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Characterizing the "Higgs" amplitude mode in a Spin-1 Bose Einstein Condensate BHARATH HEBBE MADHUSUDHANA, MATTHEW BOGUSLAWSKI, MARTIN ANQUEZ, BRYCE ROBBINS, MARYROSE BARRIOS, Georgia Inst of Tech, THAI HOANG, Purdue University, MICHAEL CHAPMAN, Georgia Inst of Tech — Spontaneous symmetry breaking in a physical system is often characterized by massless Nambu-Goldstone modes and massive Anderson-Higgs modes. It occurs when a system crosses a quantum critical point (QCP) reaching a state does not share the symmetry of the underlying Hamiltonian. In a spin-1 Bose Einstein condensate, the transverse spin component can be considered as an order parameter. A quantum phase transition (QPT) of this system results in breaking of the symmetry group $U(1) \times SO(2)$ shared by the Hamiltonian. As a result, two massless coupled phonon-magnon modes are produced along with a single massive mode or a Higgs-like mode, in the form of amplitude excitations of the order parameter. Here we characterize the amplitude excitations experimentally by inducing coherent oscillation in the spin population [1]. We further use the amplitude oscillations to measure the energy gap for different phases of the QPT. At the QCP, finite size effects lead to a non-zero gap, and our measurements are consistent with this prediction.

[1] T. M. Hoang et al, arXiv:1512.06766

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