

Fig. 2.1. In a plane wave the electric and magnetic field strengths are perpendicular to the direction of propagation. At any moment in time, the fields are constant within planes perpendicular to the direction of motion. As time advances, these planes move with constant velocity.

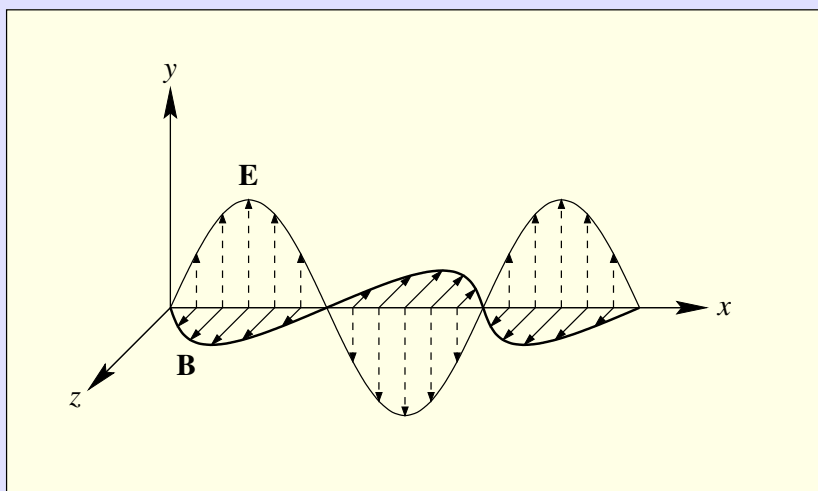


Fig. 2.2. For a given moment in time, the electric field strength \vec{E} and the magnetic field strength \vec{B} are shown along a line parallel to the direction of motion of the harmonic plane wave.

