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Dynamical Conductivity near the Superconductor to Insulator Critical Point[1]

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I review our results [1–5] for the dynamical complex conductivity near the two dimensional superconductor to insulator transition. The relativistic field theory is relevant to ordered Jospehson junction arrays and bosons trapped in an optical lattice. In the superconducting phase, the real conductivity reveals the Higgs mode mass as a threshold, with a weak ω^5 sub-gap tail. The imaginary conductivity measures the critically vanishing superfluid density. In the insulator phase, the real conductivity has a sharp threshold at the Mott (charge) gap, and the imaginary conductivity goes as $-C\omega$, where the capacitance C measures the inverse of the *vortex superfluid density*, which vanishes at the critical point. For layered, short coherence length (bosonic), superconductors, the Higgs threshold is raised by the inter-plane plasmon energy. [1] N. H. Lindner and A. Auerbach, Phys. Rev. B81, 054512, (2010); [2] D. Podolsky, A. Auerbach, D. P. Arovas, Phys. Rev. B 84, 174522 (2011); [3] S. Gazit, D. Podolsky, and A. Auerbach, Phys. Rev. Lett. 110, 140401 (2013); [4] S. Gazit, D. Podolsky, A. Auerbach, and D. P. Arovas, Phys. Rev. B 88, 235108 (2013); [5] S. Gazit, D. Podolsky, A. Auerbach, arXiv:1407.1055, Phys. Rev. Lett. in press.

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