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Collisional decoherence of internal state superpositions in a trapped ultracold gas CHRISTOPHER HEMMING, ROMAN KREMS, University of British Columbia — We analyze the temperature-dependent rate of decoherence of superpositions of internal states of trapped molecules due to collisions with ultracold buffer gas particles. Our analysis is applicable for an arbitrary bath/tracer particle mass ratio. Both elastic and inelastic collisions contribute to decoherence. We obtain an expression relating the observable decoherence rate to pairwise scattering properties, specifically the scattering lengths and low-temperature scattering amplitudes. We consider the dependence on the bath/tracer particle mass ratio for the case of light bath and heavy tracer particles. The expressions obtained may be useful in low-temperature applications where accurate estimates of decoherence rates are desirable. The results suggest a method for determining the scattering lengths of atoms and molecules in different internal states by measuring decoherence-induced damping of coherent oscillations.

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