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Complex Critical Exponents in Diluted Systems of Quantum Rotors[1] RAFAEL FERNANDES, JÖRG SCHMALIAN, Ames Laboratory and Iowa State University — In this work, we investigate the effects of the Berry phase $2\pi\rho$ on the critical properties of XY quantum-rotors that undergo a percolation transition. This model describes a variety of randomly-diluted quantum systems, such as interacting bosons coupled to a particle reservoir, quantum planar antiferromagnets under a perpendicular magnetic field, and Josephson-junction arrays with an external bias-voltage. Focusing on the quantum critical point at the percolation threshold, we find that, for rational ρ, one recovers the power-law behavior with the same critical exponents as in the case with no Berry phase. However, for irrational ρ, the low-energy excitations change completely and are given by emergent spinless fermions with fractal spectrum. As a result, critical properties that cannot be described by the usual Ginzburg-Landau-Wilson theory of phase transitions emerge, such as complex critical exponents, log-periodic oscillations, and dynamically-broken scale invariance.

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Jörg Schmalian
Ames Laboratory and Iowa State University

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