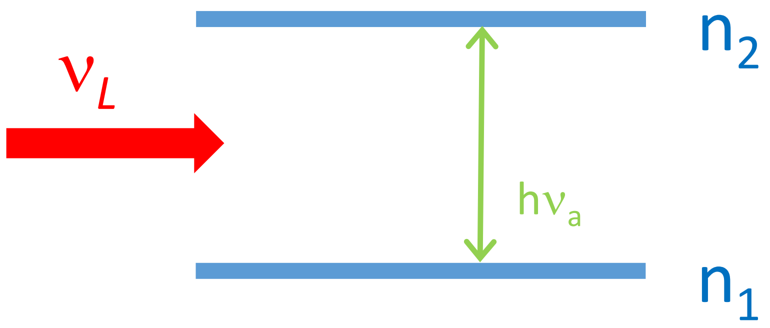
SPETTROSCOPIA



$$\frac{dI}{dx} = \sigma I \, (n_2 - n_1)$$

Spettroscopia lineare: $n_2 \approx 0 \quad n_1 \approx n$

$$I_{out} = I_{in} \, e^{-\alpha L}$$

Legge di Beer-Lambert

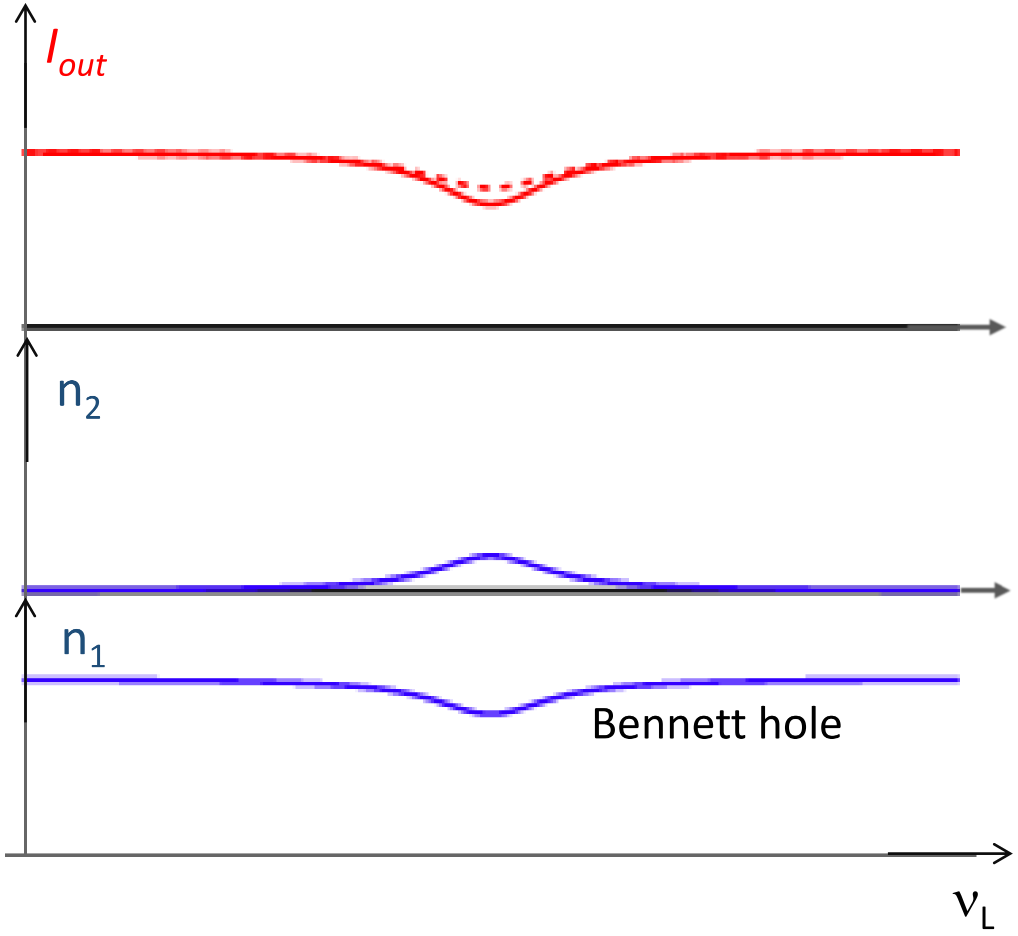
$$\alpha = \sigma \, n$$

$$\sigma(\nu_L) = \frac{1}{\pi\gamma} \frac{\sigma_0}{1 + \left(\frac{\nu_L - \nu_a}{\gamma}\right)^2}$$

SPETTROSCOPIA

$$I_{out} = I_{in}\, e^{-\alpha L}$$

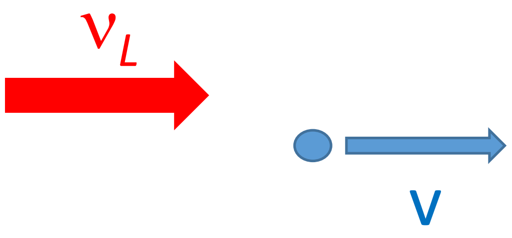
$$\sigma(\nu_L) = \frac{1}{\pi\gamma} \frac{\sigma_0}{1 + \left(\frac{\nu_L - \nu_a}{\gamma}\right)^2}$$



$$\gamma_s = \gamma \sqrt{1 + \frac{I}{I_s}}$$

ALLARGAMENTO DOPPLER

$$n(v) = n_0 \frac{1}{\sqrt{2\pi}\, v_0} \exp\left(-\frac{v^2}{2v_0^2}\right) \qquad v_0^2 = \frac{k_B T}{m}$$



