

N-body Simulation

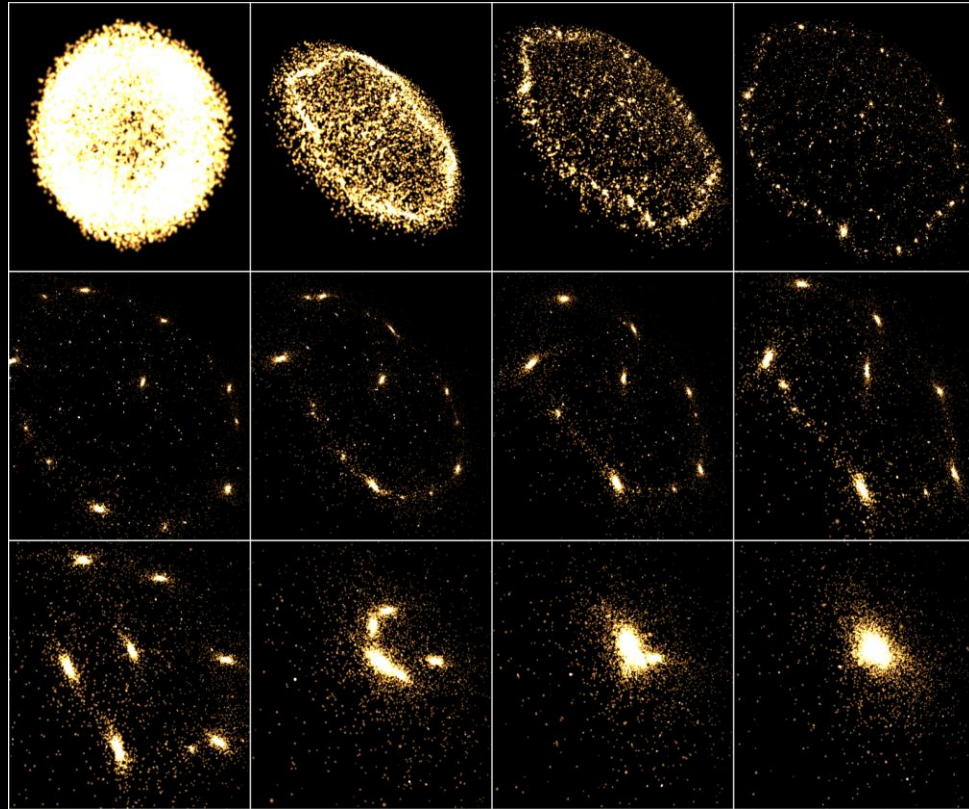
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N-Body Simulation

- Numerically Simulate evolution of system of N bodies
 - Each body continuously interacts with all other bodies
- Examples:
 - Astronomical and astrophysical simulation
 - Molecular dynamics simulation
 - Fluid dynamics simulation
 - Radiometric transfer (Radiosity, multiple scattering, etc.)
- N^2 interactions to compute per time step
 - For the brute force *all-pairs* approach we discuss here

CUDA N-Body Simulation

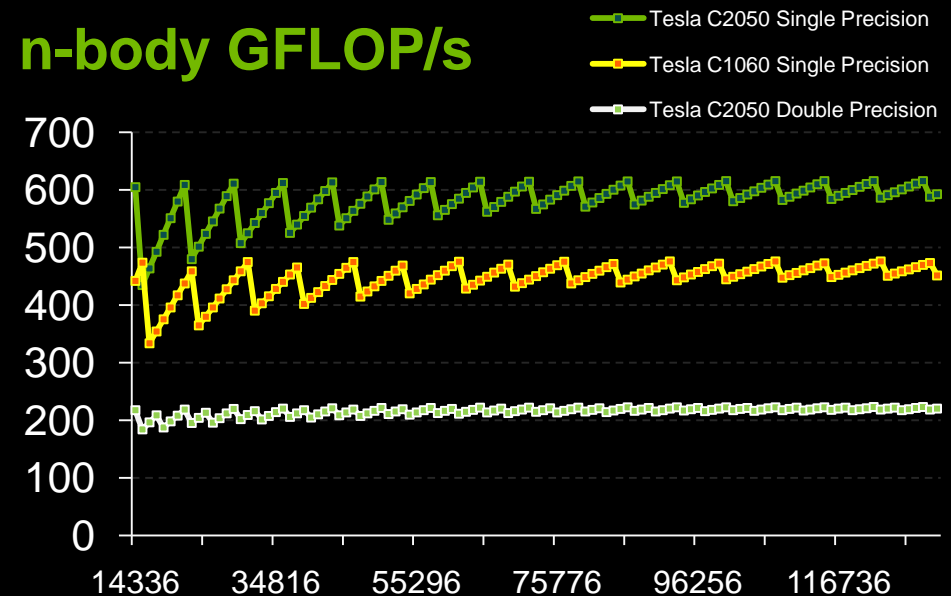


Tesla C2050

35K bodies @ 30.6 B interactions / s
x 20 flops / interaction =
612 GFLOP/s (single precision)

... 214 GFLOP/s (double precision)

n-body GFLOP/s



Gravitational n-body

- The gravitational force between bodies i and j :

$$\mathbf{f}_{ij} = \frac{\mathbf{r}_{ij}}{|\mathbf{r}_{ij}|} \cdot G \frac{m_i m_j}{|\mathbf{r}_{ij}|^2}$$

- The gravitational force on body i by all other bodies j :

$$\mathbf{F}_i = G m_i \cdot \sum_j \mathbf{r}_{ij} \cdot \frac{m_j}{|\mathbf{r}_{ij}|^3}$$