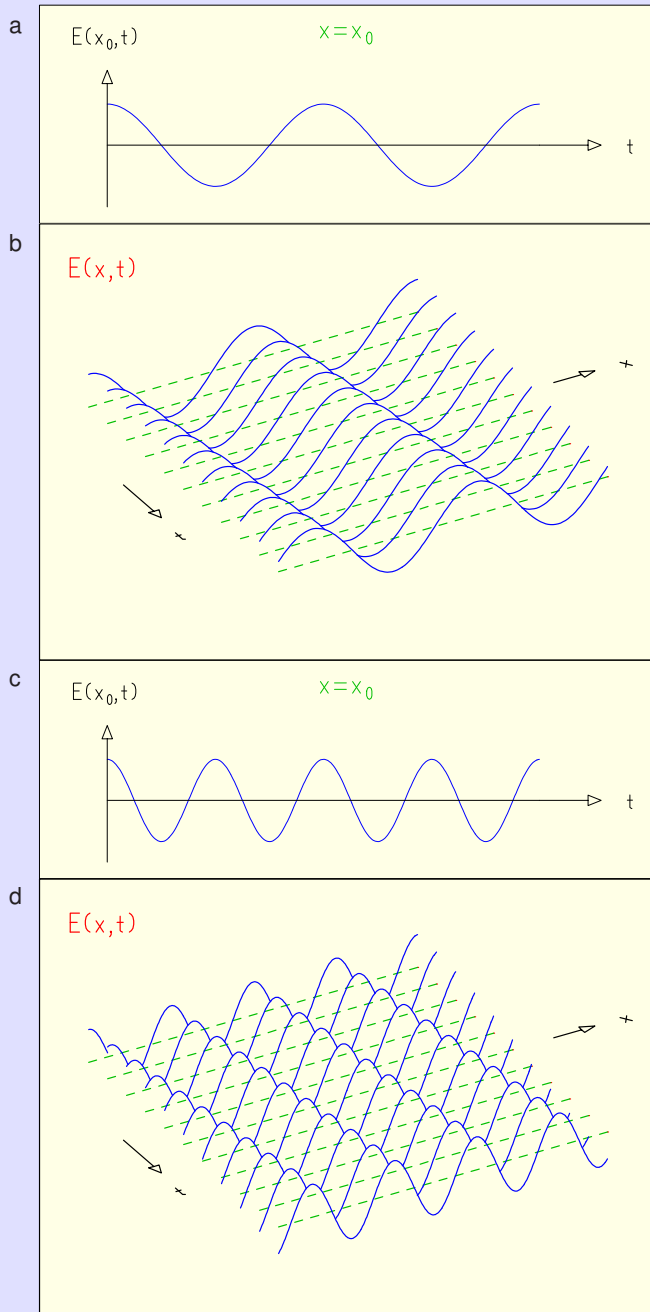


Fig. 2.3. (a) Time dependence of the electric field of a harmonic wave at a fixed point in space. (b) Time development of the electric field of a harmonic wave. The field distribution along the x direction is shown for several moments in time. Early moments are in the background, later moments in the foreground. (c, d) Here the wave has twice the frequency. We observe that the period T and the wavelength λ are halved, but that the phase velocity c stays the same. The time developments in parts b and d are drawn for the same interval of time.

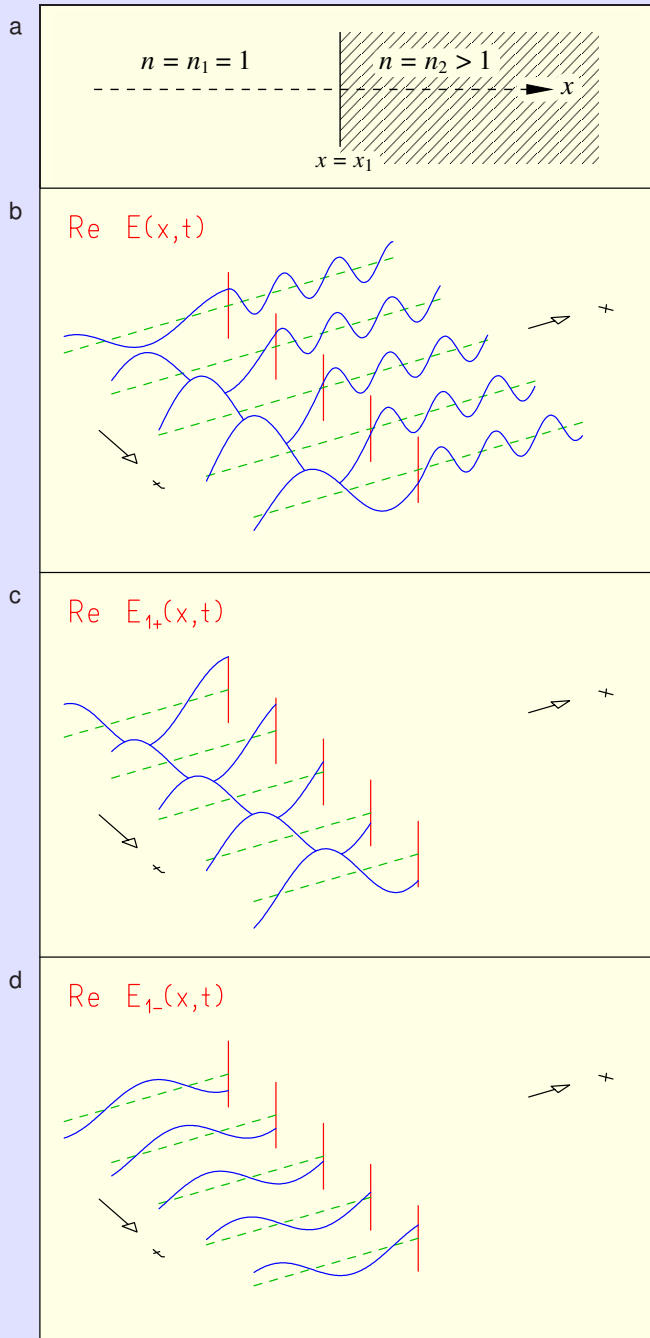


Fig. 2.4. (a) To the right of the plane $x = x_1$, a glass block extends with refractive index $n = n_2$; to the left there is empty space, $n = 1$. (b) Time development of the electric field strength of a harmonic wave which falls from the left onto a glass surface, represented by the vertical line, and is partly reflected by and partly transmitted into the glass. (c) Time development of the incoming wave alone. (d) Time development of the reflected wave alone.

