13.13 We can not ignore the exponential prefactor in the equation after (13.80), for $z = a$

Then, when taking the modulus of $\vec{F}$, there is an extra factor of $\sin\left[\frac{a}{2}\left(\frac{\omega}{v} - k\cos\theta\right)\right]$.

It is essentially equivalent to show how to obtain the approximate equation (13.83) from (13.82) under the extreme condition $\omega \gg \omega_p$, $\gamma \gg 1$, and $\theta \ll 1$. For these conditions,

$$\frac{\omega}{v} - k\cos\theta = k\left(\frac{\omega}{kv} - 1 + \frac{\theta^2}{2}\right) = k\left(\frac{1}{\beta\sqrt{\varepsilon(\omega)}} - 1 + \frac{\theta^2}{2}\right) = k\left(\left[\left(1-\frac{1}{\gamma^2}\right)\left(1-\frac{\omega_p^2}{\omega^2}\right)\right]^{-1/2} - 1 + \frac{\theta^2}{2}\right)$$

$$= k\left(1 + \frac{1}{2\gamma^2} + \frac{\omega_p^2}{2\omega^2} - 1 + \frac{\theta^2}{2}\right) = \frac{k}{2\gamma^2}\left(1 + \frac{\gamma^2\omega_p^2}{\omega^2} + \gamma^2\theta^2\right) = \frac{\omega}{2\gamma^2 c}\left(1 + \frac{1}{\nu^2} + \eta\right)$$

$$= \frac{\omega_p}{2\gamma c} \cdot \frac{\omega}{\gamma\omega_p} \cdot \left(1 + \frac{1}{\nu^2} + \eta\right) = \frac{\nu}{2D}\left(1 + \frac{1}{\nu^2} + \eta\right).$$

Therefore, $\mathcal{F} = \sin^2\left[\frac{a}{2}\left(\frac{\omega}{v} - k\cos\theta\right)\right] = \sin^2\left[\nu\left(1 + \frac{1}{\nu^2} + \eta\right)\frac{a}{4D}\right]$