

# Introduction to Parallel Processing

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## Home assignment #3

### OpenMP

Write a parallel C code with OpenMP to simulate a simple 2D N-body problem,  $O(n^2)$ .

Assume:

1.  $m=m_{\text{sun}} \approx 2 \times 10^{30} \text{kg}$
2. A square domain of size 100ly times 100ly (1ly = 1 light year  $\approx 9 \times 10^{12} \text{km}$ )
3. Gravitational constant,  $G=6.674 \times 10^{-11} \text{N} \cdot \text{m}^2/\text{kg}^2$
4.  $v$ = Average speed  $\sim 200 \text{Km/sec}$ .
5.  $N=1,000$  stars.
6. Generate initial random positions and velocities (in the range  $0.5v < v < 1.5v$ ).

- Choose an “interesting” time step.

- Choose the total number of time steps such that the run will last longer than 1 minute.

Execute the code on one of the “hobbit” nodes.

- 1) Submit your code.
- 2) A plot of the speedup ( $t_2/t_p$ ) vs. number of threads (2,4,6 and 8).
- 3) A plot of the speedup ( $t_{100}/t_{100,1000,10000}$ ) vs. number of stars (problem size) for 100, 1,000 and 10,000 stars, for 8 threads.
- 4) For 1,000 stars and 8 threads, generate 3 snapshots of your galaxy (in the beginning, in the middle and in the end of the run) and submit them as images (\*.png or \*.jpg).
- 5) Conclusions.

Due in two weeks.

Good luck!