

## Calogero Model

Consider a quantum mechanical system of  $N$  one-dimensional bosons are confined in a harmonic oscillator potential and interact via a pair-wise inverse squared potential. The Hamiltonian is given by

$$\hat{H}_{Cal} = \sum_{i=0}^{N-1} \left( -\frac{1}{2} \frac{\partial^2}{\partial x_i^2} + \frac{1}{2} x_i^2 \right) + \sum_{i < j} \frac{\nu(\nu-1)}{(x_i - x_j)^2}, \quad (1)$$

where  $\hbar = m = \omega = 1$  and  $\nu$  is an interaction parameter. Then the exact ground-state wave function and energy are given by

$$\Psi_{exact} = \exp \left( -\frac{1}{2} \sum_{i=0}^{N-1} x_i^2 \right) \prod_{i < j} |x_i - x_j|^\nu, \quad (2)$$

and

$$E_{exact} = \frac{N}{2} + \frac{\nu}{2} N(N-1). \quad (3)$$