Frequenza vista dall'atomo: $\nu_L' = \nu_L - k\,v$

$$k = 2\pi\nu_L/c$$

$$\sigma(\nu_L) = \frac{1}{\pi\gamma} \frac{\sigma_0}{1 + \left(\frac{\nu_L - (\nu_a + k\,v)}{\gamma}\right)^2}$$

$$\alpha = \int_{-\infty}^{\infty} \mathrm{d}v\, n\, \sigma = \sigma_0\, n_0 \int_{-\infty}^{\infty} \mathrm{d}v\, \frac{1}{\sqrt{2\pi}\, v_0} \exp\left(-\frac{v^2}{2v_0^2}\right) \frac{1/\pi\gamma}{1 + \left(\frac{\nu_L - \nu_a - kv)}{\gamma}\right)^2}$$

Profilo di Voigt

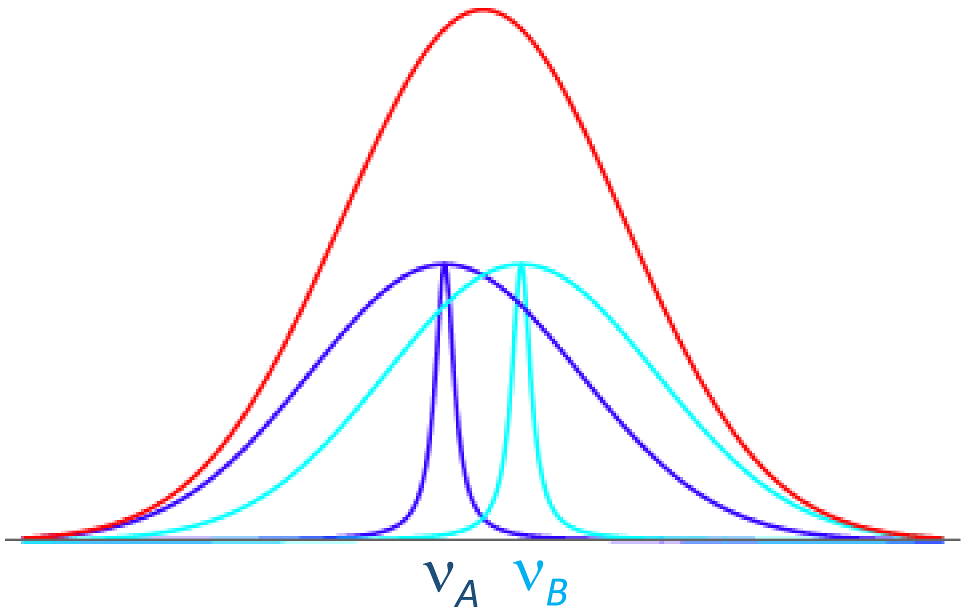
ALLARGAMENTO DOPPLER

$$\alpha = \int_{-\infty}^{\infty} \mathrm{d}v\, n\, \sigma = \sigma_0\, n_0 \int_{-\infty}^{\infty} \mathrm{d}v\, \frac{1}{\sqrt{2\pi}\, v_0}\, \exp\left(-\frac{v^2}{2v_0^2}\right) \frac{1/\pi\gamma}{1+\left(\frac{\nu_L-\nu_a-kv)}{\gamma}\right)^2}$$

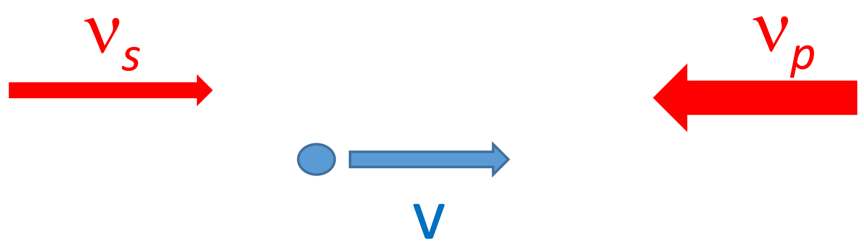
$$\gamma \ll k\, v_0$$

Larghezza Doppler

$$\alpha \approx \sigma_0\, n_0 \frac{1}{\sqrt{2\pi}\, k\, v_0} \exp\left[-\frac{1}{2}\left(\frac{\nu_L-\nu_a}{kv_0}\right)^2\right]$$

