Luminous Black Holes

$$\frac{dN_a}{d\tau} = N_a - \tilde{\Gamma}_a \left[N_a(1 + 12\pi\alpha^2 N_\gamma) - \pi\alpha^4 N_\gamma^2 \right]$$

$$\frac{dN_\gamma}{d\tau} = -\tilde{\Gamma}_e N_\gamma + 2\tilde{\Gamma}_a \left[N_a(1 + 12\pi\alpha^2 N_\gamma) - \pi\alpha^3(3+\alpha) N_\gamma^2 \right.$$

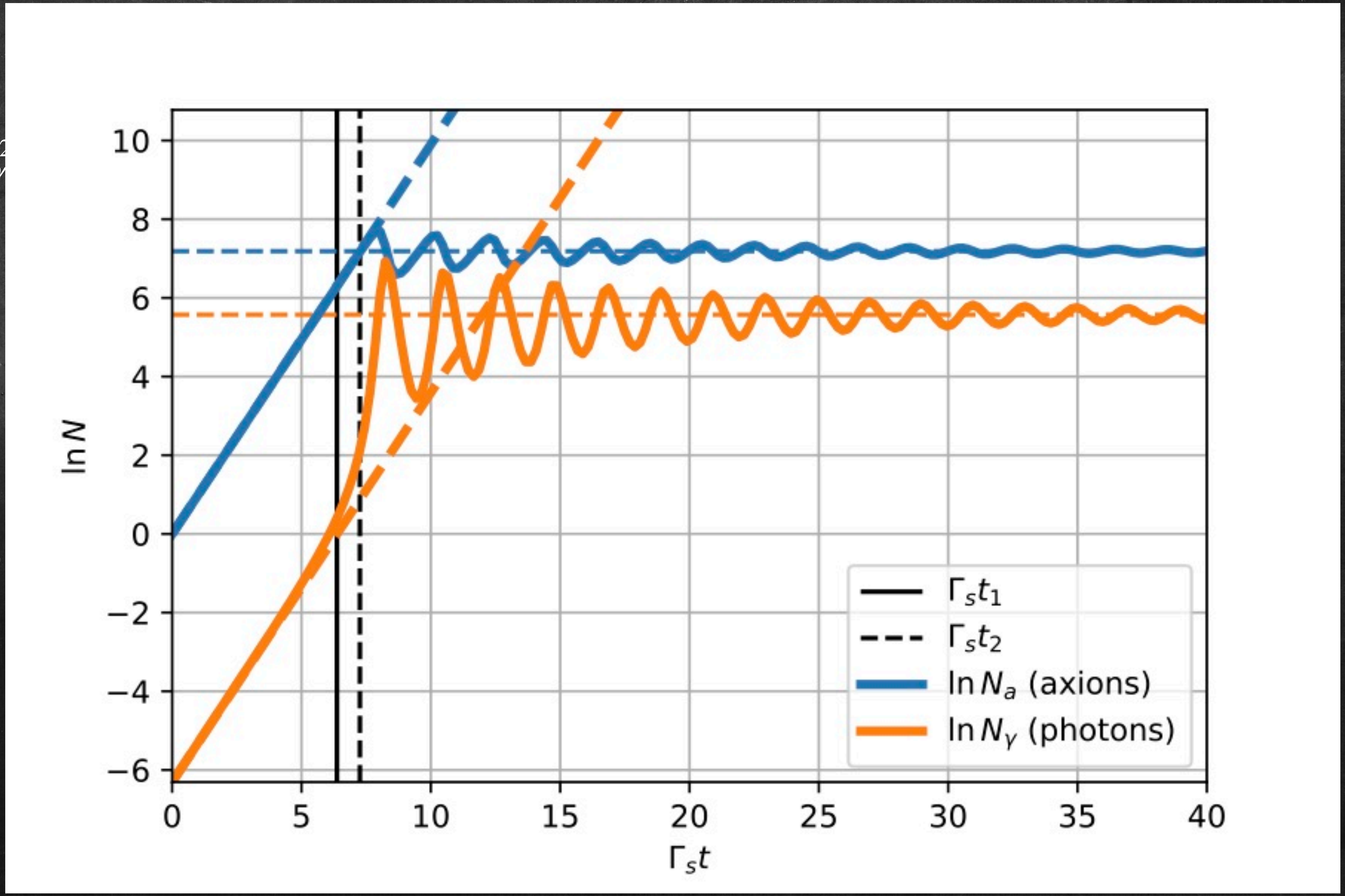
$$\Gamma_s t_1 = \ln\left(\frac{1 + \tilde{\Gamma}_e - \tilde{\Gamma}_a}{2\tilde{\Gamma}_a} \right),$$

$$\Gamma_s t_2 = \ln N_{\gamma c} \,.$$

$$N_{ac} = \left[\frac{1}{2}\tilde{\Gamma}_e + 3\pi\alpha^3 N_{\gamma c} \right] N_{\gamma c} \,,$$

$$N_{\gamma c} = \frac{A + \sqrt{A^2 + 72\tilde{\Gamma}_e(1-\tilde{\Gamma}_a)\alpha}}{72\pi\tilde{\Gamma}_a\alpha^3},$$

$$A = \alpha^2 + 3\alpha(1 - \tilde{\Gamma}_a) - 6\tilde{\Gamma}_e$$



Monochromatic spectrum

Bounds: We consider $\Omega_{PBH} = f_{PBH}\Omega_{CDM}$. Then, using measurements for I_{λ_0}, it is possible to establish upper bounds for PBH abundance

$$\lambda = \frac{24800\text{Å}}{(\mu/\text{eV})}$$

$$n_{PBH} = f_{PBH}\Omega_{CDM}\left(\frac{\rho_{c,0}}{M_{PBH}}(1+z)^3\right)$$

$$4\pi I_\lambda(\lambda_0) = c n_{PBH}\left(\frac{R_0}{R}\right)^2 \frac{d^2N_\gamma}{dt d\lambda_0}dt$$