

Mydosh J A. Spin glasses—recent experiments and systems.

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This paper presents a working definition of the term "spin glass," based upon a concentration dependence. A survey of the latest experiments on spin glasses is given with respect to the three temperature regions of importance: above, below, and at the freezing temperature. The most recent spin-glass systems are listed and discussed. [The *SCI*® indicates that this paper has been cited in more than 150 publications.]

The Spin-Glass Menagerie

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"The spin-glass problem has come of age."

So begins the article written in 1977 for a small conference (ca. 150 participants) on magnetic alloys and oxides that took place at the Technion, Haifa, Israel. My purpose was not to present a definite review of the field (such has only recently occurred¹) and thereby gain a large number of citations, but simply to introduce the new and increasingly popular area of spin glasses. At that time various interests were moving the spin glasses into great prominence. Two are mentioned in the article's first paragraph: (1) amorphous structure and magnetism, and (2) critical phenomena and percolation in random systems. Indeed, for the latter in 1978, the newly contrived solution of the Edwards-Anderson model² by D. Sherrington and S. Kirkpatrick³ was called into question by J.R.L. de Almeida and D.J. Thouless⁴ and their "irreversibility line" (which has recently returned to haunt workers in high-temperature superconductivity).

Thus began an explosion of theoretical efforts, with several thousand publications

appearing in the subsequent ten years.

Experiment naturally followed suit with much activity. My article seemed in later years to have helped set the stage for many of these exertions. It offered a good working definition of what a spin glass is and determined the concentration regimes where the freezing phenomenon would occur—in the metallic systems between the Kondo and the long-range-ordered regimes. Further, it surveyed the experimental situation, listing some salient observations that distinguished three temperature regions of behavior: the precursor (growing magnetic correlations) effects at high temperature; the unique low-temperature relaxation and irreversibilities; and the sharp response of certain experimental probes at the freezing temperature—the latter inaugurated by the steep susceptibility cusps from my work with V. Cannella.⁵ A not-unreasonable phenomenological description of the freezing process was suggested to picture the transition. Finally a collection of the various spin-glass materials was given, to emphasize the generality of the phenomenon (presently more than 500 systems have been called spin glasses).

In retrospect, I imparted too much prominence to the random metallic alloys (then the RKKY exchange was sovereign) and restricted the mixed insulating compounds with their short-range interactions that were later to become the "ideal" spin glasses for comparison with theory.⁶

What started out as a brief review article, so I could attend a topical conference, turned into a rudimentary, yet firm, basis from which future advances would spring. Since it was simple, a lot of people could quickly peruse the paper and obtain a feeling for this third general type of magnetic ordering (after ferro- and antiferromagnetism). The time was ripe, and there was good and continuous (even up until today) research support from the Dutch Stichting voor Fundamenteel Onderzoek der Materie, to whom I am most grateful.

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