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Experimental study of Lithium-6 close to Feshbach resonances FREDERIC CHEVY, J. MCKEEVER, J. ZHANG, E.G.M. VAN KEMPEN, T. BOURDEL, L. KHAYKOVICH, J. CUBIZOLLES, M. TEICHMANN, L. TAR-RUELL, S.J.J.M.F. KOKKELMANS, C. SALOMON, Laboratoire Kastler Brossel, ENS, 24 rue Lhomond, 75005 Paris — We discuss recent experiments performed on ultra-cold gases of fermionic ⁶Li in a crossed-beam dipole trap. This system enables the investigation of the so-called BEC-BCS crossover region. Using a Feshbach resonance, the magnitude of the atomic interactions can be tuned between the strongly interacting regime, where the ground state is a Bose-Einstein condensate (BEC) of molecules, to the weakly interacting regime, where the BCS (Bardeen-Cooper-Schrieffer) theory of superconductivity is more appropriate. A broad s-wave resonance was used to form a BEC of weakly bound ${}^{6}Li_{2}$ molecules in the optical trap. The molecule- molecule scattering length and the expansion energy of the cloud in the crossover region were measured. Furthermore, we have studied the scattering properties of the gas close to several p-wave Feshbach resonances, whose positions are in very good agreement with theory. We have also experimentally shown the existence of new s-wave resonances in the heteronuclear ⁶Li-⁷Li mixture.

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