

$$\sum_i m_i q_i = 0, \quad M = \sum_i m_i, \quad I = \sum_i m_i q_i^2,$$

$$K = \sum_i \dot{q}_i^2, \quad V_\alpha = \frac{1}{\alpha} \sum_{i < j} m_i m_j r_{ij}^\alpha, \quad H = \frac{1}{2} K + V_\alpha.$$

$$\Rightarrow \frac{d^2 I}{dt^2} = 2K - 2\alpha V_\alpha = 4E - 2(2 + \alpha)V_\alpha.$$

$$\text{For } \alpha = -2 : \quad \frac{d^2 I}{dt^2} = 4E \Rightarrow I = 2Et^2 + c_1 t + c_2.$$

\therefore If $I \nrightarrow 0$ and $I \nrightarrow \infty$ then $E = 0$, $c_1 = 0$, $I = \text{const.}$