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Abstract

Recent band structure calculations by Ham indicate how the Fermi surface of the alkali metals, which is expected to be nearly spherical under normal conditions, may change when the lattice constant is decreased through hydrostatic pressure. Since direct measurement of the distortion of the Fermi surface is difficult, we have tried to study its magnitude by measuring the Hall voltage in the alkalis as a function of hydrostatic pressure up to 15,000 kg/cm^2. In each case the Hall voltage decreases with increasing pressure, the size of the decrease ranging from 2 percent in 15,000 kg/cm^2 for lithium to 37 percent in 15,000 kg/cm^2 for cesium before compressibility corrections are applied.

The Hall constant, R, can be written as $1/Necn^*$ where n^* is a factor of the order of unity which expresses the deviation from the free electron value of the Hall constant. The data, with all explicit volume dependence removed, are expressed in the form of curves of n^* vs. pressure. In all of the alkalis except cesium, n^* decreases monotonically with increasing pressure; the decreases range from 5 percent in 15,000 kg/cm^2 for lithium to 8 percent in 15,000 kg/cm^2 for rubidium. In the case of cesium n^* passes through a minimum at 5000 kg/cm^2 and rises to a value of 1.2 at 15,000 kg/cm^2.

The change of n^* between room and liquid nitrogen temperatures was also measured. In all of the alkalis except lithium the change is less than 3 percent. In lithium n^* decreases by about 25 percent between room and liquid nitrogen temperature.

The warping of a nearly spherical Fermi surface is described by Kubic harmonics and the effect of the warping on n^* considered. Increases in the warping parameters increase n^*; since the band structure calculations indicate that increasing pressure increases the warping parameters, the data cannot be explained on the basis of anisotropic Fermi surfaces alone. If anisotropic scattering times as well as warped Fermi surfaces are considered, then increases of the warping parameters can cause decreases in n^*.