Abstract for an Invited Paper
for the MAR10 Meeting of
The American Physical Society

Barkhausen avalanches in thin films[1]

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The magnetization process in thin films is due to the avalanche-like motion of domain walls, that can be recorded by magneto-optical methods. Here, I discuss experimental measurements of these Barkhausen avalanches in Permalloy thin films where zigzag domain walls are formed by the competition between long-range dipolar forces and the short-range line tension of the wall. The resulting avalanche distribution is affected by the limited size of the observation window requiring an appropriate correcting scheme. Next, I present results of numerical simulations of a dipolar random-field Ising model and of a flexible domain wall model that allow to reproduce the experimental results. By studying the avalanche size distribution, we observe a cross-over from a universality class dominated by line tension to another universality class where the long-range dipolar forces become important. This crossover is accompanied with a change of the domain wall morphology from a rough to a zigzag structure.

[1]This work was done in collaboration with Stefano Zapperi (CNR-INFM, Italy), Y. J. Chen, S. Papanikolaou, (Cornell University), G. Durin, A. Magni (INRIM, Torino), L. Laurson, A. Mughal (ISI, Torino) C. Serpico (Univ. Napoli).