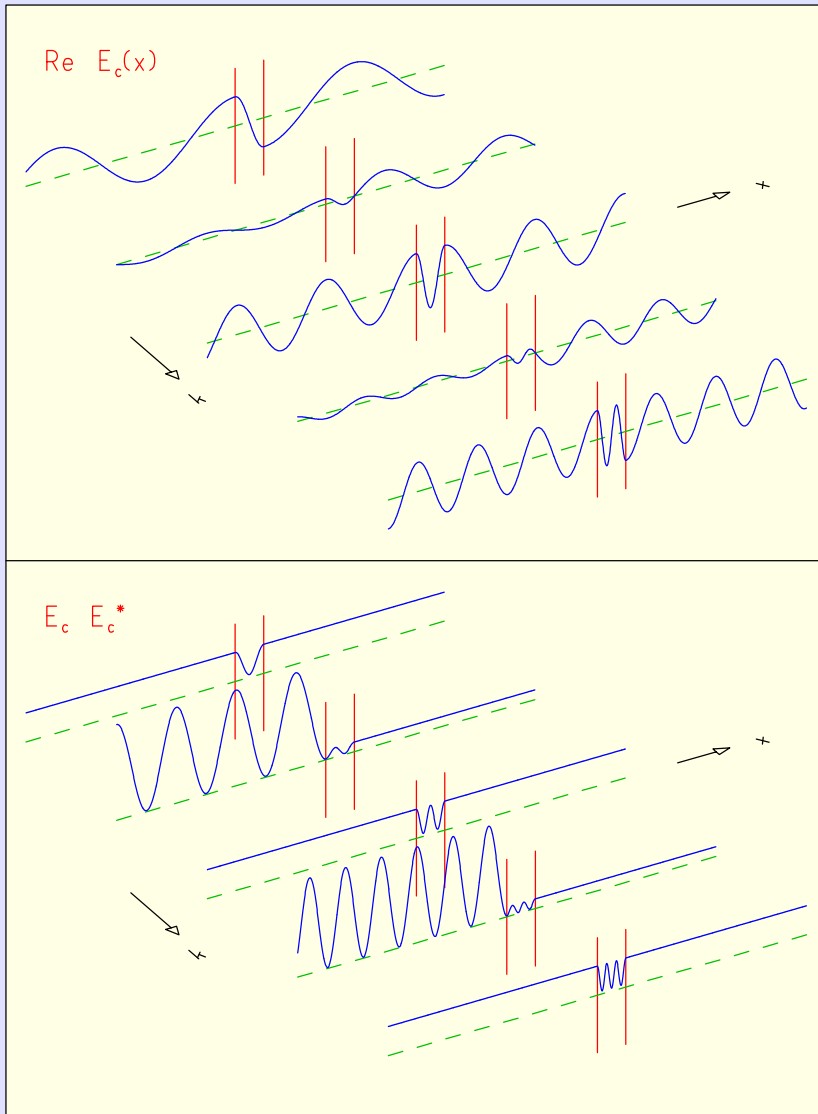


Fig. 2.5. Top: Frequency dependence of stationary waves when a harmonic wave is incident from the left on a glass plate. The two vertical lines indicate the thickness of the plate. Small values of the angular frequency ω are given in the background, large values in the foreground of the picture. Bottom: Frequency dependence of the quantity $E_c E_c^*$ (which except for a factor n_2 is proportional to the average energy density) of a harmonic wave incident from the left on a glass plate. The parameters are the same as in part a. At a resonance of transmission, the average energy density is constant in the left region, indicating through the absence of interference wiggles that there is no reflection.

