This Week's Citation Classic

Equilibrium critical phenomena are discussed, em-phasising critical point exponents α, β, g, their values and their interrelations via models, rigorous inequalities, the droplet picture, and scaling hypotheses. [The SCI® indicates that this paper has been cited over 835 times since 1967.]

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"The success of the article was due, I believe, in part to its timeliness. It was, perhaps, the first account to lay out systematically the basics of the study of critical phenomena from a unified point of view which cut across traditional specializations: magnetism, physical chemistry, low temperature physics, high pressure studies, metallurgy, etc.

"In addition the article explained and discussed critically the new scaling and homogeneity concepts which were to prove so fruitful both theoretically and experimentally in the following decade. The developments stemming from these ideas culminated in the invention of the renormalization group technique and its associated concepts by my colleague at Cornell, Kenneth C. Wilson. Our joint paper[1] introducing the idea of a dimensionality expansion (in powers of à= 4-d, where d is the spatial dimensionality) in the renormalization group context did well in the citation stakes for its year, so I am told! More recently, I have reviewed these fascinating theoretical developments in 'The renormalization group in the theory of critical behavior.'[2]

"Although the 1967 article was primarily a review there were elements of originality in some of the analyses and presentations. In fact, the account and discussion of the quantal lattice gases, which certainly improved my own thinking about the special types of long-range order associated with superfluidity and superconductivity, has been of interest to quite a few subsequent workers The general droplet picture of the critical region appeared in print first in this article and later attracted some attention.[3]

"Another useful feature of the review to many practising theorists was, I feel, the succinct account of the so-called ratio method and Pade approximant technique for the analysis and extrapolation of power series expansions The ratio method had been invented by former mentor and senior colleague, Cyril Domb, at King's College, London and developed by his associates and students in the physics department, especially by my longtime friend Martin F. Sykes. The Pade method was first exploited by George A. Baker, Jr., then at Los Alamos. It was taken up and developed further by myself and others in the group at King's College, and Baker later spent 1965 with us. The usefulness of these techniques of numerical analysis is by no means restricted to critical phenomena studies; thus the review has been helpful to various theorists interested in other applications (such as estimating spectra from moments, etc.).

"One of the gratifying features of the 1967 review, in retrospect, is that it has held its own rather well as an introduction to the subject. While there have been many important later developments which carry theory and experiment much further, I would not, in rewriting it at this point, feel the need to change a great deal. This fortunate feature has probably also contributed to the review's relatively long life.

"The article was mainly written at Cornell in the fall of 1966 using as a basis my 1964 Boulder lectures.[4] The pain of composition was eased considerably by the chemistry department's tradition of giving new faculty members a light teaching load and by an excellent secretary, Mrs. Bobbie Ingalls.

"I was not so lucky with the editors at the Institute of Physics in London. Without notifying me, they made a large number of arbitrary and capricious alterations in the text. Indeed, they renumbered about 300 of the 360 or so equations, but not, however, consistently! They also failed to submit galley proofs. Finally the article went to press without benefit of my corrections on the second set of proofs. I had sent these, so I thought, direct to England by first class airmail. The proofs, however, turned up in London only some six months after the article appeared in print and then had been mailed from Belgrade! Apparently a Yugoslav visitor at Cornell went to the department's mail room to arrange his imminent departure. He picked up the already addressed and corrected proofs with his own papers, packed them and travelled the world for six months. My proofs reemerged finally, only when he unpacked back in Yugoslavia. As a result of this sad tale the article contains many more typographical errors and slips than it should but, happily, only very few are seriously misleading."

1. Fisher M E & Wilson K G. Phys. Rev. Lett. 28:240-3, 1972.
2. Fisher M E. Rev. Mod. Phys. 46:597-616, 1974.
3. ………….Physics 3:255-83, 1967.
4. …………. The nature of critical points. (Brittin W E, ed.) Lectures in theoretical physics, VIIC. Boulder, CO: University of Colorado Press, 1965. p. 1-159.