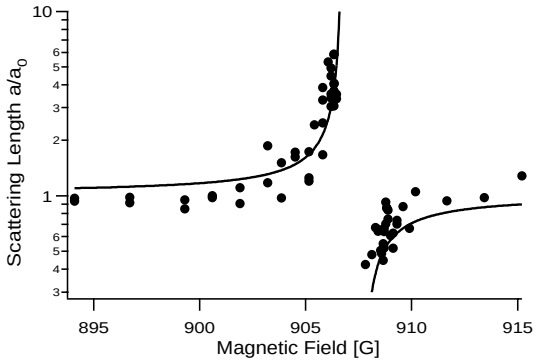
Observation of Feshbach resonances in a Bose-Einstein condensate

All the essential properties of Bose condensed systems - the formation and shape of the condensate, the nature of its collective excitations and statistical fluctuations, the formation and dynamics of solitons and vortices - are determined by the strength of the atomic interactions. In atomic gases, the strength of the interaction, characterized by the scattering length, varies dispersively near a Feshbach resonance which occurs at a specific value of the external magnetic field.

Our recent observation of Feshbach resonances in an optically trapped condensate [1] was the first such observation for cold atoms. The strength of the interaction was inferred from the measured release energy. The figure clearly displays the predicted dispersive shape and shows evidence for a variation in the scattering length by more than a factor of ten. Our observation of the dispersive variation of the scattering length confirms the theoretical predictions about "tunability" of the scattering length with the prospect of "designing" atomic quantum gases with novel properties.



Observation of the Feshbach resonance at a magnetic field of 907 G using time-of-flight absorption imaging. The figure shows the normalized scattering length versus external magnetic field, together with the predicted shape.

1. S. Inouye, M.R. Andrews, J. Stenger, H.-J. Miesner, D.M. Stamper-Kurn, and W. Ketterle, Nature **392**, 151 (1998).