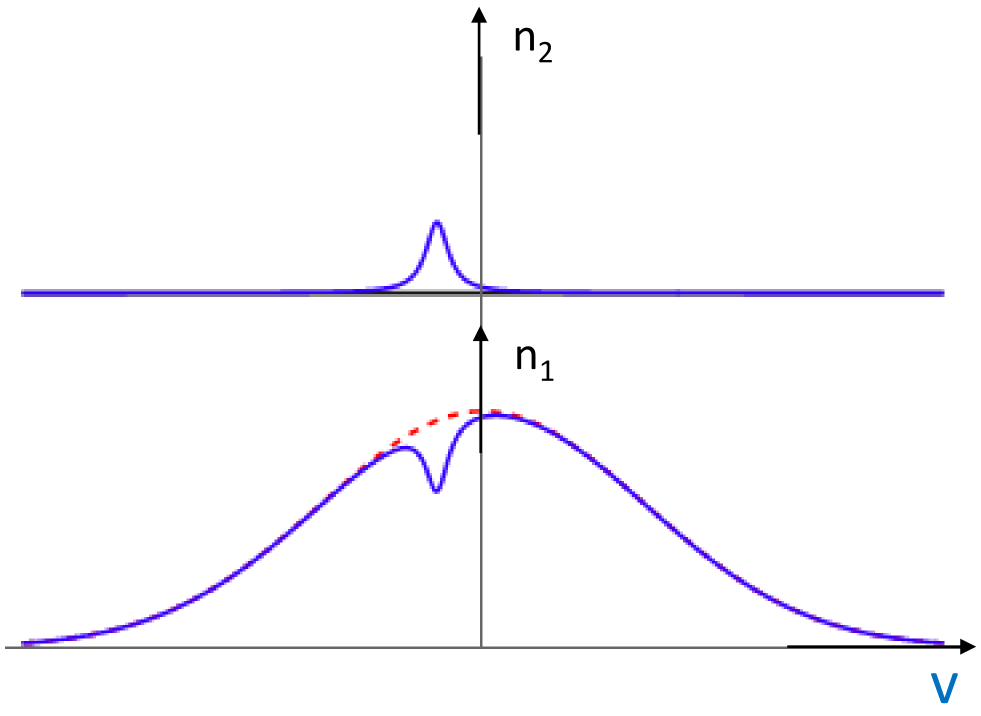


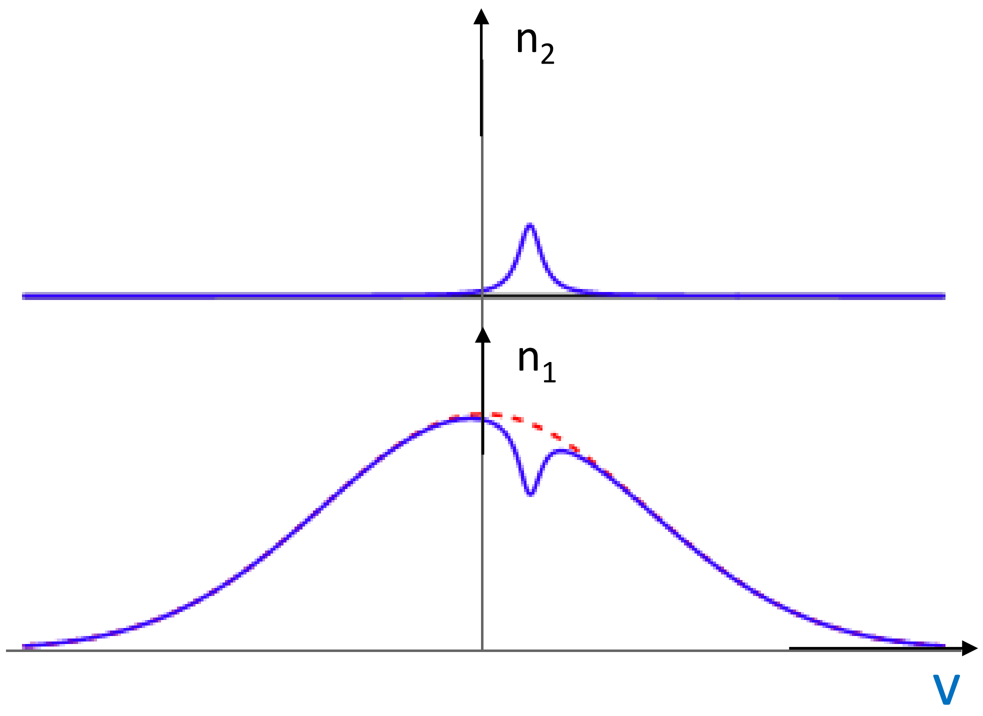
SPETTROSCOPIA SUB-DOPPLER in saturazione



$$\nu'_s = \nu_L - kv$$

$$\nu'_p = \nu_L + kv$$





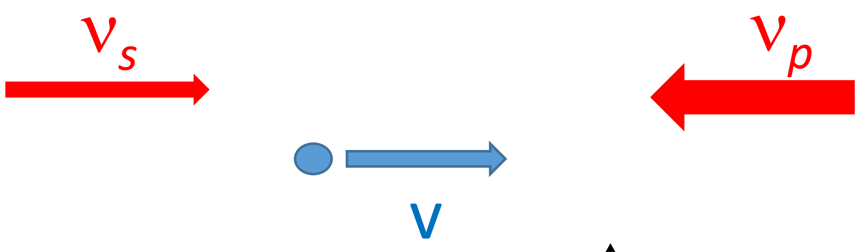
$$\nu'_s = \nu_a \implies v_s = \frac{\nu_L - \nu_a}{k}$$

