RADIATIVE TRANSFER IN GALAXIES

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Abstract

In this thesis, we present a novel algorithm for computing the radiation field in astrophysical simulations.

Dedicated to...

Acknowledgements

Thank you to all that helped.

"Some sort of quote?"

Albert Einstein (1879-1955)

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The Numerical Method

In the absence of absorbing material, the problem of radiative transfer reduces down to that of gravity. As such, the tree-algorithm for calculating gravity can be used (**?**).

- A tree can be used to partition space.
- Each level of the tree holds finer partitions of the volume. See figure **??**
- Each node of the tree contains accumulated information about the tree below it (total mass, etc.).
- In order to calculate gravity on a particular leaf (bucket), you can interact with the moment of another cell (**??**).
- To decide what level of the tree to interact with, you can define an opening angle/radius, θ. If a cell is smaller than this opening angle (the distribution of matter inside the cell is contained within a small enough angle on the sky), the entire cell can be used in the force calculation. If not, you must consider the child nodes separately. See equation **??**.

- On average, the number of interactions a each particle will have is $\log N$, where N is the total number of particles. Thus, the force calculation for the whole simulation scales as $N \log N$. Note that lowering θ shifts the number of calculations that are approximated by large cells to smaller cells, and thus if θ is very small, the code approached scaling of order N^2.

- In the case of radiation, the math is very similar (See eq **??**). However, since radiation does not cancel like forces, the dipole moment does not disappear and a rougher approximation is possible (wording wrong, fix this).

- In this case, the interaction scales as $N_{\rm sink} \log N_{\rm source}$. However, assuming the full tree is still used, the tree-build still scales as $N \log N$.

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