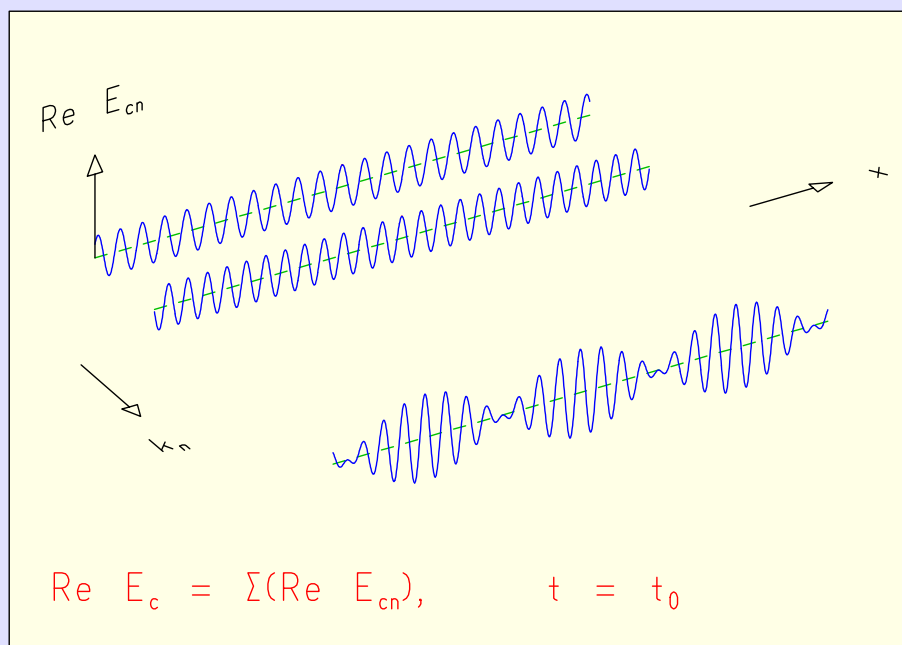


Fig. 2.6. Superposition of two harmonic waves of slightly different angular frequencies ω_1 and ω_2 at a fixed moment in time.

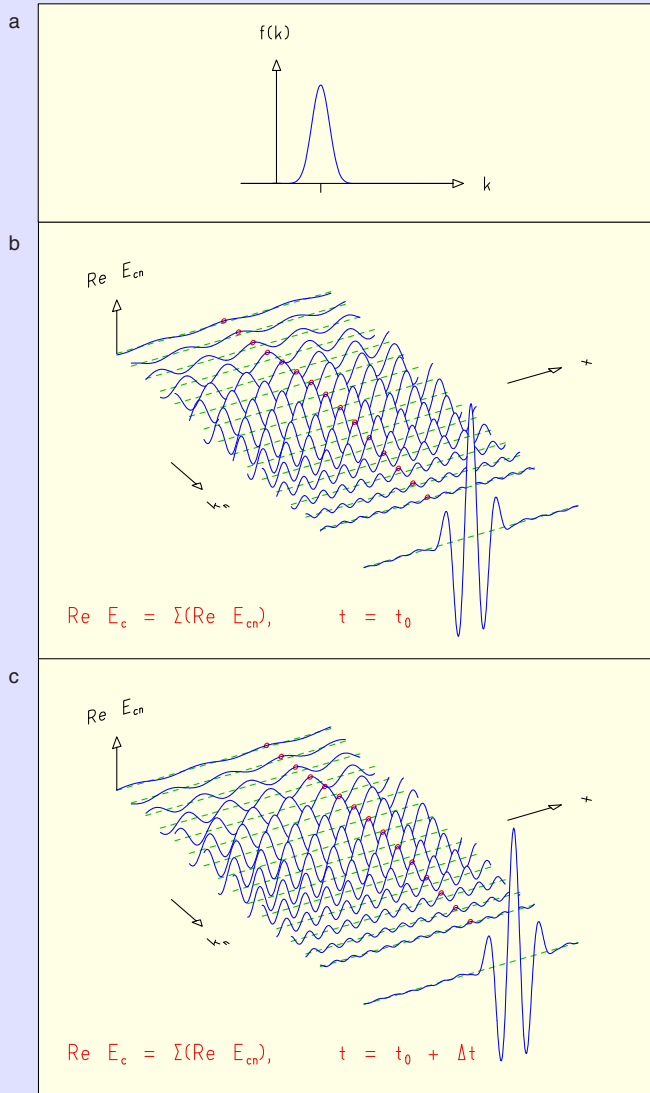


Fig. 2.7. (a) Gaussian spectral function describing the amplitudes of harmonic waves of different wave numbers k . (b) Construction of a light wave packet as a sum of harmonic waves of different wavelengths and amplitudes. For time $t = 0$ the different terms of the sum are plotted, starting with the contribution of the longest wavelength in the background. Points $x = 0$ are indicated as circles on the partial waves. The resulting wave packet is shown in the foreground. (c) The same as part b, but for time $t_1 > 0$. The phases that were at $x = 0$ for $t = 0$ have moved to $x_1 = ct_1$ for all partial waves. The wave packet has consequently moved by the same distance and retained its shape.

