Introduction to lasers

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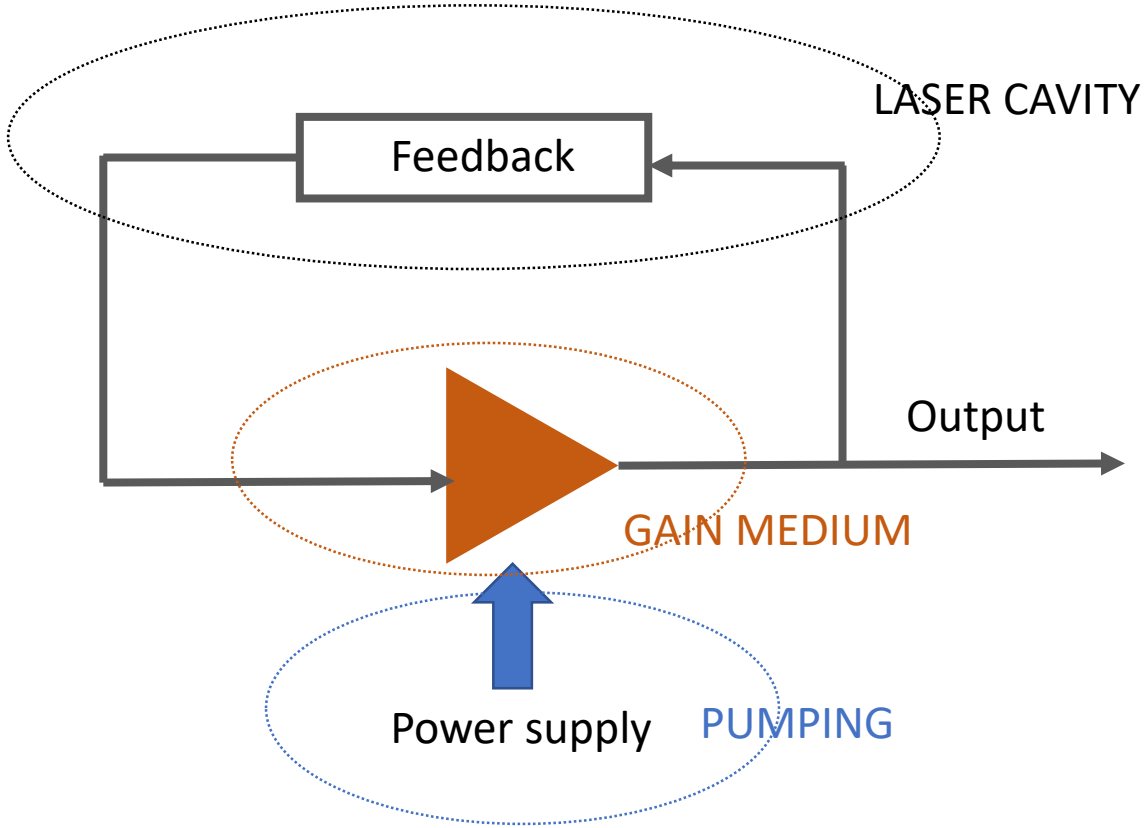
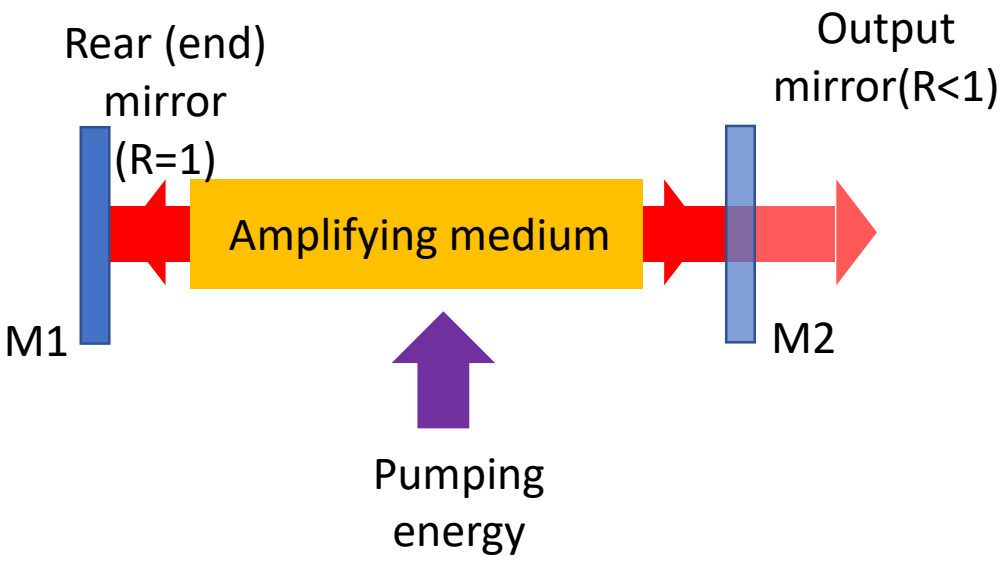
Chapter 3: Laser Oscillator



