

Parameter Constraints for ϕ CDM Model

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1 Introduction

I have reproduced the plots presented in the original paper by Farooq et al. for the ϕ CDM model. The contour plots for this model were generated using Matplotlib's standard library functions. In the subsequent sections, I provide a detailed description of the method, compare my results with those of the original paper, and display both my plots and those from the original publication.

2 Method: Using MCMC

The function χ^2 is minimized using `scipy.minimize` and the corresponding minimum value χ^2_{\min} and best parameters are obtained. After this, MCMC simulations were run to obtain Markov Chains for each parameter. The chain length was chosen as 10000 and the number of walkers as 200. These Markov chains were used to calculate the marginalized distribution for each parameter, which in turn was used to obtain 2σ bounds for each parameter. The Markov chains were also used to generate 1σ , 2σ , and 3σ contours.

3 Result Comparison and Plots

In the table presented below, a comparison is made between the results of my work and those reported in the original paper. The computations were carried out for $H_0 \pm \sigma_{H_0} = 68 \pm 2.8 \text{ km s}^{-1}$.

Attribute	Farooq et al	My Calculations
Plots	Figure 1	Figure 2
Best Fit Point (Ω_m, α)	(0.29, 0)	(0.30, 0.01)
χ^2_{\min}	18.24	17.95
2σ intervals	$0.24 \leq \Omega_{mo} \leq 0.34$ $0 \leq \alpha \leq 2.2$	$0.21 \leq \Omega_{mo} \leq 0.36$ $0.01 \leq \alpha \leq 2.8$

