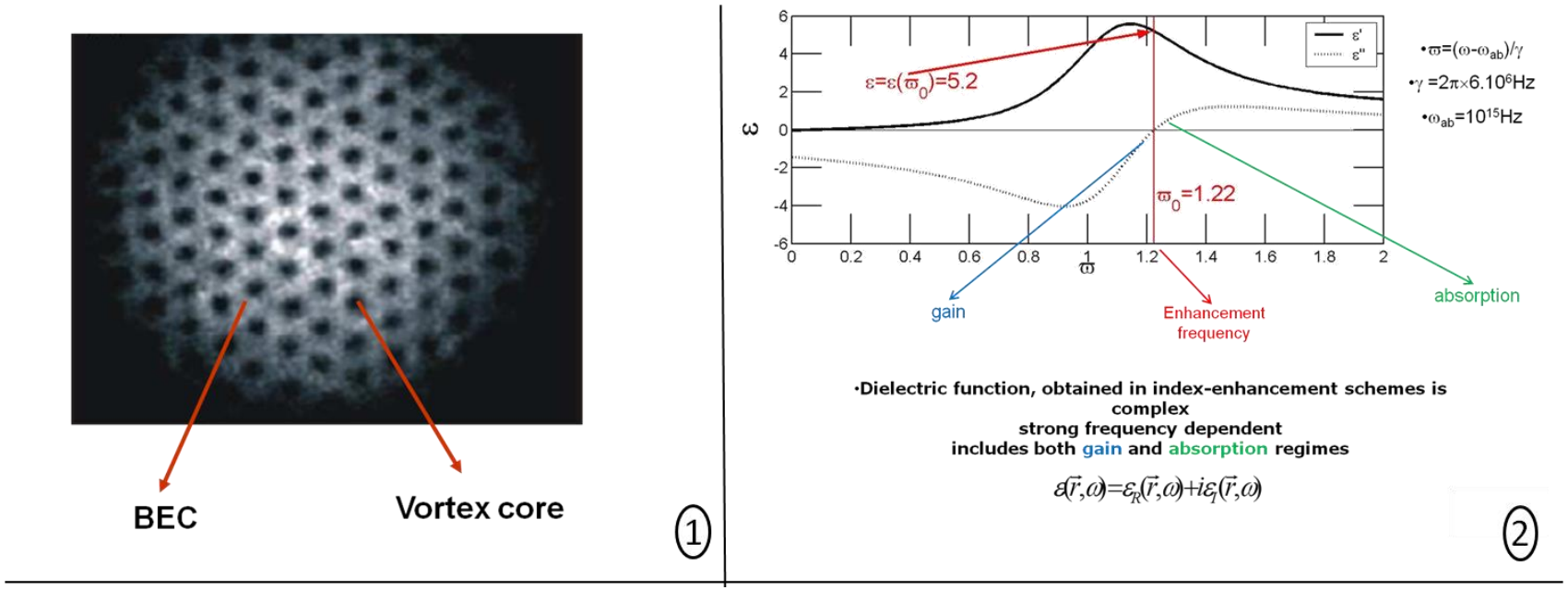
Photonic band gap in lattice of BEC vortices



* First time for such EIT systems; in the vicinity of gain and absorption.

Figure for BEC vortices is from the paper [Engels *et al.* Phys. Rev. Lett. **89**, 100403 (2002)]

[1] M.E. Taşgın, Ö.E. Müstecaplıoğlu, and M.Ö. Oktel, Physical Review A, **75**, 063627 (2007).

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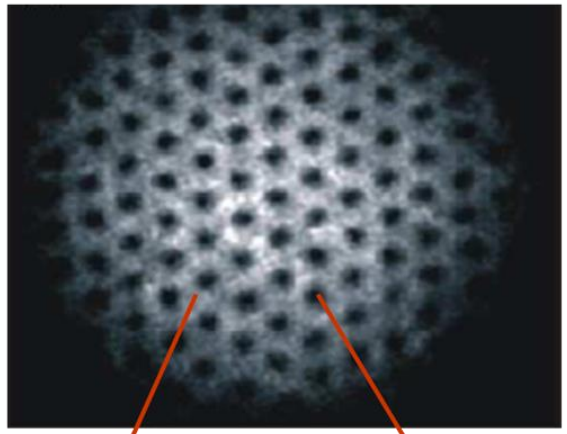
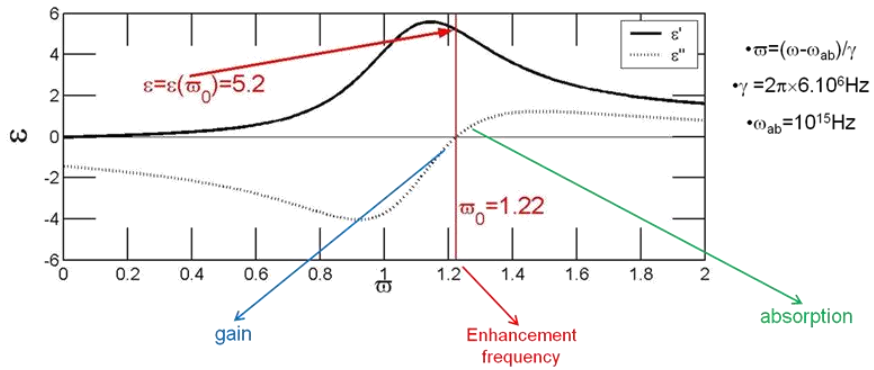


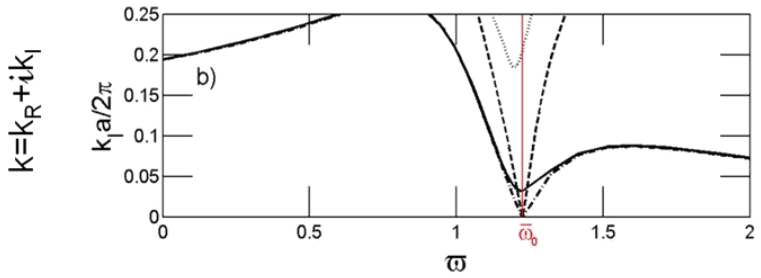
①



•Dielectric function, obtained in index-enhancement schemes is
complex
strong frequency dependent
includes both gain and absorption regimes

$$\varepsilon(\vec{r},\omega)=\varepsilon_R(\vec{r},\omega)+i\varepsilon_I(\vec{r},\omega)$$

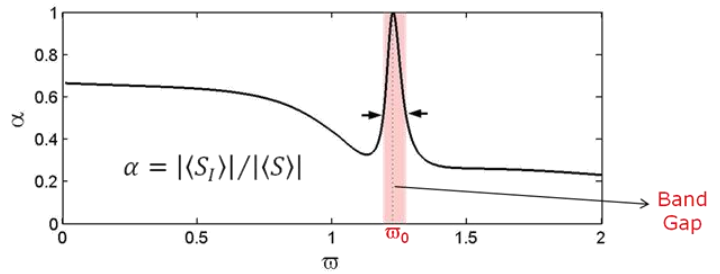
②



Problem! Sign of k_I ⟶ cannot determined.

$\varpi<\varpi_0$ → $k_I<0$ if gain; $k_I>0$ if band gap → who wins?

③



S_R : gives energy flux
S_I : gives reactive(stored) energy

•$S=S_R + i\,S_I$: Poynting Vector

Near $\varpi=\varpi_0$ → $|S_I|$ ratio is increasing; However, $|\varepsilon_I|$ is decreasing → Increase in α can only be due to the band gap.

④

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