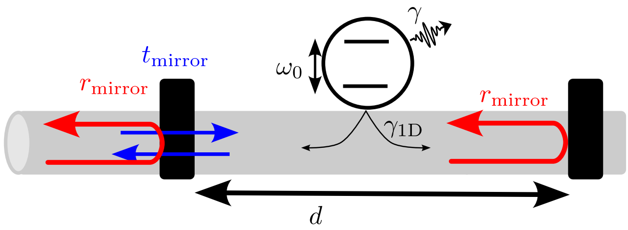

FIG. 1 Schematics of light reflection from a two-level atom inside a cavity.

Light reflection from a resonant emitter near a mirror

(Dated: February 16, 2025)

Consider light reflection from a 2-level atom placed in the center of a symmetric cavity, see Fig. 1. The distance between cavity mirrors is d, mirror reflection and transmission coefficients are r_{mirror} and t_{mirror}. The emitter reflection and transmission coefficients without a cavity are supposed to be known and are equal to

$$r(\omega)=\frac{\mathrm{i}\gamma_{1D}}{\omega_0-\omega-\mathrm{i}(\gamma_{1D}+\gamma)}\,, t(\omega)=1+r(\omega)=\frac{\omega_0-\omega-\mathrm{i}\gamma}{\omega_0-\omega-\mathrm{i}(\gamma_{1D}+\gamma)}\,. \tag{1}$$

Goal 1: Calculate the reflection coefficient from a system.

Goal 2: Obtain an equation for the frequency ω of the complex pole of the reflection coefficient.

Goal 3: Obtain the same equation using the known Green function for the emitter inside the cavity,

$$G(z,z')=\frac{\mathrm{i}}{2q}\left[\mathrm{e}^{\mathrm{i}q|z-z'|}+\frac{2\widetilde{r}}{1-\widetilde{r}^2}[\cos q(z+z')+\widetilde{r}\cos q(z-z')]\right],\quad \widetilde{r}=r_{\text{mirrror}}\mathrm{e}^{\mathrm{i}qd}, q=\omega/c\,. \tag{2}$$