High- Q bound state in the continuum in complementary metamaterials

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Bound State In the Continuum – BIC –effect has recently attracted a considerable attention due of the metamaterial community. BIC is typically characterized by the complete confinement of waves within the continuous spectrum, while coexisting with radiating waves that continuously support energy leakage [1, 2]. Another feature is that the effect can manifest itself due to the slightest change in the metamaterial symmetry.

We propose metamaterial comprising two complementary layers resembling chessboard to show BIC effect appearing due to small change on symmetry of the structure. This metamaterial has already shown an ultrabroadband transparency in microwave range [3]. We demonstrate that the slightest tilt of the angle of the incident wave results in BIC excitation.

Experimental results demonstrate the appearance of BIC resonance at ~6.5 GHz when impinging wave is tilted by 0.5 degree. We confirmed this effect by multipole expansion method and by measurements in microwave anechoic chamber [3]. Experimental results demonstrate the Q-factor ~1000.

BIC engineered structure supports highly localized electromagnetic field that is extremely sensitive to changes in the environment opening an opportunity to confine and manipulate light within subwavelength structures. This enables highly efficient nanophotonic devices for various applications, including sensing and communication technologies. Nanophotonic sensors based on the BIC effect can be fabricated on a small scale, allowing for integration into compact and portable devices for on-site or real-time monitoring applications.

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