$$\nu'_p = \nu_a \implies v_p = -\frac{\nu_L - \nu_a}{k}$$

$$v_p = v_s \implies v = 0$$

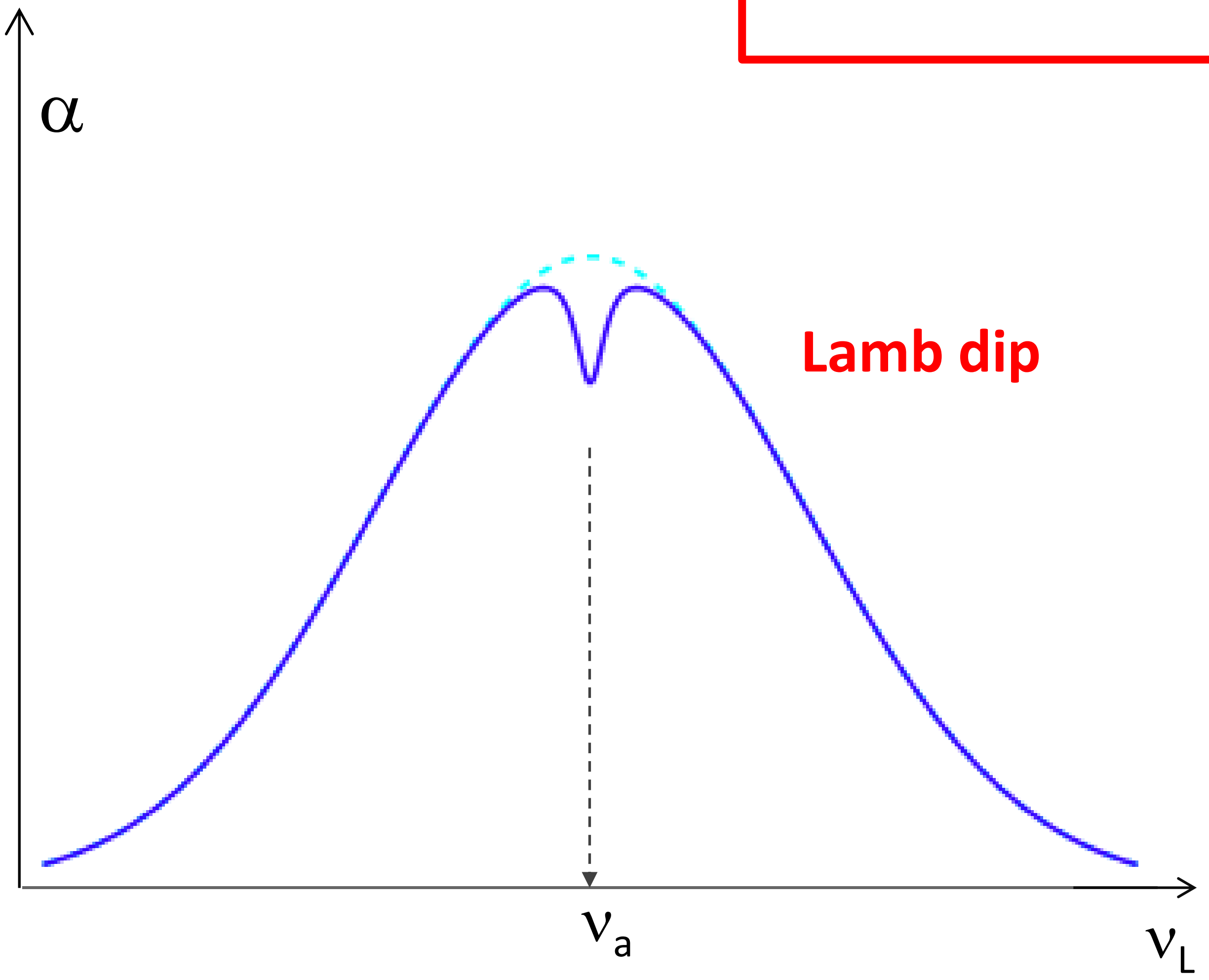
$$\nu_L = \nu_a$$

SPETTROSCOPIA SUB-DOPPLER in saturazione

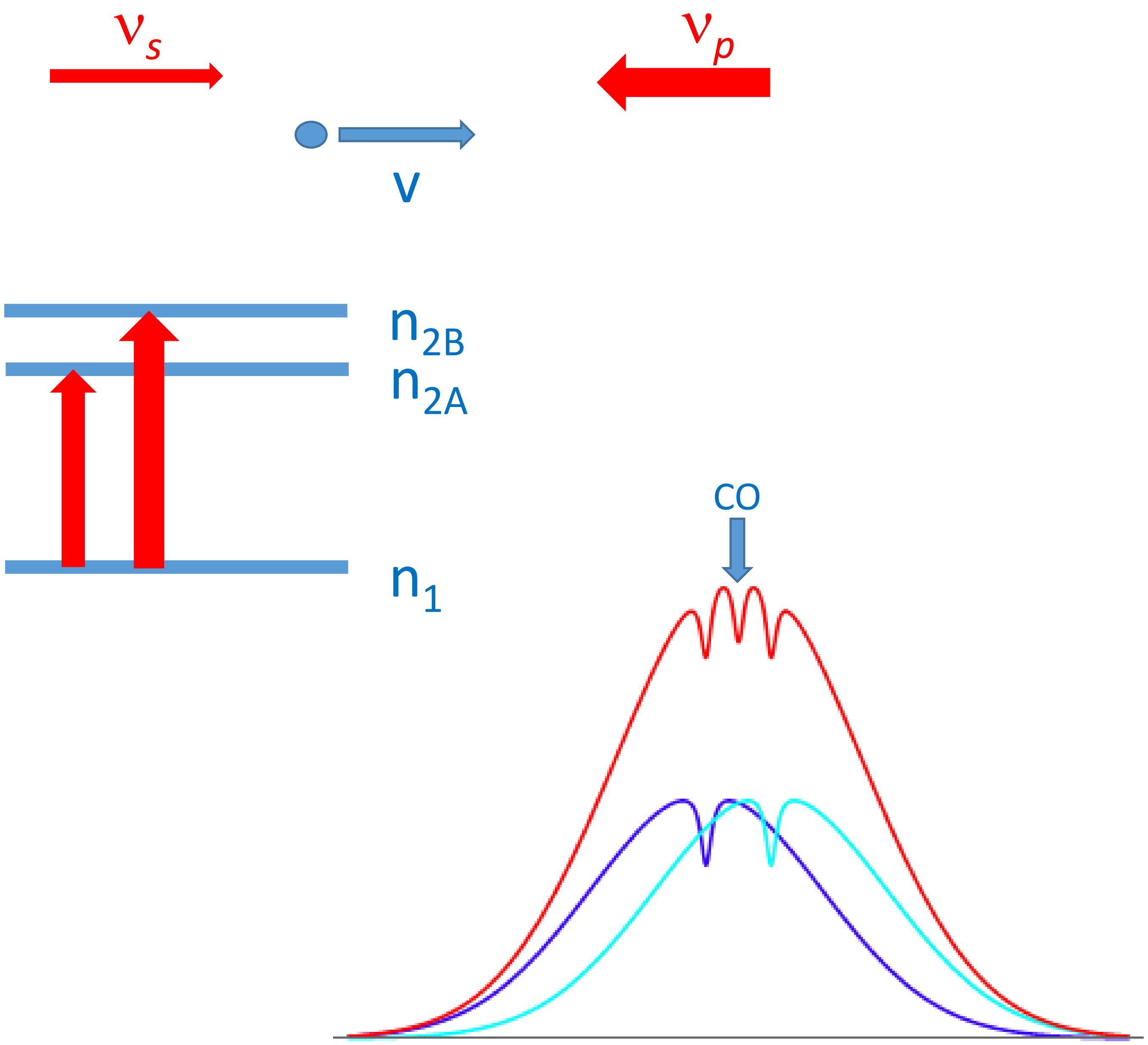


