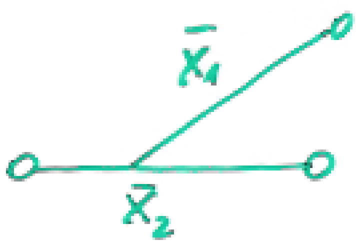
For a system of A particles (identical), the Jacobi coordinates can be defined as

$$
\begin{cases}
\bar{x}_N = \bar{r}_1 - \bar{r}_2 \\
\bar{x}_{N-1} = \sqrt{3}\,(\bar{r}_3 - \bar{R}_3) \\
\vdots \\
\bar{x}_{N-i+1} = \sqrt{\frac{2(i+1)}{i}}\,(\bar{r}_{i+1} - \bar{R}_{i+1}) \\
\vdots \\
\bar{x}_1 = \sqrt{\frac{2A}{A-1}}\,(\bar{r}_A - \bar{R}_A)
\end{cases}
$$

$N = A-1$

$$R_i = \frac{1}{i}\sum_{j=1}^{i} \bar{r}_j$$

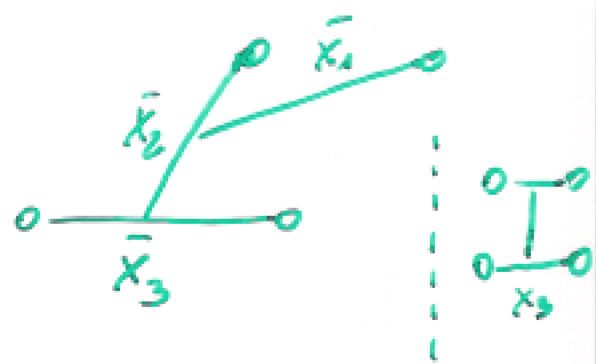
$A = 3$



$$x_2 = \rho\cos\phi$$

$$x_1 = \rho\sin\phi$$

$A = 4$



$$x_3 = \rho\cos\phi_1$$

$$x_2 = \rho\sin\phi_1\cos\phi_2$$

$$x_1 = \rho\sin\phi_1\sin\phi_2$$

$$[\bar{x}_1, \bar{x}_2] \equiv [\rho, \Omega] \equiv [\rho, \phi, \hat{x}_1, \hat{x}_2]$$

$$[\bar{x}_1, \bar{x}_2, \bar{x}_3] \equiv [\rho, \Omega] \equiv [\rho, \phi_1, \phi_2, \hat{x}_1, \hat{x}_2, \hat{x}_3]$$