4.3 Horizontal arms orbit, β, $\boldsymbol{H} \parallel \langle 10\bar{1}0\rangle$

The data for this orbit are shown in Fig. 6. The logarithmic stress derivatives are:

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{exp}} = -(2.3 \pm 0.6)\times 10^{-10} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{NFE\text{-}OPW}} = -0.542\times 10^{-10} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{M\text{-}OPW}} = -1.82\times 10^{-10} \qquad (\mathrm{dyn/cm^2})^{-1}\,.$$

The experimental results fit the modified OPW calculation well and are significantly different from the calculation using the NFE energy dependence.

4.4 Junction orbit, σ, $\boldsymbol{H} \parallel \langle 11\bar{2}0\rangle$

This area is not tied down to a symmetry point, and the search for the extremal area must be done independently.

The data for this orbit are shown in Fig. 7. The logarithmic stress derivatives are:

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{exp}} = (2.2 \pm 0.9)\times 10^{-11} \qquad (\mathrm{dyn/cm^{-2}})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{NFE\text{-}OPW}} = 1.90\times 10^{-11} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{M\text{-}OPW}} = -2.47\times 10^{-11} \qquad (\mathrm{dyn/cm^2})^{-1}\,.$$

The different signs on the two calculated values allow one to make a very clear distinction between the two models for the Fermi energy dependence on stress. The experimental data are in good agreement with the energy dependence based on the NFE model for the Fermi vector.

4.5 Bow-tie orbit, λ, $\boldsymbol{H} \parallel \langle 10\bar{1}0\rangle$

This orbit, too, must in principle have its extremum searched for in three dimensions. However, it turns out that the area observed is at the extreme side of the monster arm nearer the center of the zone. Thus the computation consists of searching along the field direction until the edge of the arm is located and then calculating at that point the area normal to the field.[3])

[3]) Higgins et al. [2] report a weak oscillation, referred to as F_{12}, when $\boldsymbol{H}$ is along $\langle 10\bar{1}0\rangle$. They suggested tentatively that this oscillation could be due to a four-arm orbit around the monster. This description also would fit the bow-tie orbit with $\boldsymbol{H}$ in the same direction, which Higgins et al. refer to as F_9. The present calculations suggest that the F_{12} oscillations could be due to an orbit similar to and parallel to the bow-tie orbit on the other side of the monster. Both orbits are due to inflection points rather than true extrema in the curves of area perpendicular to the field, versus distance in reciprocal space along the field.

The data for this orbit are shown in Fig. 8. The logarithmic stress derivatives are:

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{exp}} = (9.9 \pm 3.1)\times 10^{-12} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{NFE\text{-}OPW}} = 4.38\times 10^{-12} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{M\text{-}OPW}} = 9.92\times 10^{-12} \qquad (\mathrm{dyn/cm^2})^{-1}\,.$$

The agreement with the heuristic modification is quite close for this orbit.

4.6 Needle orbit, α, H || ⟨0001⟩

The data for the needles are shown in Fig. 9. The logarithmic stress derivatives are:

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{exp}} = (1.0 \pm 0.06)\times 10^{-9} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{NFE}} = 0.36\times 10^{-9} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{NFE\text{-}OPW}} = 1.11\times 10^{-9} \qquad (\mathrm{dyn/cm^2})^{-1}\,,$$

$$\left.\frac{\mathrm{d}\ln A}{\mathrm{d}\sigma}\right|_{\mathrm{M\text{-}OPW}} = 4.60\times 10^{-9} \qquad (\mathrm{dyn/cm^2})^{-1}\,.$$

In this case the agreement between the calculation using the NFE-OPW energy dependence and the experimental data is quite good; the calculated value based on the modified energy dependence is very different.

For this orbit the effect of uniaxial stress is readily expressed in terms of the change of the axial ratio (c/a) of the crystal, due to the compression applied along the ⟨0001⟩ direction. Similarly, both hydrostatic pressure and temperature changes produce a change in the c/a ratio. Thus it is possible to make a direct comparison of the present results with the hydrostatic pressure results of O'Sullivan and Schirber [9], and measurements on the temperature dependence of the needles made by Berlincourt and Steele [17] (whose results agree well with those of O'Sullivan and Schirber). One thus finds that the hydrostatic pressure logarithmic derivative is equivalent to:

$$9.77\times 10^{-10}\,(\mathrm{dyn/cm^2})^{-1}\,.$$

The agreement with the present work is quite satisfying.[4])

4.7 General comments

The results are summarized in Table 1. Also listed in this table are the effective masses (m^*/m) for the orbits studied here, as reported by Sabo [19]. As can be seen, for the orbits characterized by (m^*/m) $\gtrapprox 1$, i.e., ζ and λ, agreement is found between the experimental results and the calculations involving the

[4]) The value of $\mathrm{d}\ln A/\mathrm{d}\sigma$ obtained for this orbit was erroneously quoted as $-(7.3 \pm 0.5)\times \times 10^{-10}\,(\mathrm{dyn/cm^2})^{-1}$ [18].