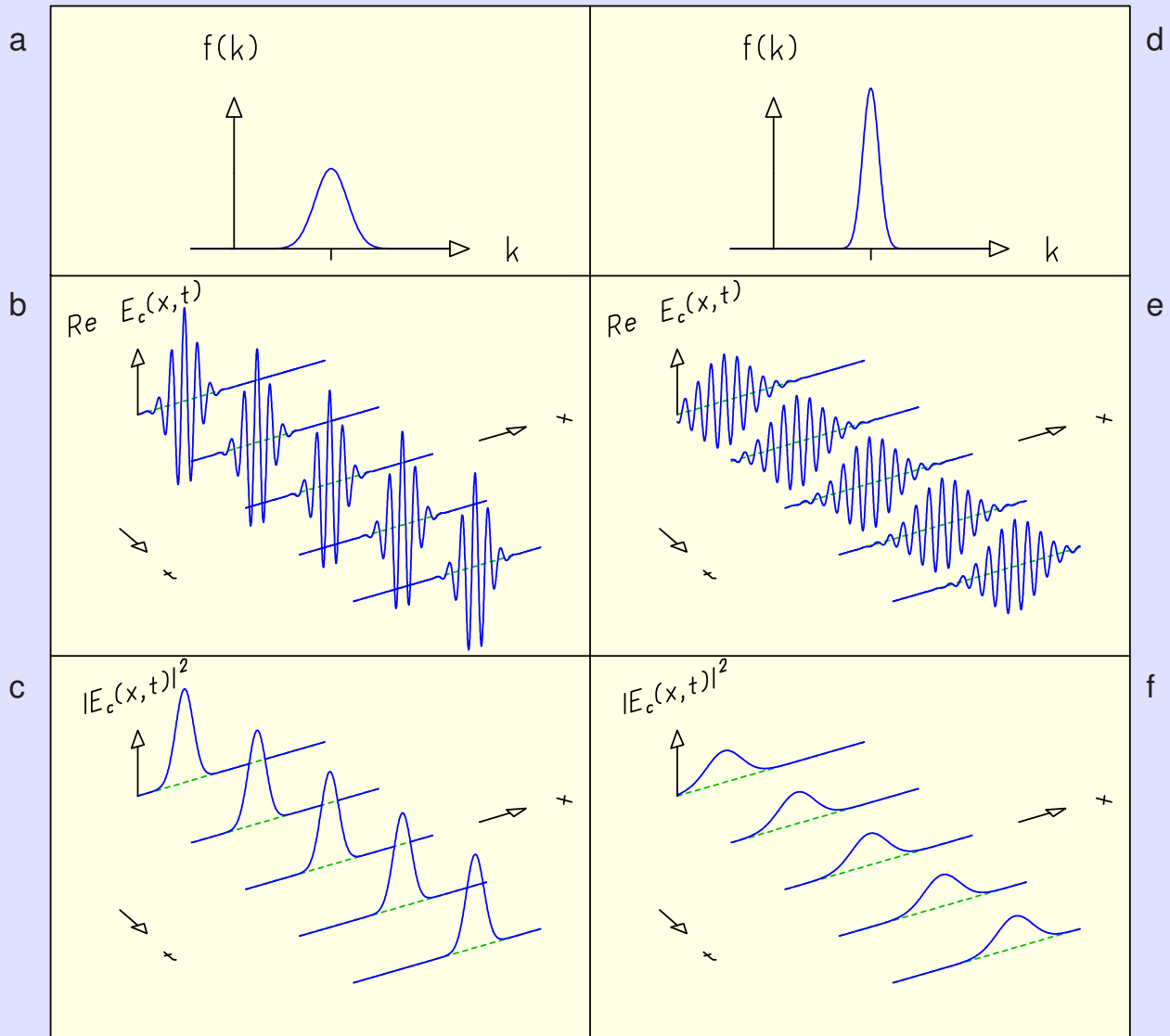


Fig. 2.8. (a, d) Spectral functions, (b, e) time developments of the field strength, and (c, f) time developments of the average energy density for two different Gaussian wave packets.

