Define a posterior: $P(\theta|D)$

Define a proposal density distribution (should be a symmetric function):

$$P(\theta_{i+1}|\theta_i)$$

Choose a starting point: $P(\theta_0)$

Given θ_i draw a new θ_{i+1}

Compute acceptance ratio $\alpha = \dfrac{P(\theta_{i+1}|D)}{P(\theta_i|D)}$

if $\alpha \geq 1$ accept proposal and add θ_{i+1} to chain

if $\alpha < 1$ accept proposal with probability α

compare α to random number *r*

if $\alpha \geq r$ add θ_{i+1} to chain

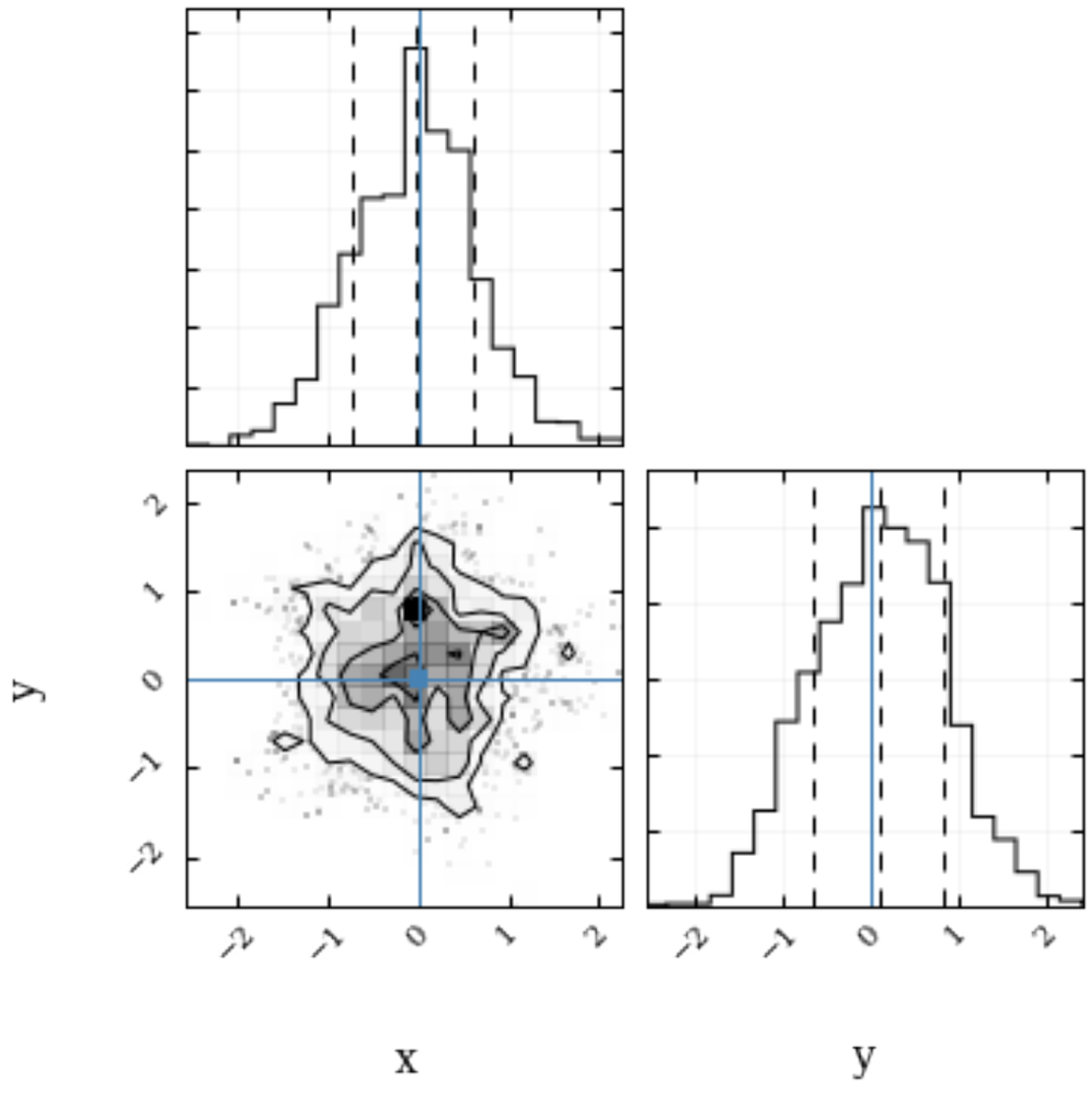
else add θ_i to chain

emcee: The MCMC Hammer

Daniel Foreman-Mackey[1,2], David W. Hogg[2,3], Dustin Lang[4,5], Jonathan Goodman[6]

