

Gauge Field in Metamaterials

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Abstract— Recent research on non-Abelian phenomena has cast a new perspective on controlling light. In this work, we will discuss our series of works to realize gauge field, Abelian or non-Abelian using anisotropic metamaterials. In general, non-Abelian electric field can be synthesized through a simple real-space rotation of any biaxial material without in-plane duality symmetry and Abelian electric field is just a special case. With orthogonal optical modes excited, their interference leads to an oscillation of the propagating optical beam, which is a direct consequence of the emergence of non-Abelian electric field, influencing light in a manner similar with how electric fields act on charged particles. This direct observation of trembling the light beam trajectory, commonly known as optical Zitterbewegung effect, is demonstrated by our microwave experiments, where excellent agreement between theoretical derivation, numerical simulations and experiments are provided. By extending the idea to optical regime using natural material, we here provide another example to shake the general intuition that light travels in straight lines in homogeneous media.

REFERENCES

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