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Resonant scattering of GHz electromagnetic waves by a linear structure of two dielectric rings on a magnetic dipole mode

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Experimental studies of resonance scattering on the main magnetic mode in a dielectric linear structure consisting of two rings oriented along the wave vector of the incident wave and excited by longitudinally incident linearly polarized microwaves have been performed. In the scattering spectrum of the reflected wave, the resonant frequency splits and the amplitudes of both peaks increase significantly compared to the amplitude for a single ring in the near zone. There is no splitting of the resonant frequency in the transmitted signal, the amplitude of the transmitted signal in the far zone increases significantly compared to a single ring.

Keywords: metamaterials, dielectric magnetic dipole, negative magnetic response, dielectric ring, dielectric structure, plane electromagnetic wave, resonance.

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REFERENCES

1. V. G. Veselago, Phys. Usp. **54** (11), 1161 (2011).
2. I. B. endik and O. G. Vendik, Tech. Phys. **58**, 1 (2013).
3. Q. Zhao, B. Du, L. Kang, H. Zhao, Q. Xie, B. Li, X. Zhang, J. Zhou, L. Li, and Y. Meng, Appl. Phys. Lett. **92**, 051106 (2008).
4. Z. B. Wang, B. S. Luk'yanchuk, M. H. Hong, Y. Lin, and T. C. Chong, Phys. Rev. B. **70**, 035418 (2004).
5. M. V. Bashevoy, V. A. Fedotov, and N. I. Zheludev, Opt. Express **13**, 8372 (2005).
6. B. S. Luk`yanchuk and V. Ternovsky, Phys. Rev. B. **73**, 235432 (2006).
7. M. Verplanken and J. Van-Bladel, IEEE Trans. Microwave Theory Technol. **24**, 108 (1976).
8. A. I. Kuznetsov, A. E. Miroshnichenko, Y. H. Fu, J. Zhang, and B. Luk'yanchuk, Sci. Rep. **2**, 57 (2012).
9. A. B. Evlyukhin, C. Reinhardt, A. Seidel, B. Luk`yanchuk, and B. N. Chichkov, Phys. Rev. B. **82**, 045404 (2010).
10. A. Garcia-Etxarri, R. Gómez-Medina, L. S. Froufe-Pérez, C. López, L. Chantada, F. Scheffold, J. Aizpurua, M. Nieto-Vesperinas, and J. J. Sáenz, Opt. Express **19**, 4815 (2011).
11. A. B. Evlyukhin, S. M. Novikov, U. Zywietz, R. L. Eriksen, C. Reinhardt, S. I. Bozhevolnyi, and B. N. Chichkov, Nano Lett. **12**, 3749 (2012).
12. B. Luk`yanchuk, L. M. Vasilyak, V. Y. Pecherkin, S. P. Vetchinin, V. E. Fortov, Z. B. Wang, R. Paniagua-Domínguez, and A. A. Fedyanin, Sci. Rep. **11**, 23453 (2021).
13. D. M. Pozar, *Microwave Engineering.* (John Wiley & Sons, USA, Hoboken, 2012).
14. Y. Yang, I. Kravchenko, D. Briggs, and J. Valentine, Nat. Commun. **5**, 5753 (2014).
15. M. M. Bukharin, V. Y. Pecherkin, A. K. Ospanova, V. B. Il'in, L. M. Vasilyak, A. A. Basharin, and B. Luk'yanchuk, Sci. Rep. **12**, 7997 (2022).
16. A. E. Krasnok, I. S. Maksymov, A. I. Denisyuk, P. A. Belov, A. E. Miroshnichenko, C. R. Simovskii, and Yu. S. Kivshar, Phys. Usp. **56** (6), 539 (2013).
17. R. Paniagua-Dominguez, B. Lukyanchuk, and A. Kuznetsov, *Control of scattering by isolated dielectric nanoantennas*, (Woodhead Publishing, UK, 2020).
18. R. Paniagua-Domínguez, Yu. Ye. Feng, A. E. Miroshnichenko, L. A. Krivitsky, F. Y. Hsing, V. Valuckas, L. Gonzaga, Y. T. Toh, K. A. Yew Seng, B. Luk'yanchuk, and A. I. Kuznetsov, Nat. Comm. **7**, 10362 (2016).
19. A. B. Shvartsburg, V. Ya. Pecherkin, L. M. Vasilyak, S. P. Vetchinin, and V. E. Fortov, Sci. Rep. **7**, 2180 (2017).
20. A. Shvartsburg, V. Pecherkin, S. Jiménez, L. M. Vasilyak, S. P. Vetchinin, L. Vázquez, and V. E. Fortov, J. Phys. D. Appl. Phys. **51**, 475001 (2018).
21. A. B. Shvartsburg, V. Ya. Pecherkin, L. M. Vasilyak, S. P. Vetchinin, and V. E. Fortov, Phys. Usp. **61** (7), 698 (2018).
22. A. Shvartsburg, V. Pecherkin, S. Jiménez, L. Vasilyak, L. Vázquez, and S. Vetchinin, J. Phys. D. Appl. Phys. **54**, 075004 (2021).
23. A. B. Shvartsburg, L. M. Vasilyak, S. P. Vetchinin, K. V. Alybin, O. D. Volpyan, Yu. A. Obod, V. Ya. Pecherkin, P. A. Privalov, and D. V. Churikov, Optics and Spectroscopy **129** (2), 252 (2021).
24. V. Ya. Pecherkin, A. B. Shvartsburg, L. M. Vasilyak, S. P. Vetchinin, T. S. Kostyuchenko, and V. A. Panov, Usp. Prikl. Fiz. **6** (5), 191 (2018).