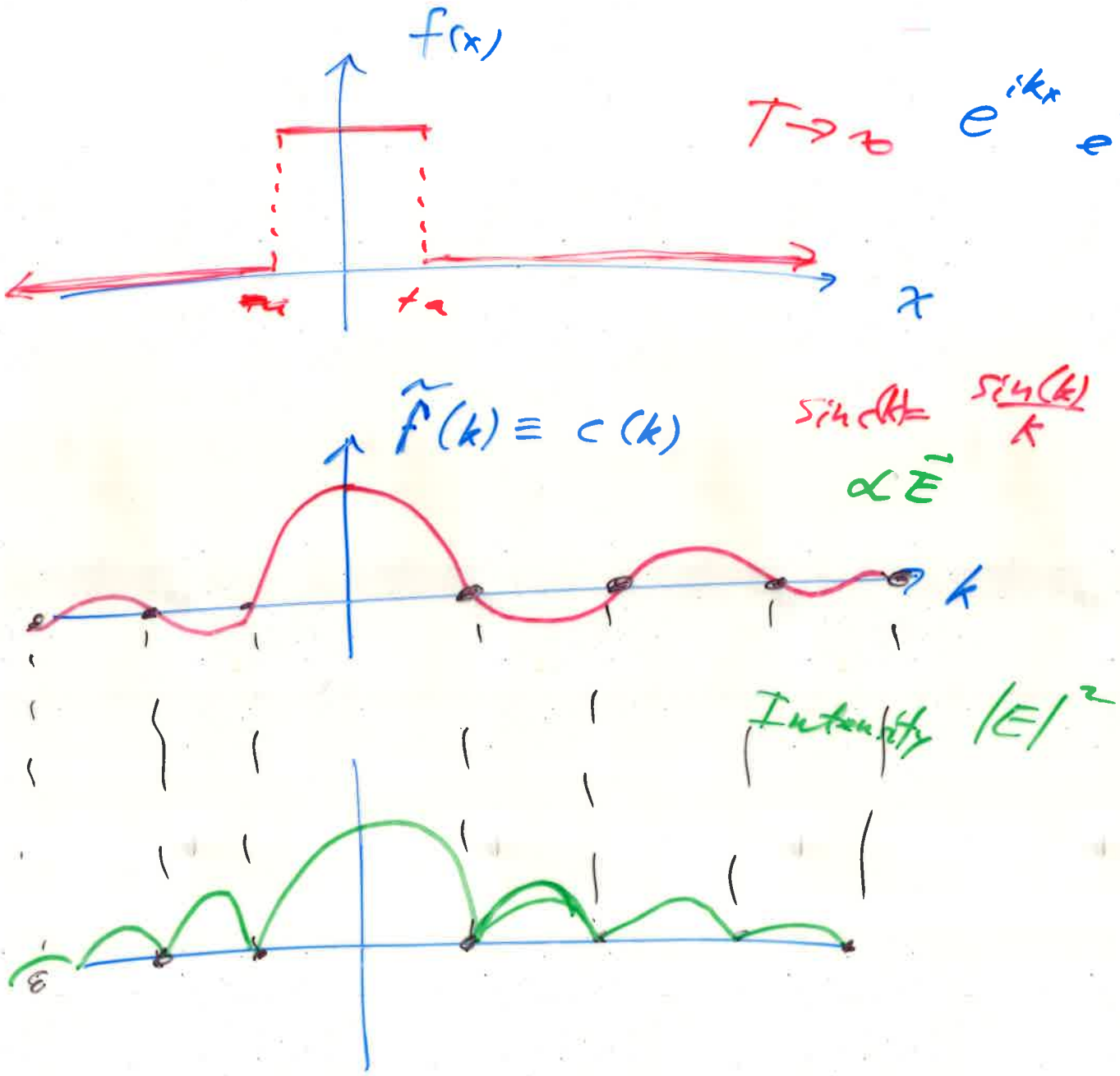

As the number of slits (scatterers) increases, the peaks become narrower. In a crystal, the number of scatterers is $\sim N_A$.

$\Rightarrow$ sharp peak in $\vec{G}_0$ direction
~ nothing in other directions

Geometric Structure Factor for fcc

Basis

$(x_1, y_1, z_1) = (0,0,0)$

$(x_2, y_2, z_2) = (\frac{1}{2}, \frac{1}{2}, 0)$

$(x_3, y_3, z_3) = (\frac{1}{2}, 0, \frac{1}{2})$

$(x_4, y_4, z_4) = (0, \frac{1}{2}, \frac{1}{2})$

Examples: no peaks: $S_{\vec{G}} = 0$

(1,0,0), (110), (102) (221)

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peaks at (111) (113) (133) (220) (200) (222)

Diamond Use conventional cubic cell

8 atoms in basis (x,y,z) = (000) (x y z) = $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$

$$S_{\vec{G}}^{\text{diamond}} = S_{\vec{G}}^{\text{fcc}} * \left[1 + e^{-\frac{\pi i}{2}(p_1+p_2+p_3)}\right]$$

S_G	Intensity
0	0
$2f$	$4f^2 \neq 0$
$f(1+i)$	$2\lvert f\rvert^2 \neq 0$

$\propto f^* f$

$n(\vec{r})$ for point-like atoms

$$Z\,\delta^3(\vec{r}) = Z\,\delta(x)\,\delta(y)\,\delta(z)$$

↑ atomic number

$$S_{\vec{G}} = \iiint n(\vec{r})\, e^{-i\vec{G}\cdot\vec{r}}\, dV = Z$$