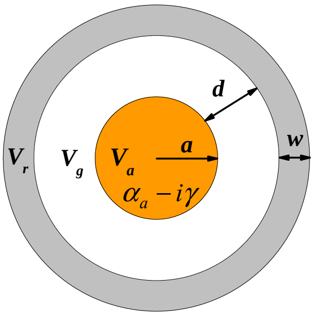
Lasing Spectra and Thresholds of Supermodes in an Active Microdisk Assisted with a Passive Microring in View of the Mode Overlap Coefficients

Object of research



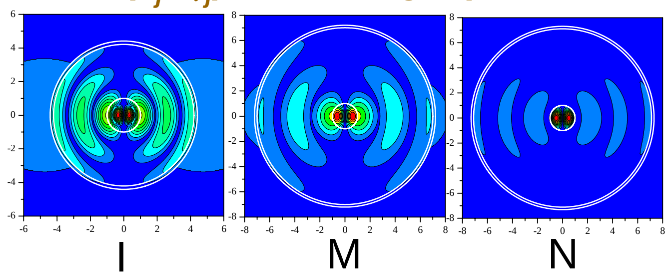
Lasing Egenvalue Problem (LEP)

$$U = E_z \text{ or } H_z, \quad U \neq 0$$

- Helmholtz equation off the boundary
- Transparent boundary conditions
- Sommerfeld radiation condition at infinity

The real-valued (κ_j, γ_j) are the eigenparameters

$H_{1,1,3,0}$

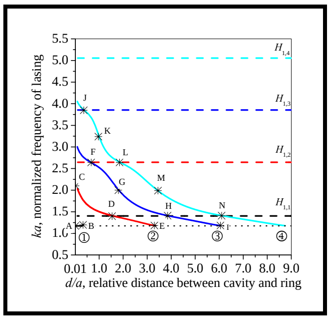


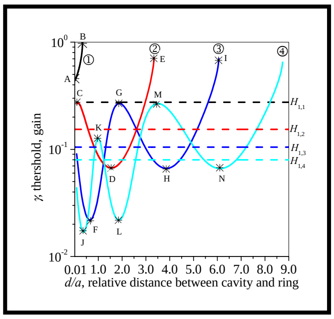
Overlap Coefficients

$$\Gamma_j^{(f)} = W_j^{(f)} / W_j \leq 1,$$

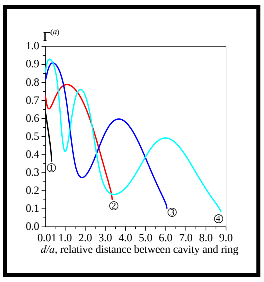
$$W_j^{(f)}(k_j, \gamma_j) = \int_{V_f} \alpha_f^2 \, |\vec{E}_j(\vec{R}, k_j, \gamma_j)|^2 dv, \quad f = a, g, r$$

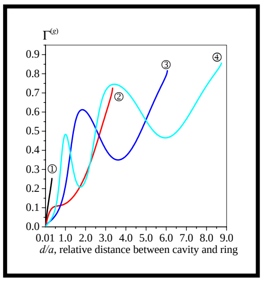
$$W_j(k_j, \gamma_j) = \int_V \alpha_a^2 \, |\vec{E}_j|^2 dv = \int_{V_a} \alpha_a^2 \, |\vec{E}_j|^2 dv + \int_{V_g} \alpha_g^2 \, |\vec{E}_j|^2 dv + \int_{V_r} \alpha_r^2 \, |\vec{E}_j|^2 dv$$

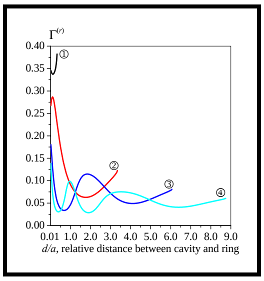




$H_{1,n,q,p}$ supermodes, $w = 0.2a$, $\alpha_a = \alpha_r = 2.63$, $\alpha_g = 1$.







Conclusions

- In multiple-domain microcavities all lasing modes are supermodes, i.e. optically-coupled modes of partial domains
- Thresholds are inverse proportional to the active-region overlap coefficients, which are specific for each mode of the cavity

Elena I. Smotrova, Trevor M. Benson, Phillip Sewel, Jiri Ctyroky, and Alexander I. Nosich