Dilute Bose and Fermi gases with large generalized scattering lengths[1] RYAN M. KALAS, D. BLUME, Department of Physics and Astronomy, Washington State University, Pullman, Washington 99164-2814 — Dilute weakly-interacting Bose and Fermi gases can be described to a very good approximation by a single atomic physics parameter, the s-wave scattering length. Utilizing broad Feshbach resonances, strongly-interacting two-component Fermi gases with infinitely large interspecies scattering lengths can now be studied experimentally. In this so-called unitary regime, the only remaining energy scale is the energy E_{FG} of the non-interacting Fermi gas, and it has been shown that the energy of the Fermi gas becomes about $0.44E_{FG}$. We investigate Bose and Fermi gases with non-vanishing angular momentum using the lowest order constrained variational method. In particular, we focus on the regime where the generalized scattering length becomes infinite. For example, we show that the energy of d-wave interacting fermions depends not only on E_{FG} but additionally on an energy scale set by the range of the underlying two-body potential.

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