$$\mathbf{R} = m\mathbf{a_1} + n\mathbf{a_2} \tag{1}$$

$$\mathbf{R} = m\mathbf{a_1} + n\mathbf{a_2} + o\mathbf{a_3} \tag{2}$$

$$E_{\mathrm{Na}} = -1748\frac{e^2}{4\pi\epsilon_0 a} = -M_d\frac{e^2}{4\pi\epsilon_0 a} \tag{3}$$

$$\mathbf{E}(\mathbf{r},t) = \mathbf{E}_0 e^{i\mathbf{k}\cdot\mathbf{r}-i\omega t} \tag{4}$$

$$I(\mathbf{r},t) = |\mathbf{E}_0 e^{i\mathbf{k}\cdot\mathbf{r}-i\omega t}|^2 = |\mathbf{E}_0|^2 \tag{5}$$

$$\mathbf{E}(\mathbf{r},t) = \mathbf{E}_0 e^{i\mathbf{k}\cdot(\mathbf{r}-\mathbf{R})-i\omega t} \tag{6}$$

$$\mathbf{E}(\mathbf{r},t) \propto e^{i\mathbf{k}\cdot(\mathbf{r}-\mathbf{R})}e^{-i\omega t} \tag{7}$$

$$\mathbf{E}(\mathbf{R}',t) \propto \mathbf{E}(\mathbf{r},t)\rho(\mathbf{r})e^{i\mathbf{k}'\cdot(\mathbf{R}'-\mathbf{r})} \tag{8}$$

$$\mathbf{E}(\mathbf{R}',t) \propto e^{i\mathbf{k}\cdot(\mathbf{r}-\mathbf{R})}\rho(\mathbf{r})e^{i\mathbf{k}'\cdot(\mathbf{R}'-\mathbf{r})}e^{-i\omega t} = e^{i(\mathbf{k}'\cdot\mathbf{R}'-\mathbf{k}\cdot\mathbf{R})}\rho(\mathbf{r})e^{i(\mathbf{k}-\mathbf{k}')\cdot\mathbf{r}}e^{-i\omega t} \tag{9}$$

$$\mathbf{E}(\mathbf{R}',t) \propto e^{-i\omega t}\int_V \rho(\mathbf{r})e^{i(\mathbf{k}-\mathbf{k}')\cdot\mathbf{r}}dV \tag{10}$$

$$\mathbf{R} = m\mathbf{a_1} + n\mathbf{a_2} + o\mathbf{a_3} \tag{11}$$

$$\mathbf{R}\cdot\mathbf{G} = 2\pi m \tag{12}$$

$$e^{\mathbf{iG}\cdot\mathbf{R}} = 1 \tag{13}$$

$$\mathbf{G} = m'\mathbf{b_1} + n'\mathbf{b_2} + o'\mathbf{b_3} \tag{14}$$

$$\mathbf{b}_1 = 2\pi\frac{\mathbf{a}_2\times\mathbf{a}_3}{\mathbf{a}_1\cdot(\mathbf{a}_2\times\mathbf{a}_3)} \qquad \mathbf{b}_2 = 2\pi\frac{\mathbf{a}_3\times\mathbf{a}_1}{\mathbf{a}_1\cdot(\mathbf{a}_2\times\mathbf{a}_3)} \qquad \mathbf{b}_3 = 2\pi\frac{\mathbf{a}_1\times\mathbf{a}_2}{\mathbf{a}_1\cdot(\mathbf{a}_2\times\mathbf{a}_3)} \tag{15}$$

$$\mathbf{a}_i\cdot\mathbf{b}_j = 2\pi\delta_{ij} \tag{16}$$

$$e^{i\mathbf{G}\cdot\mathbf{r}} = e^{i\mathbf{G}\cdot\mathbf{r}}e^{i\mathbf{G}\cdot\mathbf{R}} = e^{i\mathbf{G}\cdot(\mathbf{r}+\mathbf{R})} \tag{17}$$

$$\rho(x) = \rho_0 + \sum_{n=1}^{\infty}\left\{C_n\cos(x2\pi n/a) + S_n\sin(x2\pi n/a)\right\} \tag{18}$$

$$\rho(x) = \sum_{n=-\infty}^{\infty}\rho_n e^{ixn2\pi/a} \tag{19}$$

$$\rho_{-n}^* = \rho_n \tag{20}$$

$$g = n\frac{2\pi}{a} \tag{21}$$

$$\rho(\mathbf{r}) = \sum_{\mathbf{G}}\rho_{\mathbf{G}}e^{i\mathbf{G}\cdot\mathbf{r}} \tag{22}$$

$$I(\mathbf{K}) \propto |\sum_{\mathbf{G}}\rho_{\mathbf{G}}\int_V e^{i(\mathbf{G}-\mathbf{K})\cdot\mathbf{r}}dV|^2 \tag{23}$$

$$\mathbf{K} = \mathbf{k}' - \mathbf{k} = \mathbf{G} \tag{24}$$

$$k'_\perp - k_\perp = 2k_\perp = 2\frac{2\pi}{\lambda}\sin\Theta = G_\perp \tag{25}$$