Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Anomalous Transport in Complex Networks EDUARDO LOPEZ, Center for Polymer Studies, Boston University, SERGEY BULDYREV, Yeshiva University, SHLOMO HAVLIN, Bar-Ilan University, Israel, H. EUGENE STANLEY, Center for Polymer Studies, Boston University — To study transport properties of complex networks, we analyze the equivalent conductance G between two arbitrarily chosen nodes of random scale-free networks with degree distribution $P(k) \sim k^{-\lambda}$ in which each link has the same unit resistance. We predict a broad range of values of G, with a power-law tail distribution $\Phi_{\rm SF}(G) \sim G^{-g_G}$, where $g_G = 2\lambda - 1$, and confirm our predictions by simulations. The power-law tail in $\Phi_{\rm SF}(G)$ leads to large values of G, thereby significantly improving the transport in scale-free networks, compared to Erdős-Rényi random graphs where the tail of the conductivity distribution decays exponentially. Based on a simple physical "transport backbone" picture we show that the conductances are well approximated by $ck_Ak_B/(k_A + k_B)$ for any pair of nodes A and B with degrees k_A and k_B. Thus, a single parameter c characterizes transport on scale-free networks.

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Date submitted: 01 Dec 2004 Electronic form version 1.4