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Conductivity near quantum criticality in two space dimensions SNIR GAZIT, DANIEL PODOLSKY, ASSA AUERBACH, Technion - Israel Institute of Technology, DANIEL P. AROVAS, University of California, San Diego — We study relativistic $U(1)$ field theories near the quantum critical point in two space dimensions [1]. We compute the dynamical optical conductivity by means of large scale Monte Carlo simulations and numerical analytic continuation. Our main focus is on the universal properties and their relation to the low energy excitation spectrum. In both phases, the spectral function exhibits a sharp rise above a threshold frequency corresponding to the Higgs mass [2] in the ordered phase and to twice the single particle gap in the disordered phase. We determine the high frequency critical conductivity to be $\sigma_c^* = 0.3(\pm 0.1) \times 4e^2/h$. In addition, we find an approximate charge-vortex duality that is reflected in the ratio of the imaginary conductivity on either side of the transition. Our results are relevant to recent experiments on the superfluid to Mott insulator transition in cold atomic optical lattices and to THz spectroscopy of the superconductor to insulator transition in superconducting thin films.[1] S. Gazit, D. Podolsky, A. Auerbach, and D. P. Arovas, arXiv:1309.1765 (2013) [2] S. Gazit, D. Podolsky, and A. Auerbach, Phys. Rev. Lett. 110, 140401 (2013)

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