. Roy. Soc. Lond.* A, **124**, 119.
Wood, J. (1957). Quarterly Progress Reports, Solid State & Molecular Theory Group, M.I.T. July 15, p.55 (unpublished).

Short Communications

Contributions intended for publication under this heading should be expressly so marked; they should not exceed about 500 *words; they should be forwarded in the usual way to the appropriate Co-editor; they will be published as speedily as possible; and proofs will not generally be submitted to authors. Publication will be quicker if the contributions are without illustrations.*

Acta Cryst. (1959). **12**, 936

Rare earth ion radii in the iron garnets.

By S. Geller and D. W. Mitchell, *Bell Telephone Laboratories, Murray Hill, New Jersey, U.S.A.*

(*Received* 15 *July* 1959)

In examination of the rare earth-iron garnets, it has been found that the relative effective CN(12) radii (Geller, 1957) derived from the rare earth perovskites are applicable. (These have not been obtained as yet for any of the rare earth ions smaller than Gd.) The iron garnets of the trivalent ions of Sm, Eu, Gd and Y were carefully prepared in ceramic form by a method described elsewhere (Gilleo & Geller, 1958). The lattice constants of these specimens are listed in Table 1; listed also are those given by Bertaut & Forrat (1957).

Table 1. *Lattice constants of some rare earth-iron garnets*

Dodecahedral ion	a_0 (Å) Mitchell	See text	Bertaut & Forrat
Sm^{3+}	12·528	12·530	12·524
Eu^{3+}	12·498	12·498	12·518
Gd^{3+}	12·474	12·471	12·479
Y^{3+}	12·376	12·376	12·376

Although it is possible that the effective sizes of atoms may change differently with the same change in coordination,* it is somewhat less likely to happen for closely related rare earth ions than for such ions as Fe^{3+} and Al^{3+}.† Though few, the results obtained by use of the radius differences are gratifying. The relative effective CN(12) radii for the ions in the order of the Table 1 listing are 1·310, 1·304, 1·299, 1·281 Å. The lattice constant difference per 0·010 Å change in radius is about 0·053 Å. Using $Y_3Fe_2(FeO_4)_3$ (this has been made and measured many times) as standard, the reproduced lattice constants obtained are as shown in the third column of Table 1. The agreement with the measured values of the present work is good and may indicate a larger (than Eu^{3+}) ion impurity in the Eu-iron garnet reported by Bertaut & Forrat (1957).

It is now possible to obtain the relative effective CN(12) radii of some of the other trivalent rare earth ions (i.e. those not thus far obtained from the perovskites) from values of garnet lattice constants. Values of a_0 obtained for crystals of $Er_3Fe_2(FeO_4)_3$ grown by Nielsen & Dearborn (1958) and of $Lu_3Fe_2(FeO_4)_3$ made in ceramic form are 12·352 and 12·280 Å respectively leading to values 1·276 and 1·262 Å for the relative CN(12) radii of Er^{3+} and Lu^{3+} respectively.

It is noteworthy that similar reasoning led to an exact prediction of the lattice constant of $Mn_3Fe_2Si_3O_{12}$ (Geller & Miller, 1959).

* Rare earth ions have CN(8) in the garnets.

† In $Y_3Fe_2(FeO_4)_3$, the ratio of tetrahedral to octahedral Fe–O distances is 0·94; in $Y_3Al_2(AlO_4)_3$ the analogous Al–O ratio is 0·91.

References

Bertaut, F. & Forrat, F. (1957). *C. R. Acad. Sci., Paris*, **244**, 96.
Geller, S. (1957). *Acta Cryst.* **10**, 243.
Geller, S. & Miller, C. E. (1959). *Amer. Min.* **44**. In press.
Gilleo, M. A. & Geller, S. (1958). *Phys. Rev.* **110**, 73.
Nielsen, J. W. & Dearborn, E. F. (1958). *J. Phys. Chem. Solids*, **5**, 202.