AST1100 - Oblig 7

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1 Problem 2.3

From the virial theorem we have, $< K >= -\frac{1}{2} < U >$. Whitch gives us,

$$\lim_{t\to\infty} = \frac{1}{t}\int_0^t K dt = -\frac{1}{2}\lim_{t\to\infty} = \frac{1}{t}\int_0^t U dt$$

From the ergodic hypothesis we got that,

$$\lim_{t\to\infty} = \frac{1}{t}\int_0^t dt \to \lim_{N\to\infty} = \frac{1}{N}\sum_{i=1}^{N}$$

We therefore have, $K = -\frac{1}{2}U$, when $K = \sum_i^N \frac{1}{2} m_i v_i^2$ is the total kinetic energy of the system, $U = \sum_i^N \sum_{j<i} -G\frac{m_i m_j}{r_{ij}}$ is the total gravitational potential energy of the system. We get,

$$\sum_i^N \frac{1}{2} m_i v_i^2 = \frac{1}{2}\sum_i^N \sum_{j<i} G\frac{m_i m_j}{r_{ij}}$$

We divide by $\sum_i^N m_i$ and multiply by 2 on both sides,

$$\sum_i^N v_i^2 = \sum_i^N \sum_{j<i} G\frac{m_j}{r_{ij}}$$

Which gives,

$$\sum_{j<i} m_j = \frac{\sum_i^N v_i^2}{G\sum_i^N \sum_{j<i}\frac{1}{r_{ij}}}$$

2 Problem 2.4

asdasd

(a) asdasd