The Excitation of an Independent-particle Gas—Classical or Quantal—by a Time-dependent Potential Well*

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A systematic numerical investigation of the excitation of a classical or quantal gas of non-interacting particles in a time-dependent potential well is described. The energy was followed in time for one oscillation around the sphere for six types of deformation: spheroidal shapes and Legendre polynomial ripples P_2, P_3, P_4, P_5, P_6 with relative rms amplitudes of 0.2. Ten different speeds of deformation and eleven different values of the diffuseness of the potential well were studied. In the upper range of deformation speeds the quantal results for the non-integrable shapes P_3-P_6 agree approximately with the wall formula for dissipation, the deviations being largely accounted for by the wave-mechanical suppression factor of Koonin et al. For low deformation speeds the dissipation becomes dominated by one or two avoided level crossings.

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The Excitation of an Independent-particle Gas by a Time-dependent Potential Well. Part II*

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A systematic comparison is carried out between quantal and classical computer simulations of the excitation of independent particles in a time-dependent, diffuse potential well undergoing one cycle of oscillation. Eleven values of the diffuseness, up to 25 values of the oscillation frequency, and five Legendre polynomial deformations P_2, P_3, P_4, P_5, P_6 were examined. Oscillations around the spherical shape as well as around a P_3 deformed shape were considered. The results are compared with the one-body dissipation theory in the form of the wall formula, including corrections for the heating up of the gas, the diffuseness of the surface, the wave-mechanical suppression of dissipation and the reduction in the effective volume available to a quantal gas in a container whose diffuseness is small compared to the particle wavelengths.

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The Effect of Dynamical Correlations in a Slowly Pumped Knudsen Gas*

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In this paper we consider the effect of dynamical correlations on the absorbtion of energy by a gas of mutually noninteracting particles inside a container whose shape changes slowly (and periodically) with time. In principle, such correlations can significantly alter the rate at which energy is absorbed by the gas. We present the results of numerical simulations in which this effect is clearly seen, and compare the results with theoretical estimates.

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