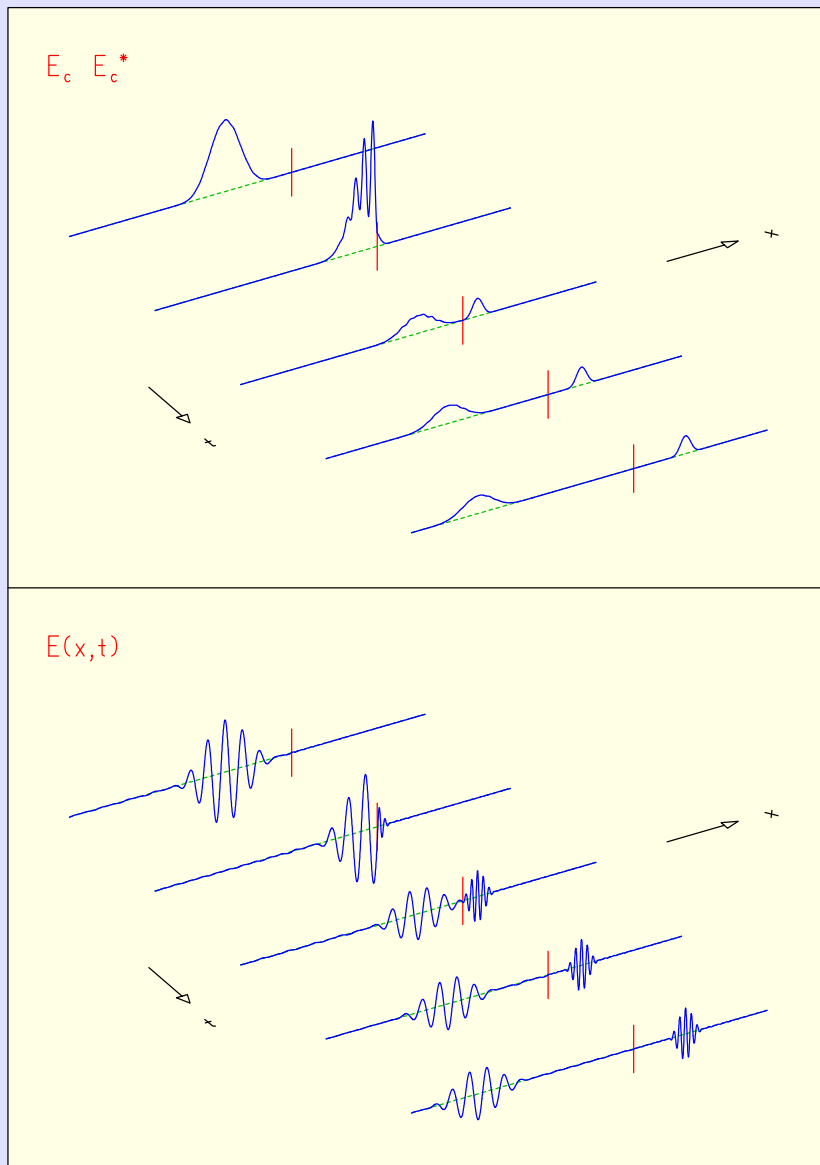


Fig. 2.9. Time developments of the quantity $E_c E_c^*$ (which except for a factor n^2 is proportional to the average energy density) and of the field strength in a wave packet of light falling onto a glass surface where it is partly reflected and partly transmitted through the surface. The glass surface is indicated by the vertical line.

