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Criticality and quenched disorder: rare regions vs. Harris criterion[1] THOMAS VOJTA, Missouri Univ of Sci & Tech, JOSE HOYOS, Instituto de Fisica de Sao Carlos — We employ scaling arguments and optimal fluctuation theory to establish a general relation between quantum Griffiths singularities and the Harris criterion for quantum phase transitions in disordered systems. If a clean critical point violates the Harris criterion, it is destabilized by weak disorder. At the same time, the Griffiths dynamical exponent z' diverges upon approaching the transition, suggesting unconventional critical behavior. In contrast, if the Harris criterion is fulfilled, power-law Griffiths singularities can coexist with clean critical behavior but z' saturates at a finite value. We present applications of our theory to a variety of systems including quantum spin chains, classical reaction-diffusion systems and metallic magnets; and we discuss modifications for transitions above the upper critical dimension. Based on these results we propose a unified classification of phase transitions in disordered systems.

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