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Ordinary Percolation with Discontinuous Transitions¹ VIJAY SINGH, STEFAN BOETTCHER, Dept. of Physics, Emory University, Atlanta, GA 30322 USA — We study percolation on hierarchical networks using generating functions and renormalization group techniques. Our exact results show the presence of novel features in these networks including the existence of non-trivial critical points, three distinct regimes in the phase diagram and, most importantly, a discontinuity in the formation of the extensive cluster at a critical point $p_c < 1$. At p_c , the order parameter P_{∞} describing the probability of any node to be a part of the largest cluster, jumps instantly to a finite value. We present simple examples of small-world networks with various hierarchies of long range bonds, indicating that the presence of discontinuous transitions is generic.

[1] S. Boettcher, V. Singh, and R.M. Ziff. Ordinary Percolation with Discontinuous Transitions. Arxiv preprint arXiv:1110.4288 (2):2 5, 2011.

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