Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Divergence of Dynamical Conductivity at Certain Percolative Superconductor-Insulator Transitions RAJESH DHAKAL, YEN LEE LOH, JOHN NEIS, EVAN MOEN, University of North Dakota — Coarse-grained superconductor-insulator composites can be modeled as random inductor-capacitor (LC) networks, which exhibit percolative superconductor-insulator transitions (SITs). We use a simple and efficient algorithm to compute the dynamical conductivity $\sigma(\omega, p)$ of one type of LC network on large (6144×6144) square lattices, where $\delta = p - p_c$ is the tuning parameter for the SIT [1]. We confirm that the conductivity obeys a scaling form near criticality, so that the characteristic frequency scales as $\Omega \propto |\delta|^{\nu z}$ with $\nu z \approx 1.91$, the superfluid stiffness scales as $\Upsilon \propto |\delta|^{t}$ with $t \approx 1.3$, and the electric susceptibility scales as $\chi_E \propto |\delta|^{-s}$ with $s = 2\nu z - t \approx 2.52$. In the insulating state, the low-frequency dissipative conductivity is exponentially small, whereas in the superconductor, it is linear in frequency. The sign of m $\sigma(\omega)$ at small ω changes across the SIT. Most importantly, right at the SIT, Re $\sigma(\omega) \propto \omega^{t/\nu z - 1} \propto \omega^{-0.32}$, so that the quasi-dc conductivity σ^* is infinite, in contrast with most other classical and quantum models of SITs.

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Date submitted: 14 Nov 2013 Electronic form version 1.4