Outline

Title: Bayesian Inference and MCMC Methods in Astrophysics

1. Introduction

    - Explain how Quantitative analysis is the backbone of research in modern Astrophysics.
    - Paragraph about the history of QA in physics (perferably astro), and the trend of problems coming into modern day.
    - Explain why this review will be focusing spcifically on Bayesian and MCMC: Their popularity in the field, flexibility, and compatibility with many types of problems.
    - Explain the structure of the rest of the paper.
        - Methodology section will cover the mathematical theory behind BI and MCMC. It will also explain how to implement them using Python using simple problems as examples.
        - For each case study, include a paragraph or so sumary about the general background, the problem, and how QA is helping solve it or advance research in the field.

2. Methodology (citing vonToussant, Brewer)

    (a) Bayesian Statistics

    - Review of Bayesian statistics and BI.
    - Include some example problems.

    (b) Markov Chain Monte Carlo

    - Explain the math and methodology of Monte Carlo methods.
    - Show how Markov Chain Monte Carlo builds off it.
    - Provide examples and the implementation of simple MCMC algoritms (like the Metropolis Algorithm)

3. Case Studies

    (a) Bayesian Frameworks for Exoplanet detection
    (Ruffio)

    - Problem

- Methods
- Pros/Cons
- Extensions

(b) Cosmological Parameter Estimation with MCMC Methods (Akeret)
Notes: Make this even more specialized. Read some more about it

(c) Bayesian approach to Gravity wave detection (Littenberg)
Notes: Don't go too deep into this. Only talk about detection, don't get into fitting the graviatational waveform.

4. Conclusion

- State of the field
- Areas for future work
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References