

$$\mathbf{a}_{ij} = \sum_{\substack{j \neq i \\ j=1}}^N \frac{Gm_j (\mathbf{r}_j - \mathbf{r}_i)}{\|\mathbf{r}_j - \mathbf{r}_i\|^3}$$

$$U = - \sum_{1 \leq i \leq j \leq n} \frac{Gm_i m_j}{\|\mathbf{r}_j - \mathbf{r}_i\|}$$