with the results of the self-consistent *ab initio* calculations based on the local density formalism [12, 13]. We focus on the following questions:

(i) How well can *ab initio* band theory describe the first few (low-angle) structure

where the result naturally depends on the highest momentum ($G_{\max}$) included in this sum (as we will see below, current high-precision experiments are limited to rather small cut-off values $\mathbf{G}_{\max}$). If the temperature factor can be deconvoluted from equation (1), one can construct the *static* (purely

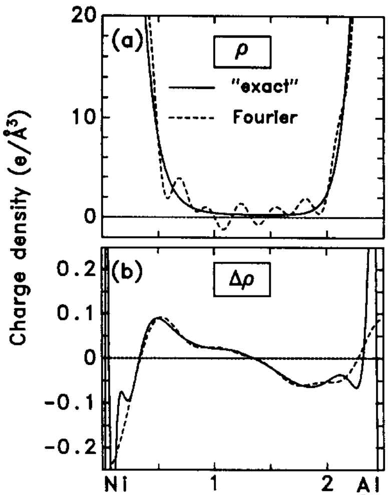


Fig. 1. (a) Static total electron [illegible]

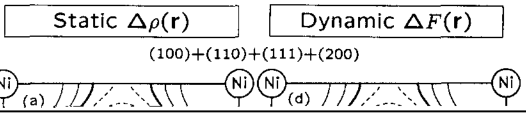
representation the *total* density ρ [Fig. 1(a)] still exhibits significant oscillations in the bonding region. On the other hand, the density *difference* $\Delta\rho_{\mathrm{sup}}(\mathbf{r}, G_{\mathrm{big}})$ (equation (12) and Fig. 1(b)] obtained from a Fourier series using $G_{\mathrm{big}} = 2\pi/a(6, 3, 1)$ closely mimics the directly calculated $\Delta\rho_{\mathrm{sup}}(\mathbf{r})$ in the bonding regions [of course, $\Delta\rho_{\mathrm{sup}}(\mathbf{r}, G_{\mathrm{big}})$ still fails to reproduce the nodal structure near the core]. Note that the maximum magnitude of the static *deformation* density $\Delta\rho_{\mathrm{sup}}(\mathbf{r})$ outside the core is only ~ 0.1 e/Å^3, while the *total* density $\rho(\mathbf{r})$ has a magnitude of ~ 10 e/Å^3 at this point. Clearly, the bonding charge is tiny.

Figure 2 shows as solid line the calculated static density *deformation* $\Delta\rho_{\mathrm{sup}}(\mathbf{r})$ calculated without any Fourier truncation, comparing it to $\Delta\rho_{\mathrm{sup}}(\mathbf{r}, G_{\mathrm{big}})$ of equation (12), in which a large but finite cut-off $G_{\mathrm{big}} = 2\pi/a(6, 3, 1)$ (54 stars) was used. We see again

that while the Fourier representation rounds off the

Here, $B_{\rm Ni}$ and $B_{\rm Al}$ are adjustable parameters while $\rho_{\rm I}$ and $\rho^{\rm MT}$ are fixed by theory (Table 1). This yields rather reasonable values of $B_{\rm Ni} = 0.56$ and $B_{\rm Al} = 0.71$.

superposition atomic structure factors (using Hartree–Fock data [17] as an example) are $F_{\rm sup}(100) = 13.30$ and $F_{\rm sup}(200) = 22.84$. Hence the accurate measurements of crystalline structure factors to date. We also include in this table the "forbidden" (222) reflection measured by Alkire *et al.*



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