Microscopic hydrodynamic modes in a hard sphere binary mixture

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The transport properties of binary gas mixtures provide a paradigm for understanding the transport properties of more complex gas mixtures. The detailed behavior of microscopic hydrodynamic modes in complex gas mixtures is sensitive to the structure of the kinetic equations used to describe the microscopic behavior of the gas. We use a method that has been applied successfully to monatomic quantum gases [1,2,3] and Bose-Einstein condensates [4,5]. We show that it is possible to derive analytic microscopic expressions for the shear viscosity, the speed of sound, and the decay rates of the hydrodynamic modes in a hard sphere binary gas mixture directly from the spectral properties of coupled Boltzmann equations. We show that the analytic expressions give good agreement with experimental viscosity data and to the results of light scattering experiments on noble gas binary mixtures.

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