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Electrodynamics of the topological insulator $(Bi_{1-x}In_x)_2Se_3$ tuned to the brink of quantum criticality LIANG WU, ROLANDO VALDES AGUILAR, ANDREAS STIER, CHRISTOPHER MORRIS, YUVAL LUBASHEVSKY, PETER ARMITAGE, Department of Physics and Astronomy, The Johns Hopkins University, MATTHEW BRAHLEK, NIKESH KOIRALA, NAMRATA BANSAL, SEONGSHIK OH, Department of Physics and Astronomy, Rutgers the State University of New Jersey, THE JOHNS HOPKINS UNIVERSITY COLLABORATION, RUTGERS THE STATE UNIVERSITY OF NEW JERSEY COLLABORATION — We have utilized time-domain terahertz (THz) spectroscopy to investigate the low frequency optical conductivity in $(Bi_{1-x}In_x)_2Se_3$ through its topological phase transition from the pure compound (x=0) to the topologically trivial strongly insulating material (x=0.27). Above a thickness dependent doping threshold we observe a sudden collapse in the transport lifetime that indicates the destruction of the topological phase. We associate this with the doping where the states from opposite surfaces hybridize. As a function of thickness this threshold asymptotically approaches the doping $x \sim 0.06$ of a maximum in the mid-infrared absorption, which can be identified with the bulk band gap closing and change in topological class. The realization of a topological quantum critical point allows the possible realization of other novel phenomena including the Weyl semi-metal. I will discuss our results on the THz response of these systems in a new generation of materials with greatly suppressed bulk carrier density levels. Reference: Wu, *et al*, **Nature Physics** 9, 410-414 (2013).

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