Example 2.

Consider the helium atom consisting of two electrons moving in the field of a He nucleus. Take the electrons to be particles '2' and '3'. Then the hamiltonian for this 3-body problem can be written in terms of the Jacobi coordinates $\boldsymbol{\xi}_3 \equiv \mathbf{x}$ and $\boldsymbol{\xi}_2 \equiv \mathbf{y}$ as ✳

$$H = -\frac{\hbar^2}{2\mu_x}\nabla^2_{\mathbf{x}} - \frac{\hbar^2}{2\mu_y}\nabla^2_{\mathbf{y}} + \frac{e^2}{x} - \frac{e^2}{|\mathbf{y}+\frac{1}{2}\mathbf{x}|} - \frac{e^2}{|\mathbf{y}-\frac{1}{2}\mathbf{x}|} .$$

where the reduced mass terms μ_x and μ_y are given by

not separable!

$$\mu_x = \frac{m}{2} \quad \text{and} \quad \mu_y = \frac{2mM}{M+2m} .$$