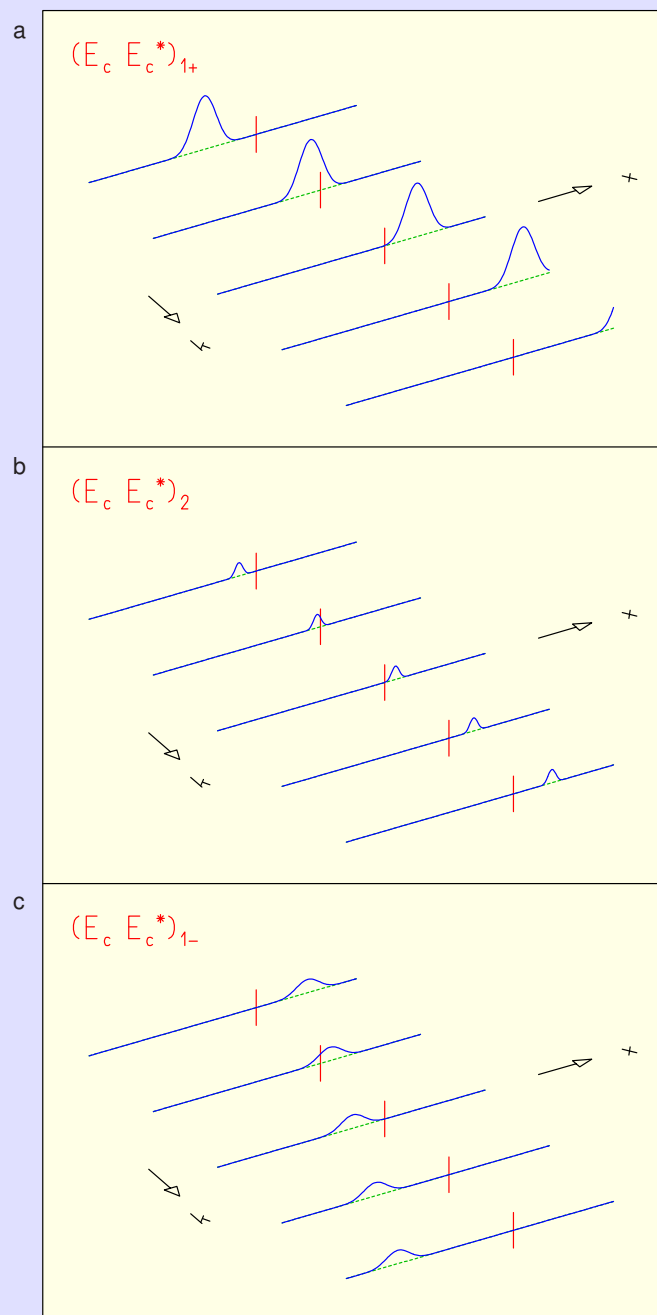


Fig. 2.10. Time developments of the quantity $E_c E_c^*$ (which except for a factor n^2 is proportional to the average energy density) of the constituent waves in a wave packet of light incident on a glass surface: (a) incoming wave, (b) transmitted wave, and (c) reflected wave.

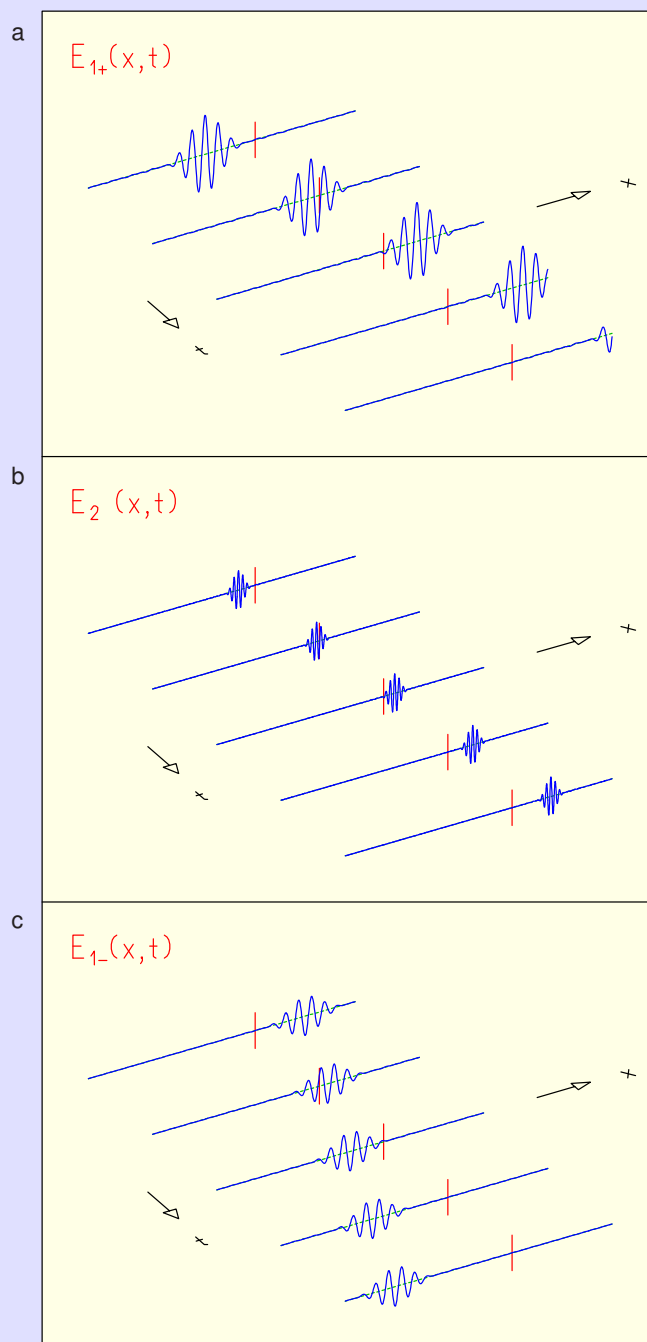


Fig. 2.11. Time developments of the electric field strengths of the constituent waves in a wave packet of light incident on a glass surface: (a) incoming wave, (b) transmitted wave, and (c) reflected wave.

