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# Critical Phenomena via Random Walk Representations: Selected Classics and Some Recent Results

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**Abstract.** SimonFest offers an opportunity to reminisce about the contribution of “soft” methods in the study of critical phenomena in Statistical Mechanics—methods which have been warmly embraced by Barry Simon and significantly advanced in his work on the subject. In addition to a partial review of the results derived at that period, I shall describe also some related recent results. The latter includes a spillover of statistical mechanics insights into the analysis of Schrödinger operators, and also the recent proofs by M. Heydenreich and R.W. van der Hofstad, and of the speaker with V. Papathanakos, of a long outstanding conjecture concerning a drastic effect of the boundary conditions (periodic versus bulk/free) on the nature of the scaling limits of critical models, in particular above the upper-critical dimensions.