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Critical percolation phase, geometric phase transitions with continuously varying exponents, and thermal Berezinskii-Kosterlitz-Thouless transition in a scale-free network with short-range and long-range random bonds A. NIHAT BERKER, Sabanci University, MICHAEL HINCZEWSKI, University of Maryland, ROLAND R. NETZ, Technical University of Munich — Percolation in a scale-free hierarchical network is solved exactly by renormalization-group theory in terms of the different probabilities of short-range and long-range bonds [1]. A phase of critical percolation, with algebraic [Berezinskii-Kosterlitz-Thouless (BKT)] geometric order, occurs in the phase diagram in addition to the ordinary (compact) percolating phase and the nonpercolating phase. The algebraically ordered phase is underpinned by a renormalization-group fixed line along which the flows reverse stability, thus also leading to geometric phase transitions with continuously varying exponents. It is found that no connection exists between, on the one hand, the onset of the geometric BKT behavior and, on the other hand, the onsets of the highly clustered small-world character of the network and of the thermal BKT transition of the Ising model on this network. Nevertheless, both geometric and thermal BKT behaviors have inverted characters, occurring where disorder is expected, namely, at low bond probability and high temperature, respectively. This may be a general property of long-range networks. [1] A.N. Berker, M. Hinczewski, and R.R. Netz, Phys. Rev. E 80, 041118 (2009).

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