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Species-selective optical lattices L.J. LEBLANC, J.H. THYWISSEN, Department of Physics, University of Toronto, 60 St. George Street, Toronto ON M5S 1A7, Canada — In binary mixtures of ultracold alkali atoms, we consider possibilities for creating an optical lattice seen by one atomic species (the "target") but not the other (the "spectator") [1]. Two schemes for single-frequency trapping are explored and compared in terms of their trap depths and heating rates. A "tune-in" scheme, where the trapping frequency is nearly resonant with the target and far detuned from the spectator, is found to be preferable for fermion-boson mixtures of Li-Na Li-K and K-Na. A "tune-out" scheme, where the trapping frequency is chosen between the D1 and D2 lines of the spectator element, is favoured for Li-Cs, K-Rb, Rb-Cs, K-Cs and ^{39}K-^{40}K mixtures. Both schemes lend themselves to a number of applications, including the creation of a lattice for the target species in the presence of a phonon-like background, the tuning of relative effective mass of the species, and the isothermal increase of phase space density in the target species. Interactions pose an upper bound on the selectivity of the lattice, since the periodically modulated density of the target can create a periodic interaction potential on the spectator.

Ref: [1] L. J. LeBlanc and J. H. Thywissen, arXiv:cond-mat/0702034.

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