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The Anderson-Higgs Amplitude Mode at the Two-Dimensional Superfluid-Mott Insulator Transition MANUEL ENDRES, TAKESHI FUKUHARA, Max Planck Institute of Quantum Optics, DAVID PEKKER, Department of Physics, Caltech University, MARC CHENEAU, PETER SCHAUSS, CHRISTIAN GROSS, Max Planck Institute of Quantum Optics, EUGENE DEMLER, Physics Department, Harvard University, STEFAN KUHR, University of Strathclyde, SUPA, IMMANUEL BLOCH, Max Planck Institute of Quantum Optics — Anderson-Higgs modes are amplitude oscillations of a quantum field and appear as collective excitations in quantum many-body systems as a consequence of spontaneous breaking of a continuous symmetry. Here we reveal and study an Anderson-Higgs mode in a two-dimensional neutral superfluid close to the transition to a Mott insulating phase. We unambiguously identify the mode by observing a resonance-like feature that shows the expected softening when approaching the quantum critical point. This was made possible by recent advances in the temperature measurement of lattice gases based on single atom detection, which allowed us to use lattice modulation spectroscopy as a sensitive tool to probe the many-body system in the linear response regime. We present an experimental and theoretical study of Anderson-Higgs excitations in our system, which also addresses the consequences of reduced dimensionality and spatial confinement.

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