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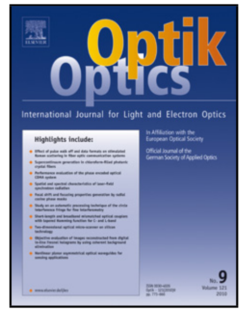

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Synchronized time-coupling theory of resonant mode splitting phenomena in a superconducting photonic crystal at terahertz

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ABSTRACT

Resonant mode splitting phenomenon can be observed in the terahertz transmission spectrum of a finite superconducting photonic crystal $(SD)^N S$, where S and D denote a superconducting layer and a dielectric layer, respectively. In this structure, each D-layer in $(SD)^N S$ constitutes a Fabry-Perot cavity. The original single resonant mode at $N = 1$ can then be split into N resonant modes for $N > 1$ due to the time-coupling effect coming from N cavities. Within the framework of the coupled mode theory, we successfully employ synchronized time-coupling theory to analytically explain the number of split resonant peaks, the resonant frequencies, and the frequency intervals between peaks. Additionally, it is found that the coupling coefficient is an increasing function of the original resonant frequency, which, in turn, indicates that the split frequencies and interval can be tuned by the thickness of layer D. Application of this synchronized time-coupling theory to elucidate similar splitting phenomena in plasma photonic crystals and metamaterial photonic crystals is also discussed.

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I. INTRODUCTION

Transmission narrowband filters have attracted much attention over the last decade

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