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Negative refraction in metamaterials based on dielectric spherical particles

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Highlights

- Two distinct negative refraction frequency bands are found in the proposed three-dimensional metamaterials consist of dielectric spherical particles.
- The effect of high-order Mie modes should be considered when the size of meta-atom is comparable with the incident wavelength.
- The negative refraction frequency band of metamaterial red shifts with the increment of volume fraction.
- Due to the difference in the slope of photonic bands, these two negative refraction bands have different transmission performances.
- The metamaterial is robust to the disorder which undermines the expression of negative refraction.

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