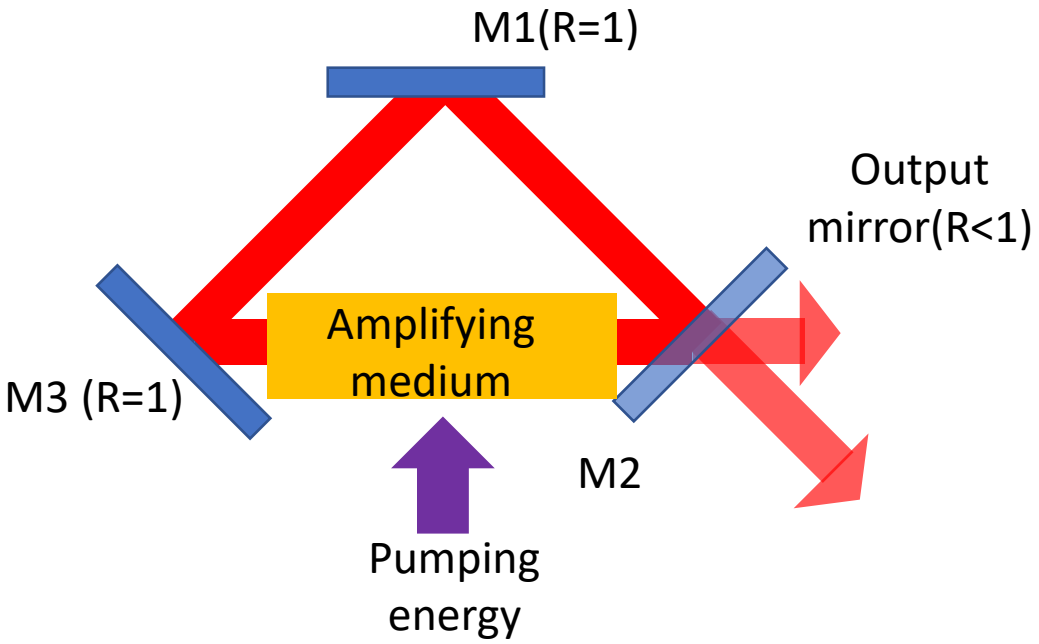
Oscillator: amplifier with a positif feedback

I. Types of cavities (see chapter VI for actual architectures)

Fabry-Perot cavity (schematic diagram)

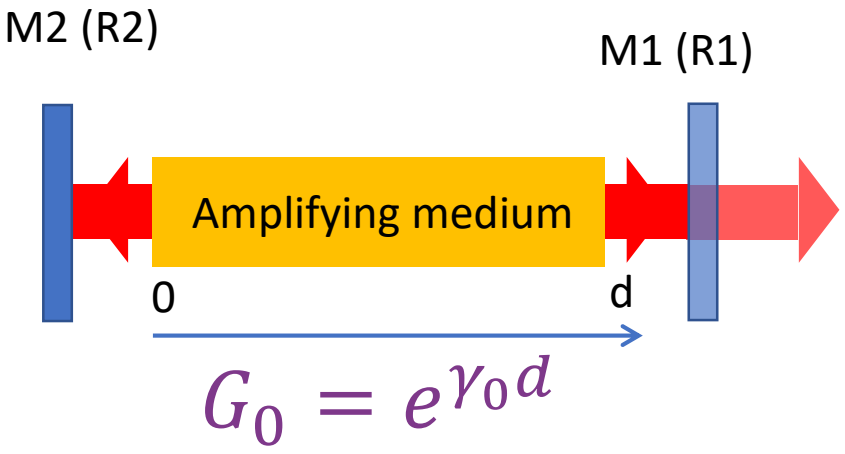


Ring cavity (schematic diagram)



II. First condition for laser oscillation: Gain condition

1. Laser threshold for Fabry Perot cavity



$$G_0 = e^{\gamma_0 d}$$

After one round trip in the cavity, i.e. two passages through the amplifying medium, the small signal gain is : $e^{2\gamma_0 d}$

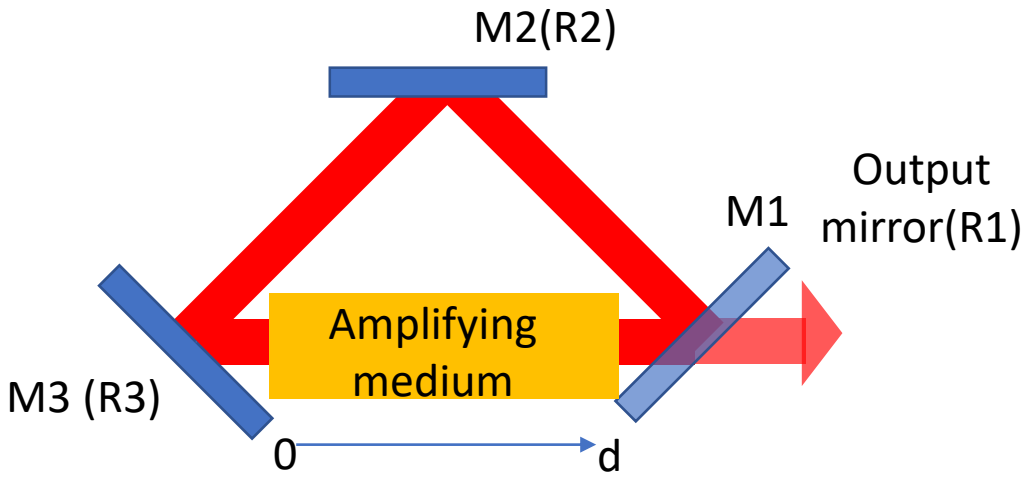
And the cavity losses (except the ones due to mirrors, i.e diffusion, spontaneous emission, finite size of cavity components) : $e^{-2\alpha d}$

