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Higgs boson in two dimensional superfluid and Mott insulator states[1] KUN CHEN, YUAN HUANG, University of Science and Technology of China and University of Massachusetts, Amherst, LONGXIANG LIU, University of Science and Technology of China, YOUJIN DENG, University of Science and Technology of China and University of Massachusetts, Amherst, LODE POLLET, Ludwig-Maximilians-Universität München, NIKOLAY PROKOF'EV, University of Massachusetts, Amherst and Russian Research Center "Kurchatov Institute" — We find that despite strong decay into Goldstone modes the Higgs boson survives as a well-defined resonance in the two-dimensional relativistic field theory realized in the cold atomic system near the quantum critical point between the superfluid (SF) and Mott insulator(MI) states. Using scaling analysis of analytically continued results from quantum Monte Carlo simulations we construct universal spectral functions for scalar response both for SF and MI phases and reveal that they share similar properties: a resonant peak followed by a broader secondary peak before saturating to a near plateau behavior at higher frequencies, i.e. the Higgs amplitude mode is present in the MI phase under the correlation length scale. Our simulations of a trapped system of ultra-cold ^{87}Rb atoms explain recent experimental data and how the signal is modified by tight confinement.

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