Excitation Spectrum a Strongly Interacting Rb85 Bose-Einstein Condensate SHAI RONEN, JOHN BOHN, SCOTT PAPP, JUAN PINO, ROBERT WILD, DEBORAH JIN, CARL WIEMAN, ERIC CORNELL, JILA, NIST, and Department of Physics, University of Colorado — The excitation spectrum of a Bose-Einstein condensate is ordinarily described by the Bogoliubov theory. However, near a Feshbach resonance, when the interactions get strong, one expects deviations from this theory, which may be calculated within the higher order Beliaev theory (Sov. Phys. JETP 34,299 (1958)). It has been well known that at low momenta Beliaev theory predicts an increase in the excitation energy. Here we highlight the fact that at large momenta in fact the opposite is true, and we map the transition between the two limits. We also study the effect of the effective range correction to the two-body scattering at large momentum transfer, and compare the theory with a Bragg scattering experiment in Rb85.

Shai Ronen
JILA, NIST, and Department of Physics, University of Colorado