AVALANCHES IN SUSPENSIONS OF SUPERCONDUCTING MICROGRANULES

A. Peñaranda[1], L. Ramírez-Piscina[1]

(1) Departament de Física Aplicada,
Universitat Politècnica de Catalunya,
Doctor Marañón 44, E-08028 Barcelona, SPAIN.

Systems of superheated superconducting microgranules are susceptible to exhibit avalanches. The transition of any microgranule, by radiation or external magnetic field, changes diamagnetic interactions in the system, especially between its neighboring granules. Depending on the relative position of the microgranules and on the direction of the applied field, a transition of a single grain can then produce the flip of other microspheres to the normal state.
This effect can be useful in detecting low-energy radiation. To produce the transition of a microgranule to the normal state a quantity of energy proportional to the volume of the grain is necessary in the global heating model [1]. In this sense, a device composed of small microspheres could act as an ultrasensitive low-energy detector. The change of magnetic flux induced by the loss of the Meissner effect could be amplified if an avalanche of transitions is produced. The enhancement of the signal would permit the detection of the incident particle or radiation. In addition, the amplified signal could be used as a trigger in high- energy experiments.
In this work we study the avalanches produced in disordered dispersions of superheated superconducting granules with adequate geometry immersed in an increasing external magnetic field. We simulate this situation by placing at random the desired number of microspheres, N, in a box and working out the diamagnetic interaction between granules. Results obtained with systems of N = 5000 spheres corresponding to configurations with different initial concentrations of microgranules suggest that induced avalanches follow a power scaling law. Results are compared to other avalanche models

[1] H. Dubos, T.A. Girard, G. Waysand et al. Phys. Rev. B**58** (1998) 6468.