

Abstract Submitted
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Theorems Determining Reciprocal and Nonreciprocal Properties of Negative Refractive Bi-Crystal Heterostructures CLIFFORD KROWNE, Naval Research Laboratory — One of the most interesting questions in regard to the negative refractive bicrystal heterostructure is what multi-terminal electronic characteristics it may possess. The heterostructure possesses a symmetry breaking operation creating asymmetric fields associated with the $SO(2)$ rotation group [1]. Two terminal behavior may be addressed by examining generalized theorems for complex anisotropic media [2]. Applying the anisotropic reaction theorem to subregions of the heterostructure, and then to the composite structure, we find that passive nonreciprocity [3] is not possible while active nonreciprocity is possible as mentioned in [4]. Possible device applications include beam steering, and isolation devices requiring direction sensing control. Simulations show what happens to the asymmetry when making the heterostructure macroscopically using $LiNbO_3$ crystals versus using nanostructure technology which would work with ferroelectric films deposited by MBE. A fabrication effort used to build the structure, with metal patterning to test a derivative property of the asymmetry, namely terminal reciprocity/nonreciprocity, will be discussed too [5]. [1] C. M. Krowne, PRL 93, 053902, 30 July 2004. [2] C. M. Krowne, IEEE Trans. Ant. Propag. 32, 1224 Nov. 1984, [3] C. M. Krowne, IEEE Trans. MTT 53, 1345, 2005, [4] C. M. Krowne, arXiv.org/abs/cond-mat/0408369, 17 Aug. 2004. [5] Private commun. S. W. Kirchoefer, J. A. Bellotti, and J. M. Pond, 2005.

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