

PROJECT 1

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ABSTRACT

A common issue with performing heavy numerical calculations is the limited amount of resources available in a computing device. For this reason it is important to write optimized code that does not use more resources than a computer has available. To demonstrate this, we use various numerical methods to solve the one-dimensional Poisson equation with Dirichlet boundary conditions. The methods were written in C++ and applied on a linear set of equations representing the Poisson equation. We observe that our own written algorithm performs faster and is less prone to memory errors compared to using a regular LU-decomposition performed by the Armadillo library.

Subject headings: computational physics – linear algebra

1. INTRODUCTION

Programs using poorly optimized code will often take longer to run, and in the worst case the program will not execute properly. If the method used for solving a problem requires storing too many values in the RAM (random access memory), the computer will run out of available memory and the program will never finish running.

2. METHOD

Describe method. Define data model and likelihood. Outline how the likelihood was computed (grid or MCMC).

Define the power law model in terms of Q and n .

3. DATA

Summarize properties of data. Which data are used (experiment, frequencies etc.)? Pixel resolution (N_{side}), ℓ_{max} – everything necessary to repeat the analysis for other researchers.

Show a sky map of the smoothed data. Use the Healpix routine “smoothing” to do this; it works just like anafast.

Smooth with a 7° beam, and plot with “map2gif”. Show the RMS pattern as well.

4. RESULTS

Show the 2D likelihood contours. Summarize constraints on Q and n .

5. CONCLUSIONS

Summarize results. Discuss their importance, referring to the discovery to the initial seeds for structure formation. Mention that these results are in good agreement with expectations from inflationary theory.

TABLE 1

Column 1	Column 2	Column 3	Column 4
Item 1	Item 2	Item 3	Item 4

NOTE. — Summary of main results.

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REFERENCES

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