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Relaxation rates for inverse power law particle interactions and their variable hard sphere surrogates ROBERT RUBINSTEIN, None — It is well known that collision models based on an assumed intermolecular potential (IPL, LJ, ...) can be successfully replaced by simplified surrogates (VHS, VSS, VS, ...) in DSMC calculations. But these surrogates only reproduce certain gross properties of the molecular model, for example, the temperature dependence of the viscosity; they do not approximate, and even mis-state, the details of the particle interactions. The success of the simplified models in problems at finite Knudsen number, where the Navier-Stokes approximation is not valid, may therefore seem surprising. To understand this success in a very special case, we showed that the first seven relaxation rates of the linearized Boltzmann equation for Maxwellian molecules are well approximated by the corresponding relaxation rates of its VHS surrogate. We will show that this analysis can be extended in somewhat less generality to IPL interactions, and to some extent to more realistic models including LJ. We believe that this analysis can help address the more general problem of identifying the properties of the collision model that dominate the predictions of the Boltzmann equation.

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