Table 1: Comparison of Results

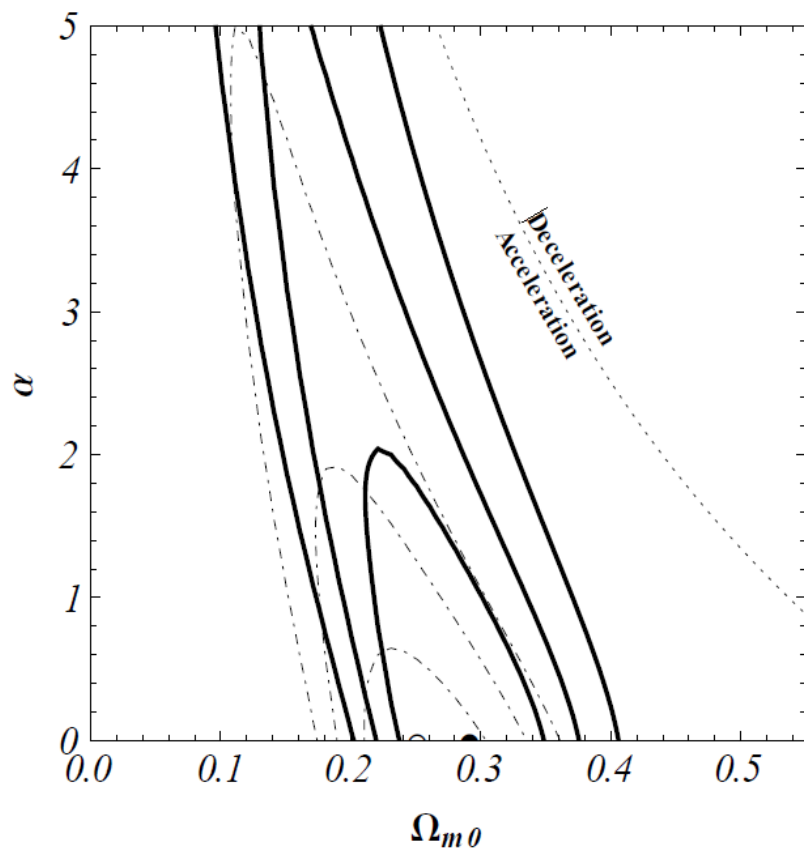


Figure 1: Original Plot

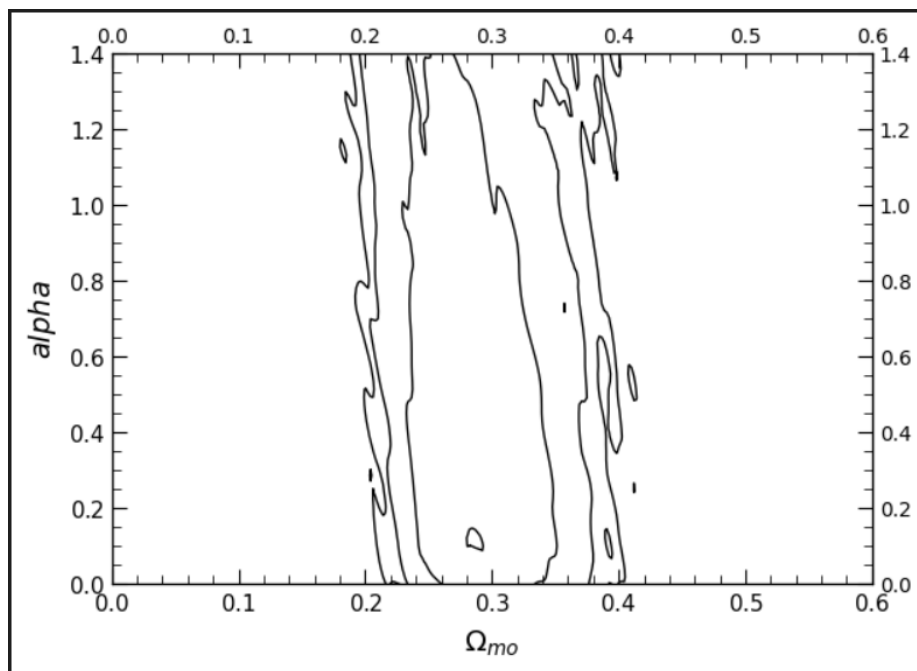


Figure 2: My Plot using MCMC

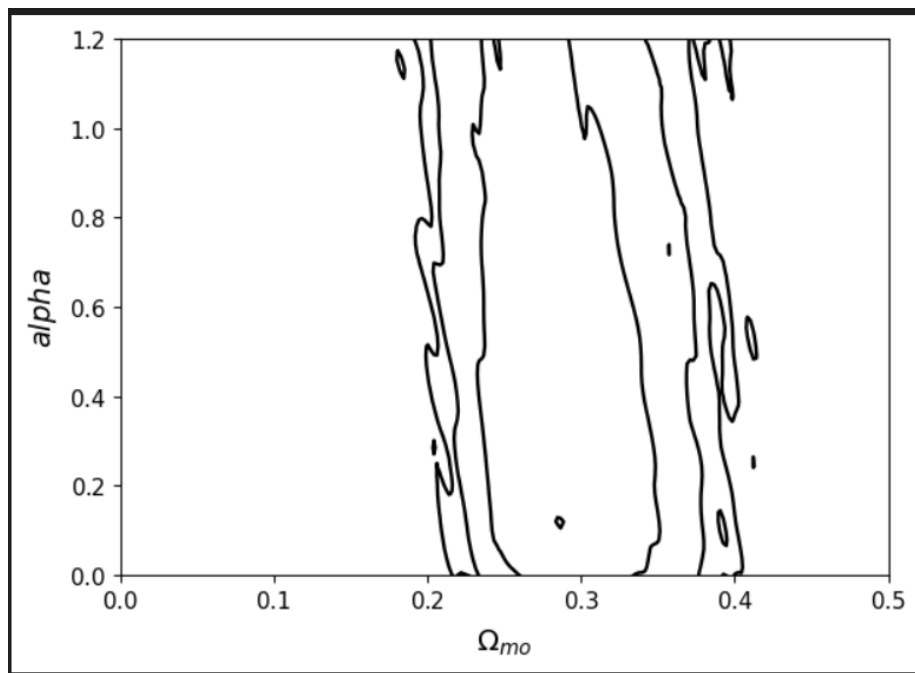


Figure 3: My Plot using MCMC