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Degenerate gases in quasi-1D harmonic traps

Quantum degenerate Bose gases and two-component Fermi gases in highly elongated harmonic traps are investigated over a wide range of interaction strengths. We find that the properties of the gas under tight transverse confinement are well reproduced by a 1D model Hamiltonian with contact interactions. In the case of bosons, we point out the existence of a regime where the correlations are stronger than in a Tonks-Girardeau gas and the properties of the system are well described by a gas of hard rods. In the case of fermions, we predict the existence of a molecular Tonks-Girardeau gas for strong attractive effective interactions. Possible experimental evidences of these regimes are analyzed by investigating the frequency of the lowest compressional mode.