$$\frac{d^2 I}{dt^2} = 0 \Rightarrow \qquad K = \sum_k \frac{p_k^2}{m_k} = \sum_{i<j} m_i m_j,$$

$$V_0 = \sum_{i<j} m_i m_j \log r_{ij} = E - \frac{1}{2} \sum_{i<j} m_i m_j.$$