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**Breakdown of the Perturbative Renormalization Group at Certain Quantum Critical Points** JOERG ROLLBUEHLER, D. BELITZ, Department of Physics and Materials Science Institute, University of Oregon, T.R. KIRKPATRICK, Institute for Physical Science and Technology, and Department of Physics, University of Maryland — We show that a controlled loop expansion for critical exponents can break down if multiple time scales are present at a quantum critical point. We present a mechanism that leads to a divergence of coefficients in a controlled  $\epsilon$ -expansion. This can invalidate results obtained from a finite-order perturbative renormalization group treatment. The mechanism is explained in terms of dangerous irrelevant variables. As a physically relevant example we discuss the quantum ferromagnetic transition in disordered metals.

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