again the condition of the continuity of their tangential components along the crystal surface. The extremities, M_j and N_j, of these wavevectors

$$\mathbf{OM}_j = \mathbf{K}_{\mathbf{o}j}^{(d)} \qquad \mathbf{HN}_j = \mathbf{K}_{\mathbf{h}j}^{(d)}$$

lie at the intersections of the spheres of radius k centred at O and H, respectively, with the normal $\mathbf{n}'$ to the crystal exit surface drawn from P_j ($j = 1$ and 2) (Fig. 5.1.6.3).

If the crystal is wedge-shaped and the normals $\mathbf{n}$ and $\mathbf{n}'$ to the entrance and exit surfaces are not parallel, the wavevectors of the waves generated by the two wavefields are not parallel. This effect is due to the refraction properties associated with the dispersion surface.

5.1.6.3.2. *Amplitudes – Pendellösung*

We shall assume from now on that the crystal is plane parallel. Two wavefields arrive at any point of the exit surface. Their constituent waves interfere and generate emerging waves in the refracted and reflected directions (Fig. 5.1.6.4). Their respective

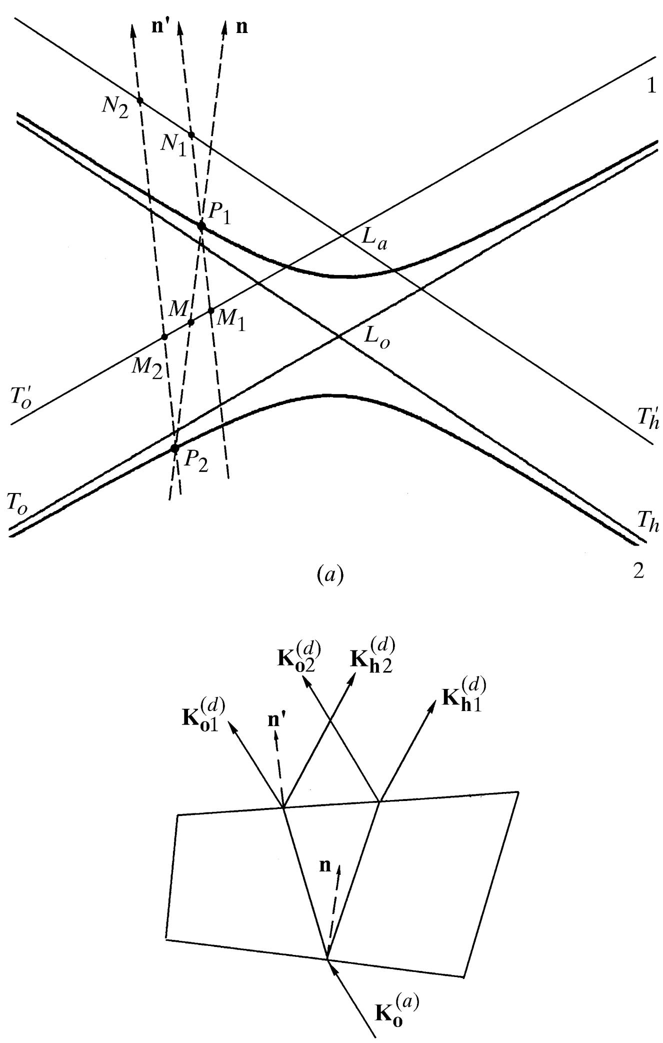

Fig. 5.1.6.3. Boundary condition for the wavevectors at the exit surface. (*a*) Reciprocal space. The wavevectors of the emerging waves are determined by the intersections M_1, M_2, N_1 and N_2 of the normals $\mathbf{n}'$ to the exit surface, drawn from the tie points P_1 and P_2 of the wavefields, with the tangents T'_o and T'_h to the spheres centred at O and H and of radius k, respectively. (*b*) Direct space.

