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### **Small Mass- and Trap-Imbalanced Two-Component Fermi Gases<sup>1</sup>**

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Motivated by the prospect of optical lattice experiments with two-component Fermi gases consisting of different atomic species such as Li and K, we calculate the energies for  $N$  fermions under harmonic confinement as a function of the mass- and trap-imbalance, i.e., the ratio between the masses and frequencies of species one and two, using microscopic approaches. Our energies for  $N=2$  through 6 can be used to determine the energetically most favorable configuration for a given number of atoms per species of a deep lattice in which each lattice site is approximately harmonic and in which tunneling between neighboring sites can be neglected. Extending the calculations for equal trapping lengths to up to  $N=20$ , we determine and interpret the excitation gap for unequal-mass systems with equal oscillator lengths.

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