

### 3.3 Dispersionsrelationen

$$\begin{aligned}
 \mathcal{P} \int_{-\infty}^{+\infty} \frac{f(\omega') d\omega'}{\omega' - \omega} &= \\
 &= \lim_{\varepsilon \rightarrow 0} \left[ \int_{-\infty}^{\omega - \varepsilon} \frac{f(\omega') d\omega'}{\omega' - \omega} + \int_{\omega + \varepsilon}^{+\infty} \frac{f(\omega') d\omega'}{\omega' - \omega} \right]
 \end{aligned}$$


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$$\begin{aligned}
 \int_{-\infty}^{+\infty} \frac{\omega' f(\omega') d\omega'}{\omega'^2 - \omega^2} &= \int_{-\infty}^0 \frac{\omega' f(\omega') d\omega'}{\omega'^2 - \omega^2} + \int_0^{+\infty} \frac{\omega' f(\omega') d\omega'}{\omega'^2 - \omega^2} \\
 &\rightarrow \int_0^{\infty} \frac{\omega' f^*(\omega) d\omega'}{\omega'^2 - \omega^2} = - \int_0^{\infty} \frac{\omega' f^*(\omega) d\omega'}{\omega'^2 - \omega^2}
 \end{aligned}$$


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### Kap 3 Nichtlineare Optik

$$\begin{aligned}
 \vec{D}(\vec{r}, t) &= \varepsilon_0 \vec{E}(\vec{r}, t) + \varepsilon_0 \int_0^{\infty} \underline{\chi}(t') \cdot \vec{E}(\vec{r}, t-t') dt' + \mathcal{P}^{NL}(\vec{r}) \\
 &= \varepsilon_0 \int_0^{\infty} \delta(t-t') \underline{1} \cdot \vec{E}(\vec{r}, t') dt' + \varepsilon_0 \int_0^{\infty} \dots + \mathcal{P}^{NL} \\
 \delta(t-t') \underline{1} + \underline{\chi}(t') &= \underline{\varepsilon}(t')
 \end{aligned}$$

$$\vec{D}(\vec{r}, t) = \epsilon_0 \int_0^{\infty} \underline{\epsilon}(t') \cdot \vec{E}(\vec{r}, t') dt' + \vec{P}^{NL}(\vec{r}, t)$$