Polariton dispersion in the close-to-Bragg structure

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Dispersion of polaritons in one-dimensional array of resonant emitters is described by the equation

$$\cos Kd = \cos qd - \frac{\gamma_{1D}}{\omega_0 - \omega} \sin qd, \quad qd = \frac{\omega}{\omega_0}\varphi_0 \tag{1}$$

for the polariton wave vector $K(\omega)$ where ω_0 is the resonance frequency , γ_{1D} is the spontaneous decay rate, $\varphi_0 = 2d/\lambda_0$ is the phase gained by light at the frequency ω_0.

Goal: Calculate numerically and plot solution for the dispersion equation $\mathrm{Re}\, K(\omega)$ for 3 values of d: $d = 0.4\lambda_0$, $d = 0.5\lambda_0$ (Bragg value), $d = 0.6\lambda_0$ in the range $\omega = -17\omega_0 \ldots 17\omega_0$. Assume that $\gamma_{1D}/\omega_0 = 0.02$.

Answer: Compare with Fig. 9 in (Sheremet *et al.*, 2023).

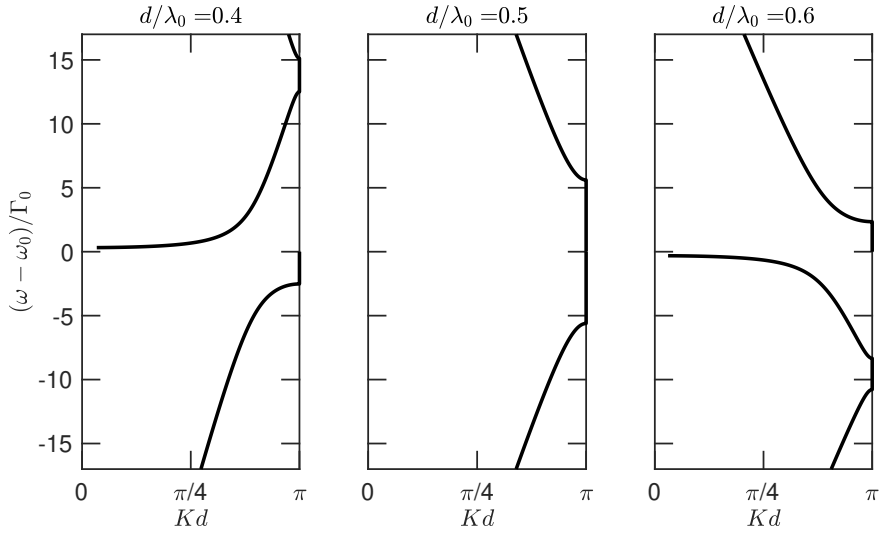

FIG. 1 Polariton dispersion in the atomic arrays with different periods Calculation has been performed for $\gamma_{1D}/\omega_0 = 0.02$.

References

Sheremet, A. S., M. I. Petrov, I. V. Iorsh, A. V. Poshakinskiy, and A. N. Poddubny, 2023, Rev. Mod. Phys. **95**, 015002.