Threshold Condition

As light bounces back and forth in an optical resonator ,it undergoes attenuation as it suffers various losses .The losses occur mainly due to transmission at the output mirror ,inner mirror and due to scattering and diffraction of the light within the active medium and some other processes, which in total can be called as the absorption losses .For maintaining the continuous oscillations in the resonator cavity it is essential that this attenuation should be overcome by amplification between two consecutive reflection .For this amplification energy can be taken from pumping source. A mathematical condition can be obtained by considering the change in the intensity of the beam of the light undergoing the round trip. In short threshold condition is condition required to sustain oscillations in an optical resonator. This condition is given as

$$\gamma \geq \alpha_s + \frac{1}{2L} \ln \frac{1}{R}$$

Where

γ = amplification of the laser will be dependent on how hard laser medium is pumped

α_s=All type of losses

L= Length of the resonator

$R=r_1 r_2$ = Where r_1 and r_2 are the Reflectivities of the mirrors(Input and output)