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Effective coherent four-body interactions in optical lattices[1] PHILIP JOHNSON, WILLIAM FLYNN, American University, EITE TIESINGA, NIST, Gaithersburg — The interactions of neutral bosons with small scattering lengths confined in optical lattices are dominated by two-body collisions. When the scattering length is increased (say, via a Feshbach resonance), three-body interactions become important; however, even for small scattering lengths effective higher-body interactions—generated by virtual transitions to higher lattice orbitals—can play a surprisingly important role in some processes. For example, we recently showed that effective three-body interactions would have a significant influence on the collapse and revival of coherent states in 3D lattices [Johnson et al, NJP 11, 093022 (2009)]. Beautiful experimental evidence for this physics was recently presented in [Will et al, arXiv:0911.5066 (2009)]. Moreover, this data also shows clear signatures of four- and higher-body effective interactions. In this talk we describe how higher-body effective interactions arise in deep lattices and, in particular, we find the strength of the coherent four-body interactions which we compare to experiments.

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