the phase matching condition always plays a significant role.

Fig.6—2 shows the relationship between the reflectivity and the block number N. In the calculations, we have choose λ, l_{A1}, n_1 and n_2 such that the phase matching condition is satisfied at $G_{1,1}$. In this case, a reflectivity of 100 % can be realized. For comparison, we have also calculated the dependence of the reflectivity on the block number N under the condition that Eq.(6—14) is not fulfilled. The reflectivity is low and varies with the block number rather randomly.Fig.6—3 shows the results.

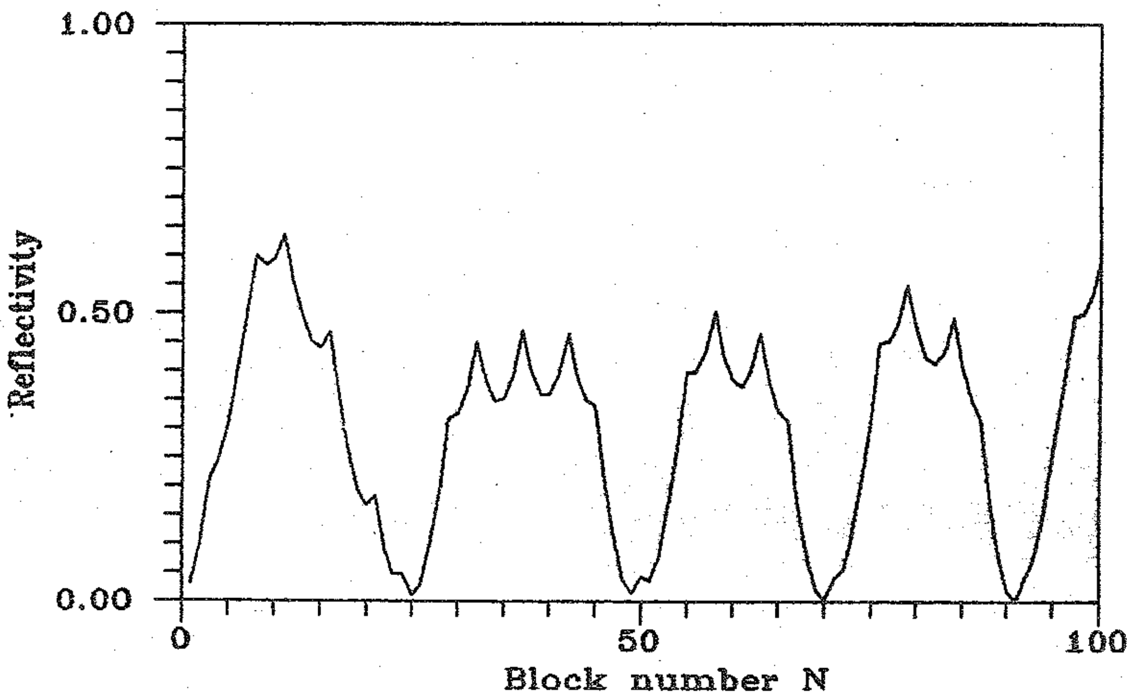

Fig.6—3.Reflectivity vs.block number for light waves with $\Delta k \neq G_{m,n}$.

The importance of the δ-function in Eq.(6—4) and Eq.(6—5) also lies in that it determines the features of the spectrum of reflectivity. From Eq.(6—4) and Eq.(6—5), we can see that for an acoustic wave, its velocity being non-dispersive, the spectrum will be self-similar;whereas for a light wave, dispersive effect of the refractive index should be taken into account. So the spectrum will be non-self-similar.

For the purpose of discussing the extinction phenomenon of the spectrum, in what follows we have set

$$l_{A2}=\frac{n_1}{n_2}\, l_{A1}(1+\eta),$$

$$l_{B2}=\frac{n_1}{n_2}\, l_{A1}(1-\tau\eta) \qquad (6—15)$$

with $\tau=\frac{1}{2}(1+\sqrt{5})$ and $\eta=0.34$, and assumed that n_1 and n_2 are independent of the wavelength. Fig.6—4 presents the reflectivity vs. Γ with $\Gamma=\Delta k n_1 l_{A1}$. The structure is self-similar. Otherwise, under the condition that n_1 and n_2 are dependent on the wavelength, the reflectivity will be non-self-similar. It should be pointed out that the results of the numerical calculation conforms to the analytical ones. This implies that the analytical expression obtained here is reasonable.

As mentioned before, because of the existance of the two kinds of interfaces, there appears a factor $\sin\frac{1}{2}\Delta k L_{A1}$ in Eq.(6—4). This will lead to the occurrence of the extinction phenomenon. Fig.6—5 is a magnified view of one portion of Fig.6—4. There, we can see clearly the mode

