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**Autor:** Kaschner, R. / Kobe, S.

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## Comment to numerical study of a long range Ising spin-glass: exact results for small samples

By R. Kaschner and S. Kobe, Sektion Physik, Technische Universität Dresden, DDR-8027 Dresden, GDR

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Ariosa et al. [1] have studied Ising  $s_i = \pm 1$  spin chains with a Ruderman-Kittel-Kasuya-Yosida-like interaction

$$J_{ij} = J_0 \frac{\cos(\alpha |x_i - x_j|)}{|x_i - x_j| + 1} \quad (1)$$

with  $J_0 = -10$ ,  $\alpha = 7\pi$  and random spin positions ( $x_i = x_{i-1} + 20 \cdot r$ ,  $r$  being a random number,  $0 \leq r \leq 1$ ) as a model for a long range spin-glass. To have a well

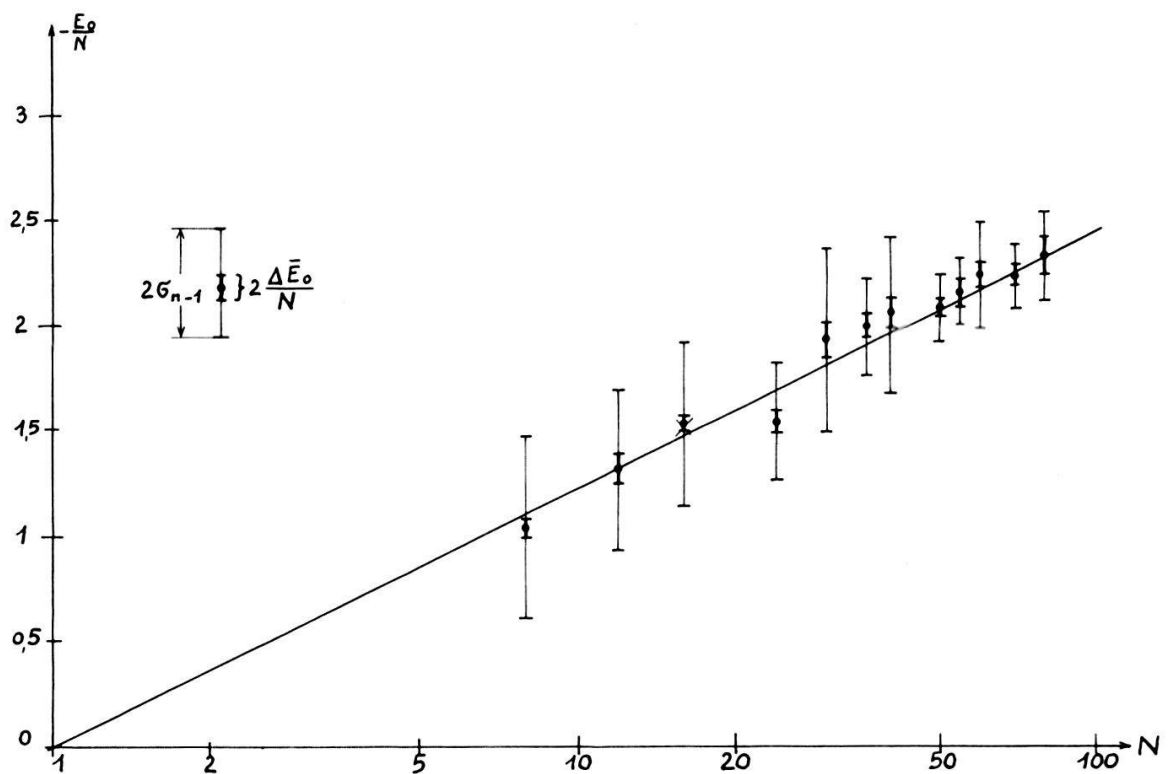


Figure 1

Averaged ground state energy per spin  $E_0/N$  as function of the number of spins  $N$ . The points represent the values  $\bar{E}_0/N$  averaged about  $n$  configurations with standard deviations  $\sigma_{n-1}$  and  $\Delta \bar{E}_0/N = \sigma_{n-1}/\sqrt{n-1}$ ;  $\times$  from [1]. The straight line represents  $E_0/N = -0.53 \ln N$ .

defined thermodynamic limit the coupling constant  $J_0$  has to be replaced by  $J_0/\rho(N)$ ,  $\rho(N)$  being such that the free energy becomes extensive. In [1]  $\rho(N) = N^{0.35}$  is determined numerically by extrapolation of the ground state energy for small samples with  $N=8, 12$  and  $16$  having in mind that this power law approximates the suggestion

$$\rho(N) = \ln N \quad (2)$$

very well for small  $N$ .

Using a new procedure to find the exact ground state of Ising systems without enumeration of all  $2^{N-1}$  states [2] we were able to recalculate  $\rho(N)$  up to  $N=80$ . The samples were chosen following the same criteria as in [1], section III [3].

The results (Fig. 1) show that the function (2) is more suitable than a power law for the given case. For the averaged ground state energy we found  $\bar{E}_0(N) = -0.53N \ln N$ . Thus the rescaling procedure in [1] for energies and temperature on the basis of (2) is confirmed with greater confidence.

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