Two-membrane cavity optomechanics

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\[ \omega_{cav} = \omega_0 \left(1 - \frac{x}{L}\right) \]

Radiation pressure couples the cavity radiation field to the mechanical motion.

\[ G = \frac{d\omega_{cav}}{dx} = \frac{\omega_0}{L} \]
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Advantages:
• Strong coupling regime
• Energy transfer and entanglement
• Synchronization

\[
R_m < 1 \quad \longrightarrow \quad |G_j^{\text{max}}| = \frac{1}{1 - \sqrt{R_m}} |G_{\text{sing}}^{\text{max}}|
\]

\[
R_m \sim 0.4 \quad \longrightarrow \quad |G_j^{\text{max}}| \sim 2.72 |G_{\text{sing}}^{\text{max}}|
\]

Optomechanical coupling strength


Advantages:
- Strong coupling regime
- Energy transfer and entanglement
- Synchronization
Tunable coupling - laser cooling

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Conclusions

• Enhanced the optomechanical coupling strength by a factor $\approx 2.47$ respect to the single membrane case.

• Optical cooling and heating of the fundamental modes of the membranes.

• Onset of synchronization.

• Non-linear dynamics of the optomechanical system.