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Superspace symmetry and phenomenology of incommensurate type-II multiferroics

J. Ribeiro[1]

[1]*Centro de Física, Universidade do MInho, 4710-057 Braga, Portugal*

The recent upsurge of research work on multiferroic materials has made clear the need for a comprehensive knowledge of the constraints imposed by symmetry on the magnetic structure and tensor properties of incommensurate magnetic phases. That knowledge can be provided by the magnetic superspace formalism in a simple and robust manner. In this communication I will briefly review some of the basic concepts of this formalism pertaining to magnetic systems. Several practical examples will be given in order to illustrate how the assignment of a magnetic superspace group to a given phase is, in general , more restrictive and wide-ranging than the simple assignment of the order parameter irreducible representation. The direct connection between symmetry and phenomenology, which naturally arises via Landau theory, will then be used in order to illustrate how several complex phase diagrams of type-II magneto-electric multiferroics can be interpreted, and how the magnetically induced ferroelectric states can be anticipated on the basis of general symmetry considerations.

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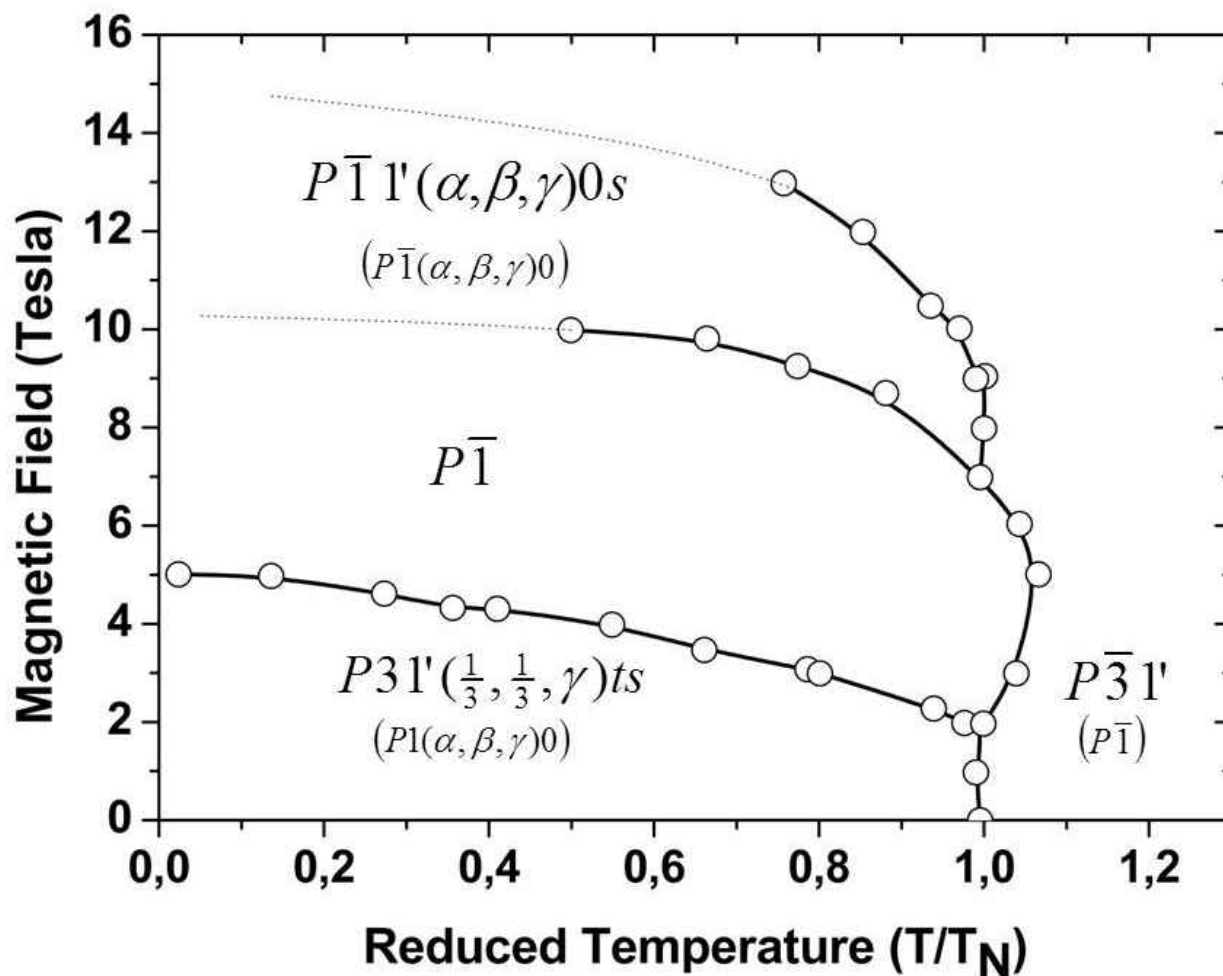
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