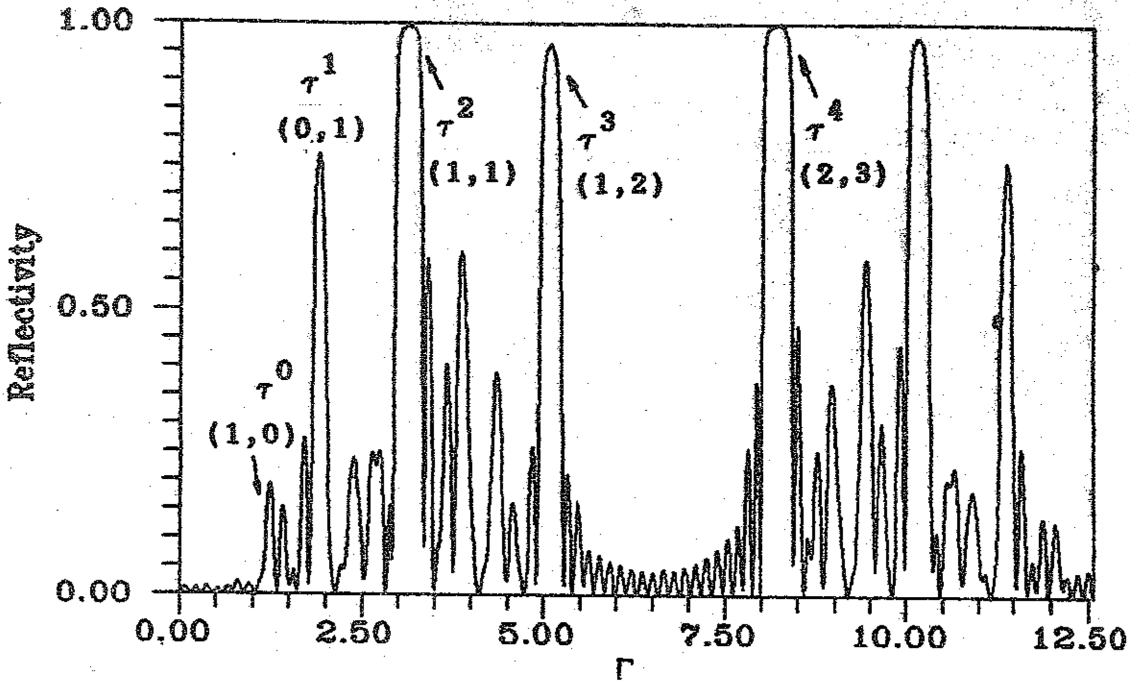

Fig.6—4.Reflectivity vs.Γ for light waves, $\Gamma=\Delta k n_1 l$, $n_1=2.5$ and $n_2=2.0$.

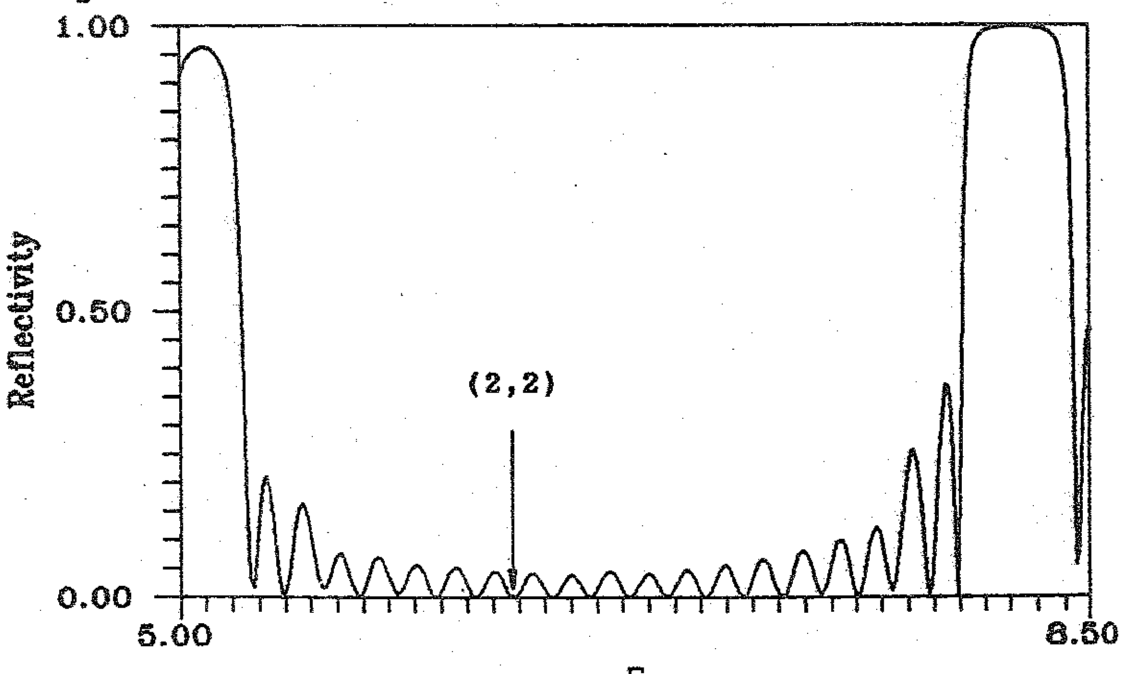

Fig.6—5.Magnified view of one portion of Fig.6—4. Mode (2,2) is clearly absent in this figure.

(2,2) is absent. More generally, we can derive the extinction rule from Eq.(6—4) which is

$$(m,n)=(2j,2j). \tag{6—16}$$

It should be noted that all the results obtained are equally suitable to the Fibonacci micron superlattice.

§6—3. Summary

We have analysed the propagation of light and acoustic waves in a conventional quasiperiodic superlattice theoretically. The results can be applied to the micron superlattice. The phase matching concept has been proposed. For light waves, the spectrum is non-self-similar due to the dispersive effect of the refractive index. But for acoustic waves, the spectrum is still self-similar because its velocity is non-dispersive. For both of them, the extinction phenomenon exists provided the structure parameters are properly selected.

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