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Precise measurements on a quantum phase transition in antiferromagnetic spinor Bose-Einstein condensates[1] CHANDRA RAMAN, ANSHUMAN VINIT, School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332, USA — We have experimentally investigated the quench dynamics of antiferromagnetic spinor Bose-Einstein condensates in the vicinity of a zero temperature quantum phase transition at zero quadratic Zeeman shift q. A key feature of this work was removal of magnetic field inhomogeneities, resulting in a steep change in behavior near the transition point. The quadratic Zeeman shift at the transition point was resolved to 250 mHz uncertainty, equivalent to an energy resolution of $k_B \times 12$ picoKelvin. To our knowledge, this is the first demonstration of sub-Hz precision measurement of a phase transition in quantum gases. It paves the way toward observing shifts of the transition point due to finite particle number N that scale as $1/N$, and also, to potential Heisenberg limited spectroscopy with antiferromagnetic spinor gases.

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Chandra Raman
School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332, USA

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