$$v_p = v_s \quad \Longrightarrow \quad v = 0$$

$$\nu_L = \nu_a$$



Segnali di CROSS-OVER



$$\nu'_s = \nu_L - kv$$

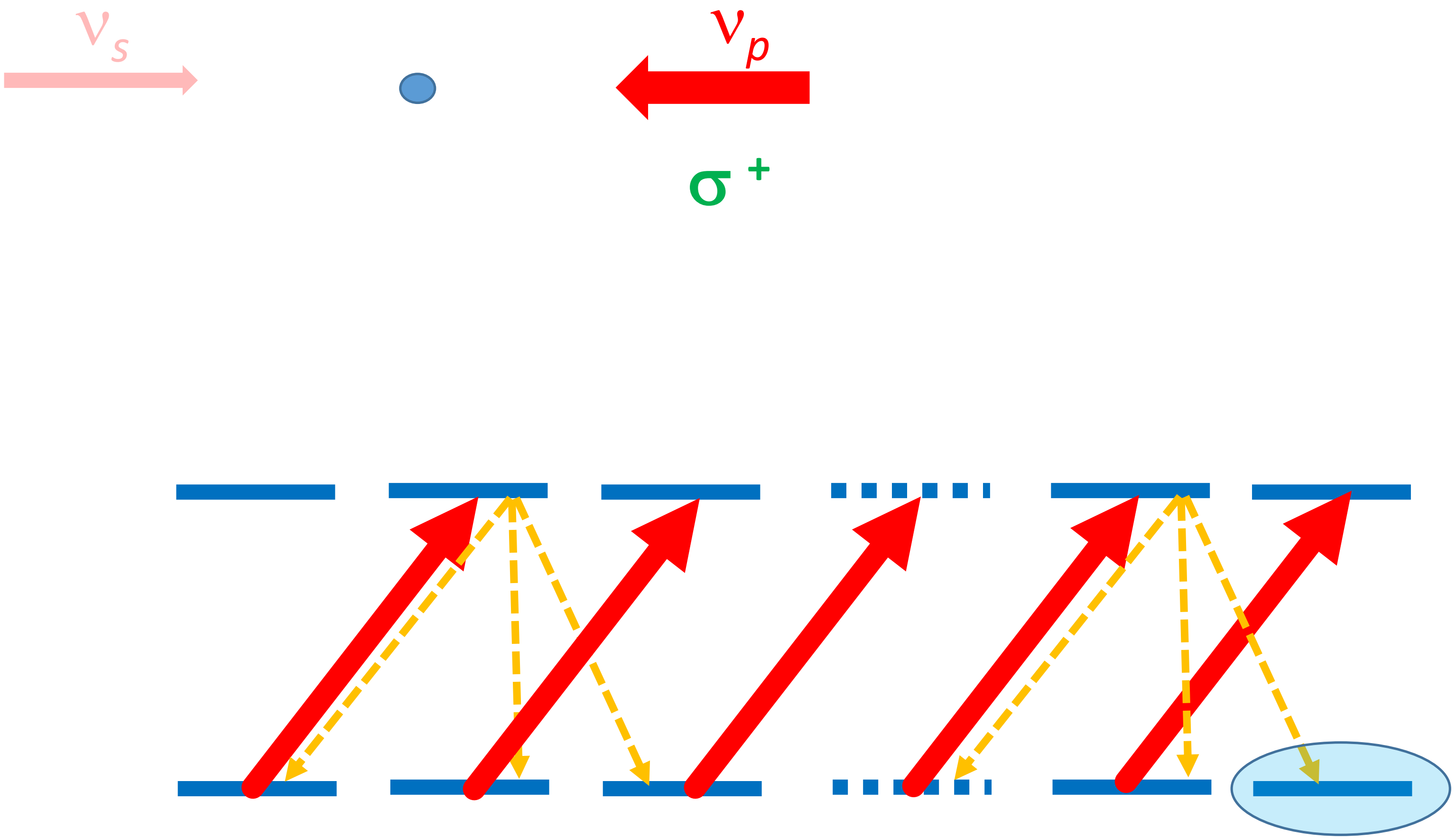
$$\nu'_p = \nu_L + kv$$

$$\nu'_s = \nu_A \quad \Longrightarrow \quad v_s = \frac{\nu_L - \nu_A}{k}$$

