Memory and rejuvenation phenomena in spin glasses, a computational approach for a thirty year open problem.

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Spin glasses are magnetic systems whose low-temperature phase is frozen and disordered and they are often seen as paradigmatic examples for the study of glassy behavior. The experimental study of spin glasses is plenty of interesting phenomena such as the *aging* phenomenon [1]. In our work [2], however, we will focus on the *memory* and *rejuvenation* phenomena [3].

Unfortunately, despite more than thirty years of theoretical efforts following the experimental discovery of memory and rejuvenation, these effects have thus far been impossible to simulate reliably.

Yet, recent developments convinced us to accept this challenge. First, the custom-built Janus II supercomputer makes it possible to carry out "numerical experiments" in which the very same quantities that can be measured in experiments are computed from the simulation, allowing for parallel analysis of the simulation/experiment data. Second, recent numerical results for the off-equilibrium study of spin glasses [4, 5], have allowed us to compare experimental and numerical results.

All these aspects together have allowed us to simulate a protocol in which we can numerically reproduce the memory and rejuvenation phenomena, as can be shown in Figure 1.

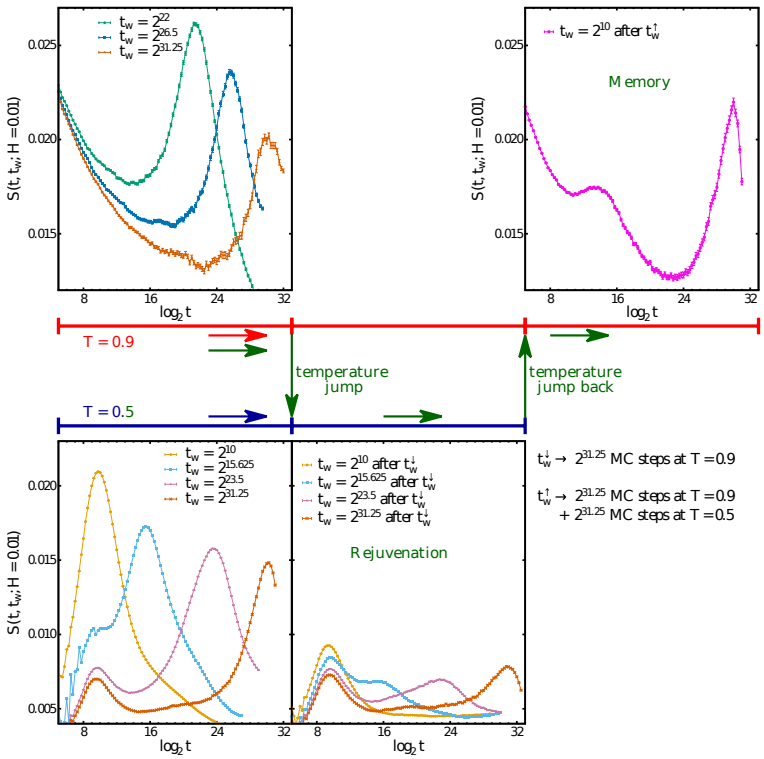

Fig. 1. Magnetic response of simulated spin glass in different moments of the thermal protocol shows the rejuvenation and memory phenomena.

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