Phase shift and Beth-Uhlenbeck formula for an atomic gas in a harmonic waveguide

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In a non-degenerated gas with low density and high temperature, the fugacity is a small parameter. The equation of state can be thus efficiently approached by the virial expansion. Since the n-order virial coefficient is known from the solution of the n-body problem, the virial expansion built a bridge between thermodynamics and few-body physics.

In this talk we study the 2nd order virial coefficient for a gas trapped into a 1D or a 2D harmonic waveguide (shape of a cigar or a pancake). Interactions are modeled by a quantitative two-channel model that include the coupling between atoms and Feshbach molecules. We defined in this context the scattering phase-shift and we derive from a diagrammatic approach a Beth-Uhlenbeck formula that takes into account the presence of the molecules and the external waveguide.