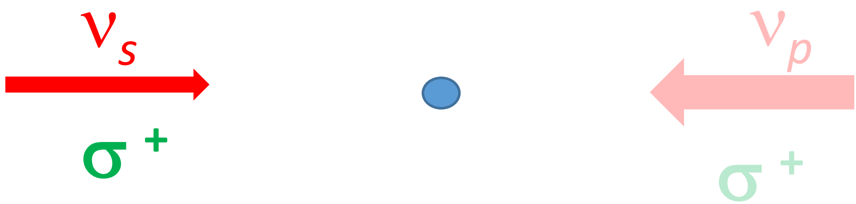
$$\nu'_p = \nu_B \quad \Longrightarrow \quad v_p = -\frac{\nu_L - \nu_B}{k}$$

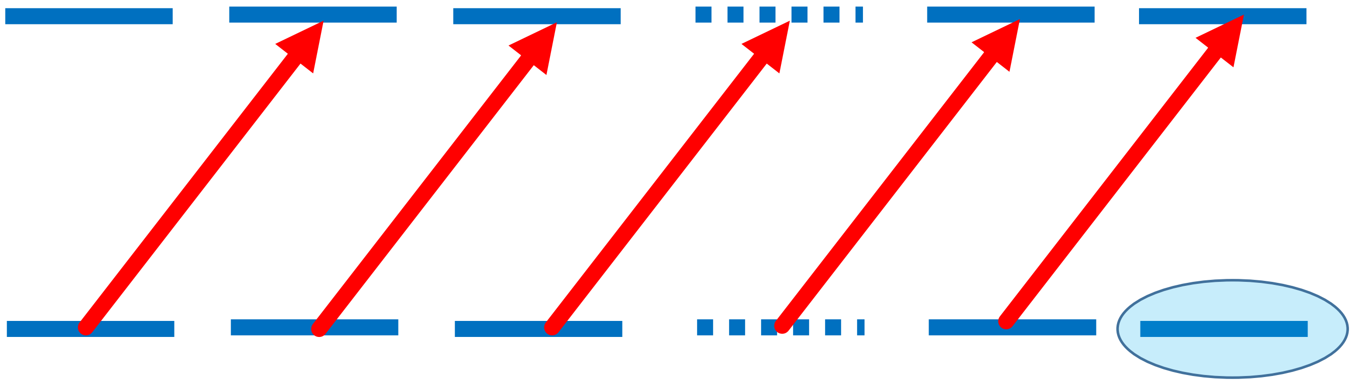
$$\boxed{\nu_L = \frac{\nu_B + \nu_A}{2}}$$