After one round-trip inside the cavity:

To complete

To complete

2. Laser threshold for ring cavity

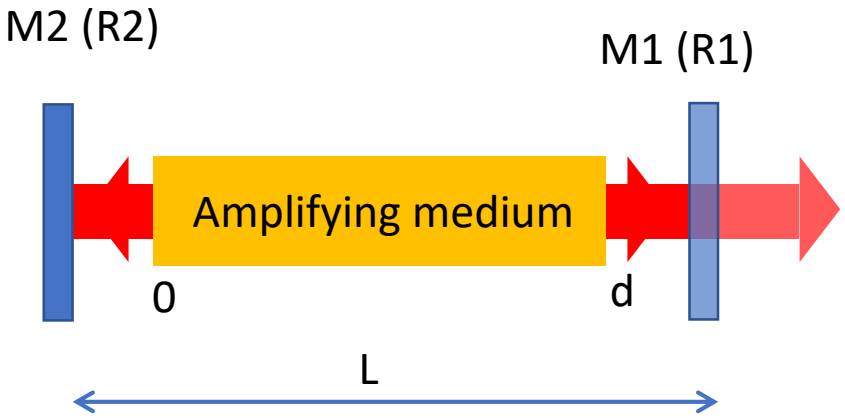


$$G_0 = e^{\gamma_0 d}$$

To complete

III - Second condition for laser oscillation: Phase condition

→ **Laser frequencies**



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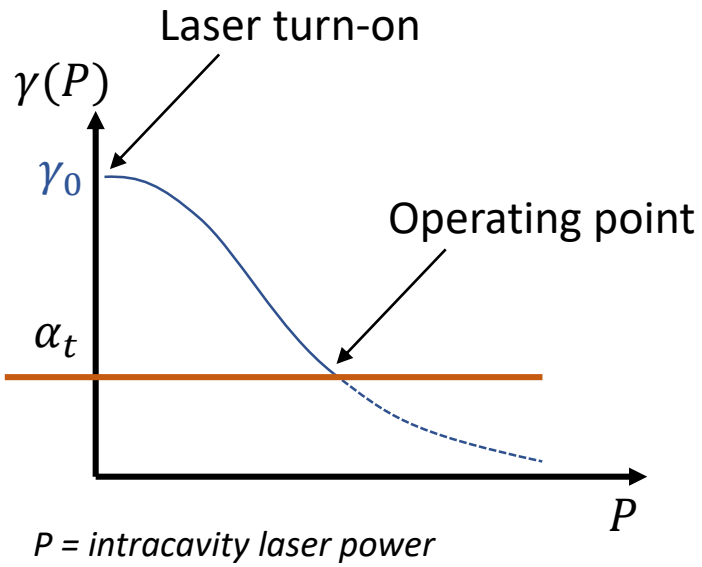
IV - Steady-state operation

→ Operating point

Laser pumped above threshold ($\gamma_0 > \alpha_t$)



P = intracavity laser power

Transient regime

To complete

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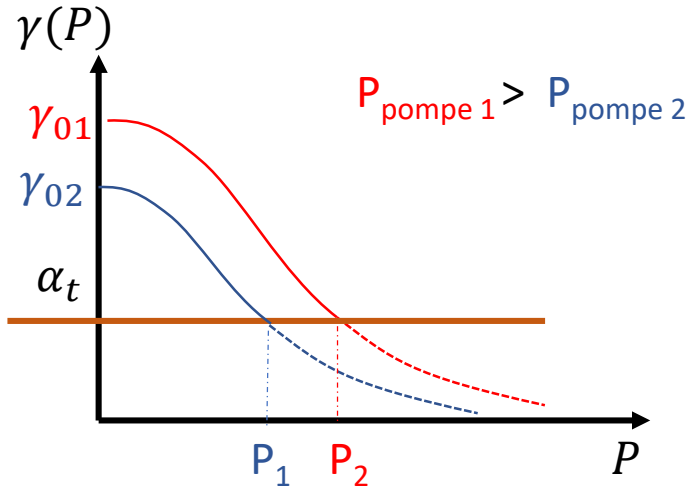
Comment



Transient regime

P = intracavity laser power