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Multiferroic Vortices and Graph Theory SANG-WOOK CHEONG, S.C. CHAE, Y. HORIBE, Rutgers Center for Emergent Materials, D.Y. JEONG, Department of Mathematics, Soongsil University, Korea , N. LEE, S. RODAN, T. CHOI, Rutgers Center for Emergent Materials — Hexagonal $REMnO_3$ (RE= rare earths) with RE=Ho-Lu, Y, and Sc, is an improper ferroelectric where the size mismatch between RE and Mn induces a trimerization-type structural phase transition, and this structural transition leads to three structural domains, each of which can support two directions of ferroelectric polarization. We reported that domains in h-$REMnO_3$ meet in cloverleaf arrangements that cycle through all six domain configurations, Occurring in pairs, the cloverleafs can be viewed as vortices and antivortices, in which the cycle of domain configurations is reversed. Vortices and antivortices are topological defects: even in a strong electric field they won't annihilate. Recently we have found intriguing, but seemingly irregular configurations of a zoo of topological vortices and antivortices in h-$REMnO_3$. These configurations can be neatly analyzed in terms of graph theory.

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