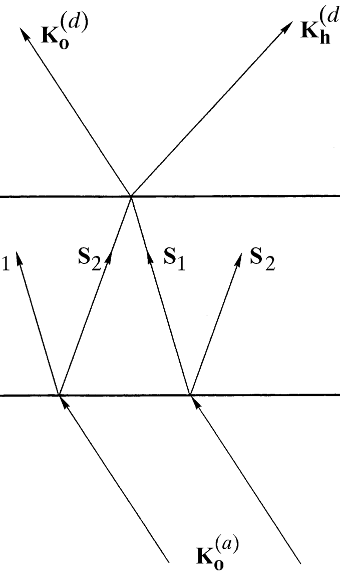

Fig. 5.1.6.4. Decomposition of a wavefield into its two components when it reaches the exit surface. $\mathbf{S}_1$ and $\mathbf{S}_2$ are the Poynting vectors of the two wavefields propagating in the crystal belonging to branches 1 and 2 of the dispersion surface, respectively, and interfering at the exit surface.

amplitudes are given by the boundary conditions

$$\begin{aligned} D_o^{(d)} \exp(-2\pi i \mathbf{K}_{\mathbf{o}}^{(d)} \cdot \mathbf{r}) &= D_{o1} \exp(-2\pi i \mathbf{K}_{\mathbf{o}1} \cdot \mathbf{r}) \\ &\quad + D_{o2} \exp(-2\pi i \mathbf{K}_{\mathbf{o}2} \cdot \mathbf{r}) \\ D_h^{(d)} \exp(-2\pi i \mathbf{K}_{\mathbf{h}}^{(d)} \cdot \mathbf{r}) &= D_{h1} \exp(-2\pi i \mathbf{K}_{\mathbf{h}1} \cdot \mathbf{r}) \\ &\quad + D_{h2} \exp(-2\pi i \mathbf{K}_{\mathbf{h}2} \cdot \mathbf{r}), \end{aligned} \qquad (5.1.6.4)$$

where $\mathbf{r}$ is the position vector of a point on the exit surface, the origin of phases being taken at the entrance surface.

In a plane-parallel crystal, (5.1.6.4) reduces to

$$\begin{aligned} D_o^{(d)} &= D_{o1} \exp\left(-2\pi i \overline{MP_1} \cdot t\right) + D_{o2} \exp\left(-2\pi i \overline{MP_2} \cdot t\right) \\ D_h^{(d)} &= D_{h1} \exp\left(-2\pi i \overline{MP_1} \cdot t\right) + D_{h2} \exp\left(-2\pi i \overline{MP_2} \cdot t\right), \end{aligned}$$

where t is the crystal thickness.

In a *non-absorbing* crystal, the amplitudes squared are of the form

$$\left|D_o^{(d)}\right|^2 = |D_{o1}|^2 + |D_{o2}|^2 + 2D_{o1}D_{o2} \cos 2\pi \overline{P_2P_1} t.$$

This expression shows that the intensities of the refracted and reflected beams are oscillating functions of crystal thickness. The period of the oscillations is called the *Pendellösung* distance and is

$$\Lambda = 1/\overline{P_2P_1} = \Lambda_L/(1 + \eta_r^2)^{1/2}.$$

5.1.6.4. *Reflecting power*

For an *absorbing* crystal, the intensities of the reflected and refracted waves are

$$\begin{aligned} \left|D_o^{(d)}\right|^2 &= \left|D_o^{(a)}\right|^2 A_\eta \Big\{ \cosh(2v + \mu_a t). \\ &\quad + \cos\left[2\pi t \Lambda^{-1} - 2\eta_i (1 + \eta_r^2)^{-1/2}\right] \Big\} \\ \left|D_h^{(d)}\right|^2 &= \left|D_o^{(a)}\right|^2 |F_h/F_{\bar{h}}| \gamma^{-1} A_\eta \left[\cosh(\mu_a t) - \cos(2\pi t \Lambda^{-1})\right], \end{aligned} \qquad (5.1.6.5)$$

where