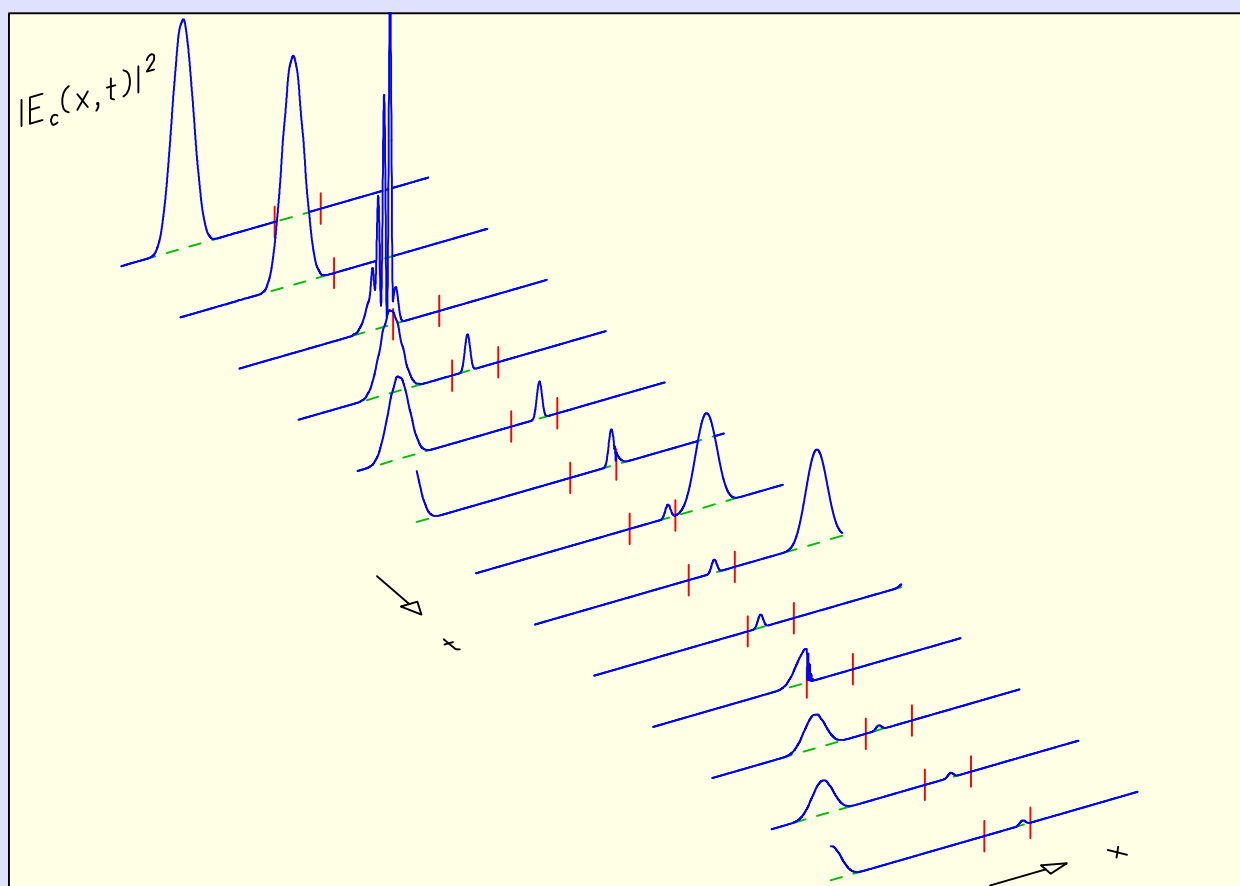


Fig. 2.12. Time development of the quantity $E_c E_c^*$ (which except for a factor n^2 is proportional to the average energy density) in a wave packet of light incident on a glass plate.