The Dependence of the Auto-Oscillation Frequency of Parametric Spin Waves on the Pumping Power and Inter Mode Interaction Strengths

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Computer simulations of spin waves parametric excitations are carried out in the framework of the two modes model. The dependence of the auto-oscillation frequency, $\boldsymbol{f}$, on the pumping amplitude $\boldsymbol{h}$ is investigated. The results support the conventional expression for this dependence in cases where the parametric excitation threshold, $\boldsymbol{h}_{th}$ is very close to the auto-oscillation threshold $\boldsymbol{h}_{osc}$. In cases when $\boldsymbol{h}_{osc}$is considerably larger than $\boldsymbol{h}_{th}$a much better fit is obtained to a slightly modified expression: $\boldsymbol{f} = \boldsymbol{f}_0$+B([$\boldsymbol{h}$ /$\boldsymbol{h}_{osc}$]^2 –1)$^{0.5}$ where $\boldsymbol{f}_0$is the onset frequency and B is a constant. Support is given to the idea that auto oscillation evolves from a damped oscillation below $\boldsymbol{h}_{osc}$. The decay time of this oscillation is critically dependent on $\boldsymbol{h}$ and exhibits a critical slowing down power law: τ_{CO}= A(1- $\boldsymbol{h}/\boldsymbol{h}_{osc}$)$^{1.6}$ where A is a constant.

The dependence of $\boldsymbol{f}$ on the inter mode interaction strengths when $\boldsymbol{h}$ is constant, satisfies the expression: $\boldsymbol{f}$ = D+C / (E+2T$_{11}$+ S$_{11}$+2T$_{12}$+S$_{12}$) where D, C, and E are constants and T$_{11}$, T$_{12}$, S$_{11}$, and S$_{12}$are the inter mode interaction strengths in the two modes model.

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