Maximized Enhancement of Polarized and Unpolarized Emissions via Critical Coupling in Brillouin Zone Folding Metasurfaces

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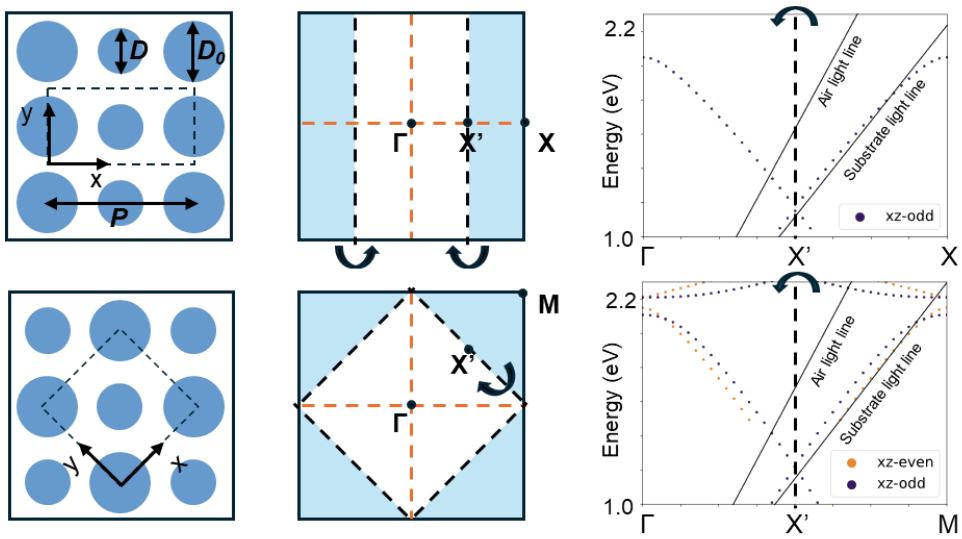
Critical coupling can induce maximized field enhancement in resonant optical modes. Therefore, it is important for various photonic technologies. Here, it is shown that directional light sources with highly enhanced emission intensities can be realized via critical coupling. A clear experimental demonstration of maximized emission enhancement is presented in quantum dot (QD)-coated Brillouin zone folding (BZF) metasurfaces. BZF dielectric metasurfaces support guided-mode resonances, where the radiative quality factor can be gradually tuned by structural parameters, allowing critical coupling to occur at the QD emission wavelength. Maximized enhancements of polarized and unpolarized emissions are demonstrated in the normal direction, resulting in highly enhanced, directional, and narrow-angled emissions. The investigations indicate that light emission from quantum emitters can be optimized via critical coupling and that BZF metasurfaces can provide a highly tunable platform for both polarization-sensitive and polarization-insensitive critical coupling. Maximized field enhancement and highly enhanced light–matter interactions in BZF metasurfaces are important for a wide range of photonic technologies such as light sources, photodetectors, sensors, nonlinear enhancement, and quantum photonic devices.



References

1. Han, Jungho, Yeonsoo Lim, Jeheon Lee, Seongheon Kim and Young Chul Jun. "Maximized Enhancement of Polarized and Unpolarized Emissions via Critical Coupling in Brillouin Zone Folding Metasurfaces". Laser & Photonics Reviews, https://doi.org/10.1002/lpor.202401923.