Ferroelectric Soft Modes and Gilbert-like Damping

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Motivated by the progress of a multiscale approach in magnetic materials the dynamics of the Ising model in a transverse field as a basic model for ferroelectric order-disorder phase transition is reformulated in terms of a mesoscopic model and inherent microscopic parameters. The dynamics is governed by a reversible propagating part giving rise to a soft mode behavior. The life-time of the excitation energy is obtained by including damping terms which are derived under the condition of breaking the time reversal symmetry due to dissipation. The final dynamical equation reminds of the Gilbert-damping appearing for an isotropic ferromagnet, but with an anisotropic effective field and consequently a different physical behavior. The temperature dependence of the excitation energy and its life-time is discussed [1]. The model is extended by including an additive noise term. The validity of the fluctuation-dissipation theorem is demonstrated.
A further extension of the model is realized by including stochastic fields [2].
Moreover we propose an attempt to model the behavior of multiferroics, a material where magnetic and ferroelectric properties are combined.

[1] S. Trimper, T. Michael, and J. M. Wesselinowa, Phys. Rev. B **76**, 045701 (2006).
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