强吸收 锥折射（高斯 on 双轴）

类似 Nd:YAG 的 激光晶体：拥有多条 强吸收线
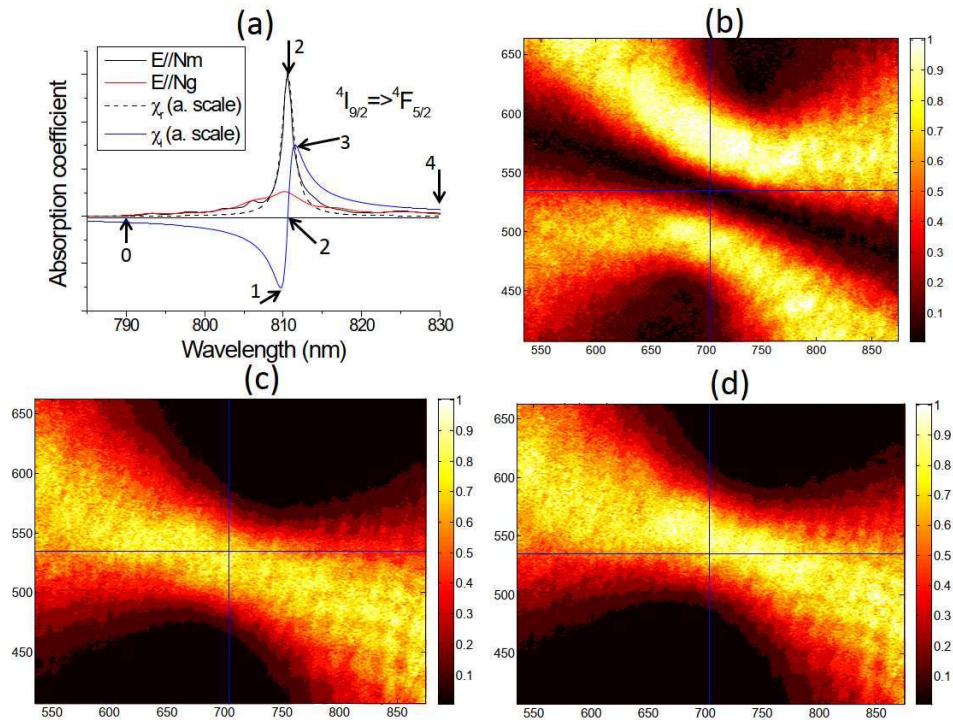### 波长相关：才是需要讨论 K-K Relation 的地方
时空频域光谱：全面表征光与物质相互作用之吸收

Fig. 2: (a) Example of $^4I_{9/2} \rightarrow {}^4F_{5/2}$ absorption spectra of KGW:Nd in two polarizations near 810 nm and the main line modeled in arbitrary scale; (b), (c), (d): transmission angular distribution in arbitrary units at 810.6 nm of the optical axis-oriented KGW:Nd sample respectively in linear, right-circular and left-circular input polarizations. The cross center is the location of the optical axis of the transparent crystal (790 nm).
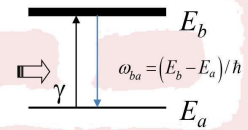
频率为ν、强度为$I(\nu)$的平面波在z方向通过厚为dz的吸收样品后的减弱$dI(\nu)$正比于$I(\nu)$和dz，有

$$-dI(\nu) = \alpha I(\nu)dz$$

比例系数α称为吸收系数，对于一个确定的从态a到态b的吸收跃迁过程，吸收系数α_{ab}依赖二能级布居和原子吸收截面σ_{ab}。

$$\alpha_{ab}(\nu) = \sigma_{ab}(\nu)\left(N_a - \frac{g_a}{g_b}N_b\right)$$

$\omega_{ba} = (E_b - E_a)/\hbar$

$\sigma_p = 7.81 \ 10^{-20} \ cm^2$, $\sigma_m = 26.75 \ 10^{-20} \ cm^2$, $\sigma_g = 3.43 \ 10^{-20} \ cm^2$

$^4F_{5/2}$ —— Nd^{3+}

$\alpha \propto \kappa \propto \sigma \propto$ $\quad W_{i \to f} \propto |M|^2 g(\hbar\omega)$

$^4I_{9/2}$

(Fermi's Golden Rule)