$$\Delta E - \nabla\nabla\cdot\vec{E} = +\mu_0\ddot{\vec{D}} \quad ; \nabla\cdot\vec{D}=0 \; ; \vec{D}=\varepsilon_0\vec{E}+\vec{P}$$

Trennung der linearen von den nichtlinearen Termen

$$\vec{D} = \varepsilon_0\vec{E} + \varepsilon_0\int_0^\infty \underline{\chi}\cdot\vec{E}(\vec{r},t-t')\,dt' + \vec{P}^{NL} \quad \Big| \quad \vec{P}^{NL} = \varepsilon_0\underline{\chi}^{(2)}:\vec{E}\vec{E}$$

Poisson-Glg. $\nabla\cdot\vec{D}=0$ / $\vec{D}=\varepsilon_0\underline{\varepsilon}\cdot\vec{E}+P^{NL}$

$$\varepsilon_0\int_0^\infty \nabla\cdot\underline{\varepsilon}(t')\cdot\vec{E}(\vec{r},t-t')\,dt' + \nabla\cdot\vec{P}^{NL}=0$$

ohne Gedächtniseffekt: $\vec{D}=\varepsilon_0\underline{\varepsilon}\cdot\vec{E}(\vec{r},t)+\vec{P}^{NL}$

Poisson-Glg $\nabla\cdot\underline{\varepsilon}\cdot\vec{E} = -\frac{1}{\varepsilon_0}\nabla\cdot P^{NL} = -\nabla\cdot\underline{\chi}^{(2)}:\vec{E}\vec{E}$

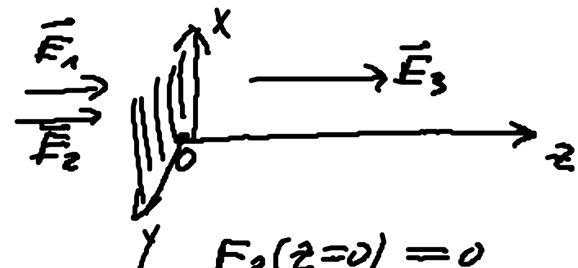
quadrat. Form

$$\Delta\vec{E} - \nabla\nabla\cdot\vec{E} - \frac{1}{c^2}\underline{\varepsilon}\cdot\ddot{\vec{E}} = \mu_0\ddot{P}^{NL} = \frac{1}{c^2}\underline{\chi}^{(2)}\frac{\partial^2}{\partial t^2}\vec{E}\vec{E}$$

$$\omega_1+\omega_2=\omega_3 \implies \omega_1=\omega_3-\omega_2$$

Näherungsannahmen:

1) $|E_3| \ll |E_1|, |E_2|$
2) $\vec{E}_j$ ebene Wellen in z-Richtung
   $\vec{E}_j = \vec{E}_j(z,t)$
3) opt. Achse = z-Achse mit $\underline{\varepsilon} = \begin{pmatrix}\varepsilon_\perp & & 0\\ & \varepsilon_\perp & \\ 0 & & \varepsilon_\parallel\end{pmatrix}$



$E_3(z=0)=0$

Dgl $\Delta\vec{E}_3 - \nabla\nabla\cdot\vec{E}_3 + \frac{\omega_3^2}{c^2}\underline{\varepsilon}\cdot\vec{E}_3 = -\frac{\omega_3^2}{c^2}\underline{\chi}^{(2)}:\vec{E}_1\vec{E}_2$

$\perp$ $\quad \frac{\partial^2}{\partial z^2}E_\perp + \underbrace{\boxed{\frac{\omega_3^2}{c^2}\varepsilon_\perp}}_{=k^2} E_\perp = -\frac{\omega_3^2}{c^2}\underbrace{\boxed{\vec{e}_\perp\cdot\underline{\chi}^{(2)}:\vec{n}_1\vec{n}_2}}_{\chi_\perp^{(2)}} E_{10}E_{20}\times \exp\{i(k_1z+k_2z)\}$