POMPAGGIO OTTICO



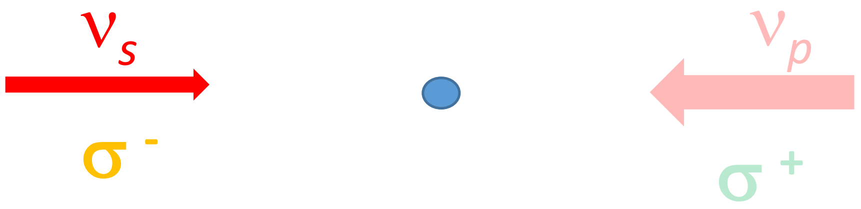
POMPAGGIO OTTICO

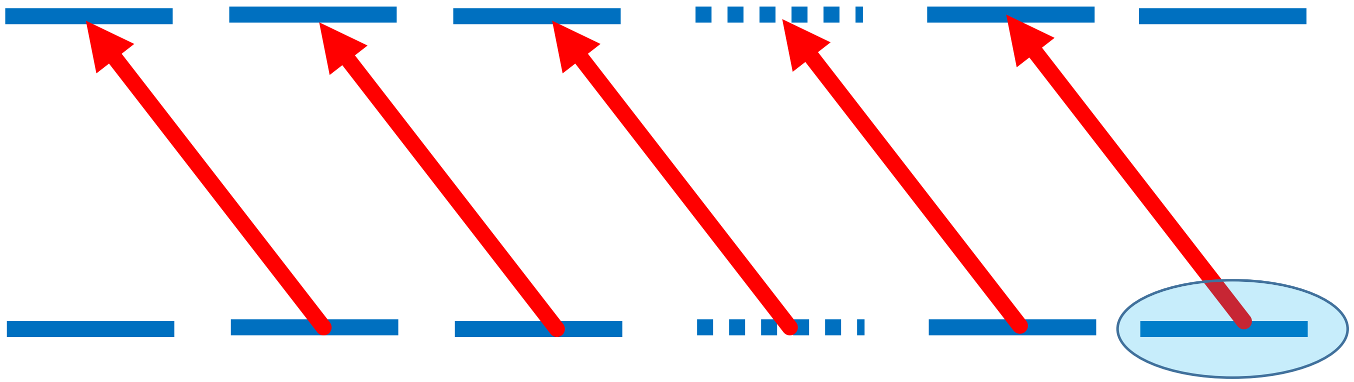




Diminuisce l’assorbimento

POMPAGGIO OTTICO





Aumenta l’assorbimento

SCHEMA ALLA HAENSCH

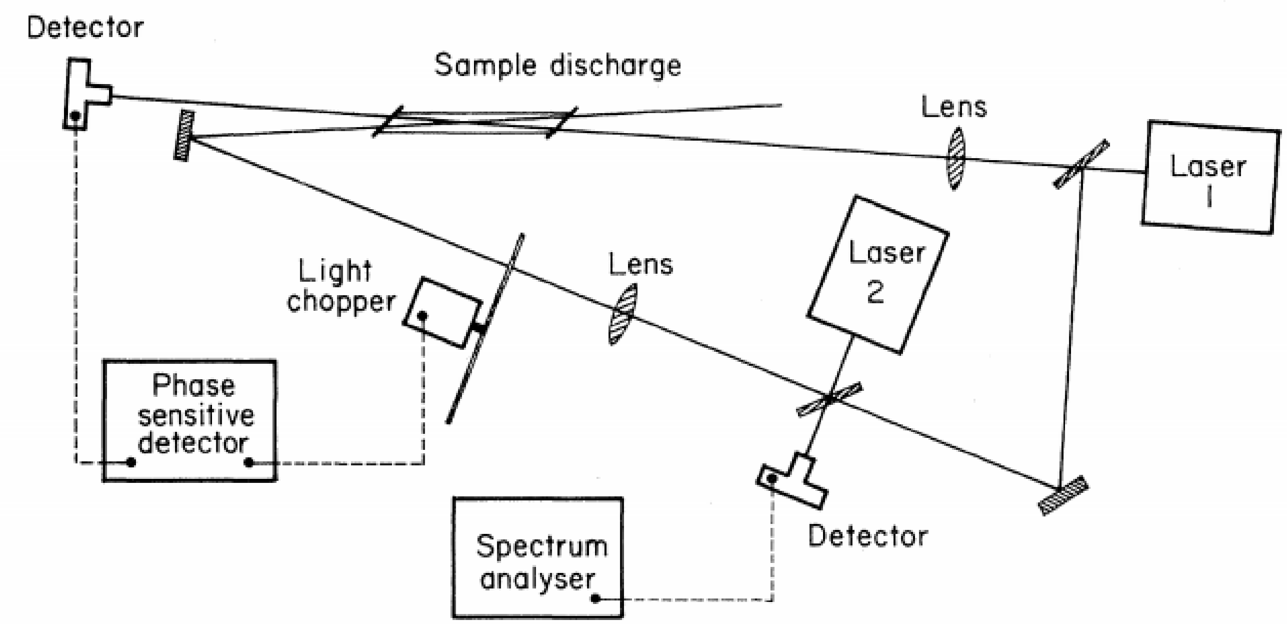
VOLUME 26, NUMBER 13 PHYSICAL REVIEW LETTERS 29 MARCH 1971

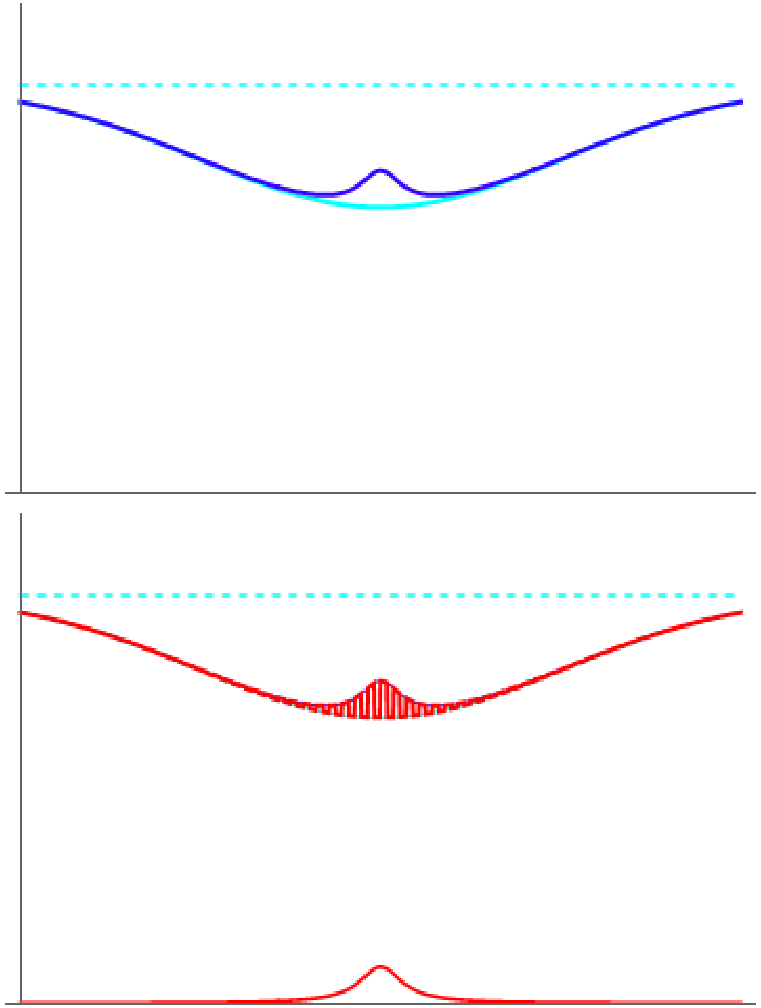
Cross-Relaxation Effects in the Saturation of the 6328-Å Neon-Laser Line

P. W. Smith*
Bell Telephone Laboratories, Holmdel, New Jersey 07733

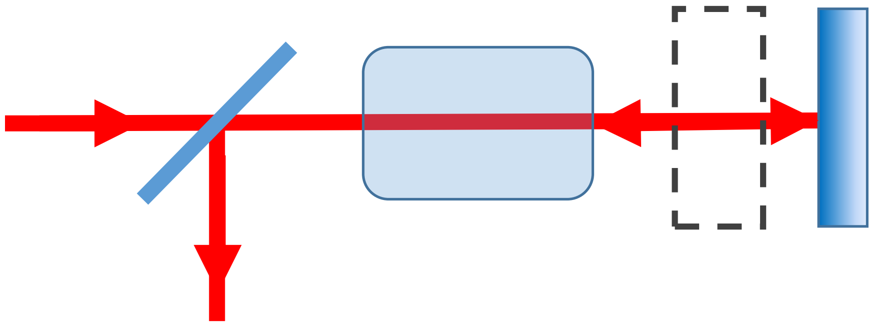
and

T. Hänsch†
Department of Physics, Stanford University, Stanford, California 94305
(Received 25 January 1971)





SCHEMA SEMPLICE



RIVELAZIONE IN DERIVATA

$$\mathcal{S} \simeq \mathcal{S}_0 - \mathcal{G}(\nu_L) + \mathcal{L}(\nu_L)$$

$$\nu_L = \nu_L^0 + \epsilon \cos \Omega t$$

$$\mathcal{S} \simeq \mathcal{S}_0 - \mathcal{G}(\nu_L^0) + \mathcal{L}(\nu_L^0)$$

$$- \left(\frac{\mathrm{d}\mathcal{G}}{\mathrm{d}\nu}\right) \epsilon \cos \Omega t + \left(\frac{\mathrm{d}\mathcal{L}}{\mathrm{d}\nu}\right) \epsilon \cos \Omega t$$

$$- \left(\frac{\mathrm{d}^2\mathcal{G}}{\mathrm{d}\nu^2}\right) \frac{\epsilon^2}{2} \underbrace{\cos^2 \Omega t} + \left(\frac{\mathrm{d}^2\mathcal{L}}{\mathrm{d}\nu^2}\right) \frac{\epsilon}{2} \underbrace{\cos^2 \Omega t}$$

$$\frac{\cos 2\Omega t + 1}{2}$$