ABSTRACT

We introduce a stable, well tested Python implementation of the affine-invariant ensemble sampler for Markov chain Monte Carlo (MCMC) proposed by Goodman & Weare (2010). The code is open source and has already been used in several published projects in the astrophysics literature. The algorithm behind emcee has several advantages over traditional MCMC sampling methods and it has excellent performance as measured by the autocorrelation time (or function calls per independent sample). One major advantage of the algorithm is that it requires hand-tuning of only 1 or 2 parameters compared to $\sim N^2$ for a traditional algorithm in an N-dimensional parameter space. In this document, we describe the algorithm and the details of our implementation. Exploiting the parallelism of the ensemble method, emcee permits *any* user to take advantage of multiple CPU cores without extra effort. The code is available online at http://dan.iel.fm/emcee under the MIT License.



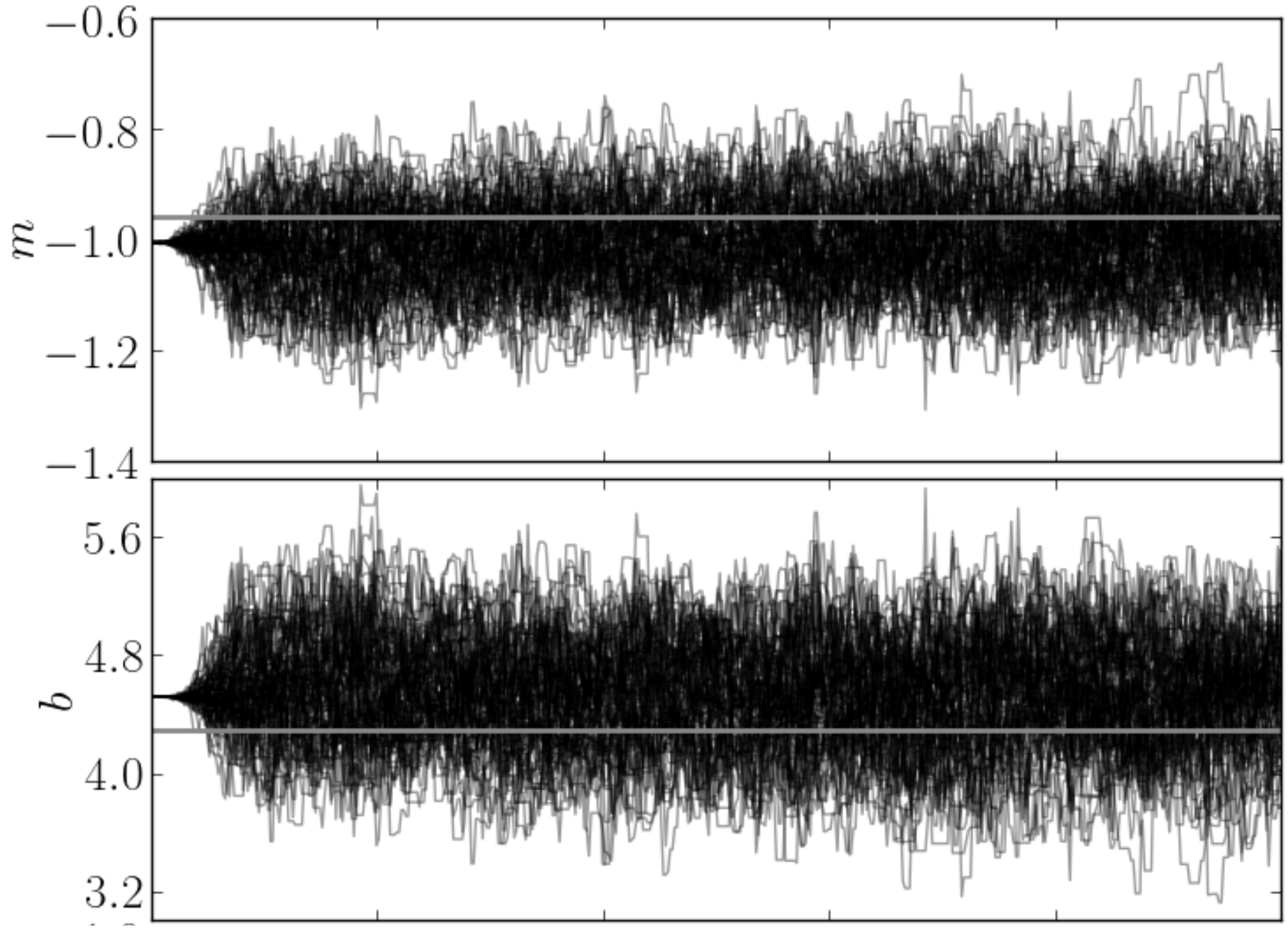
Joint distribution

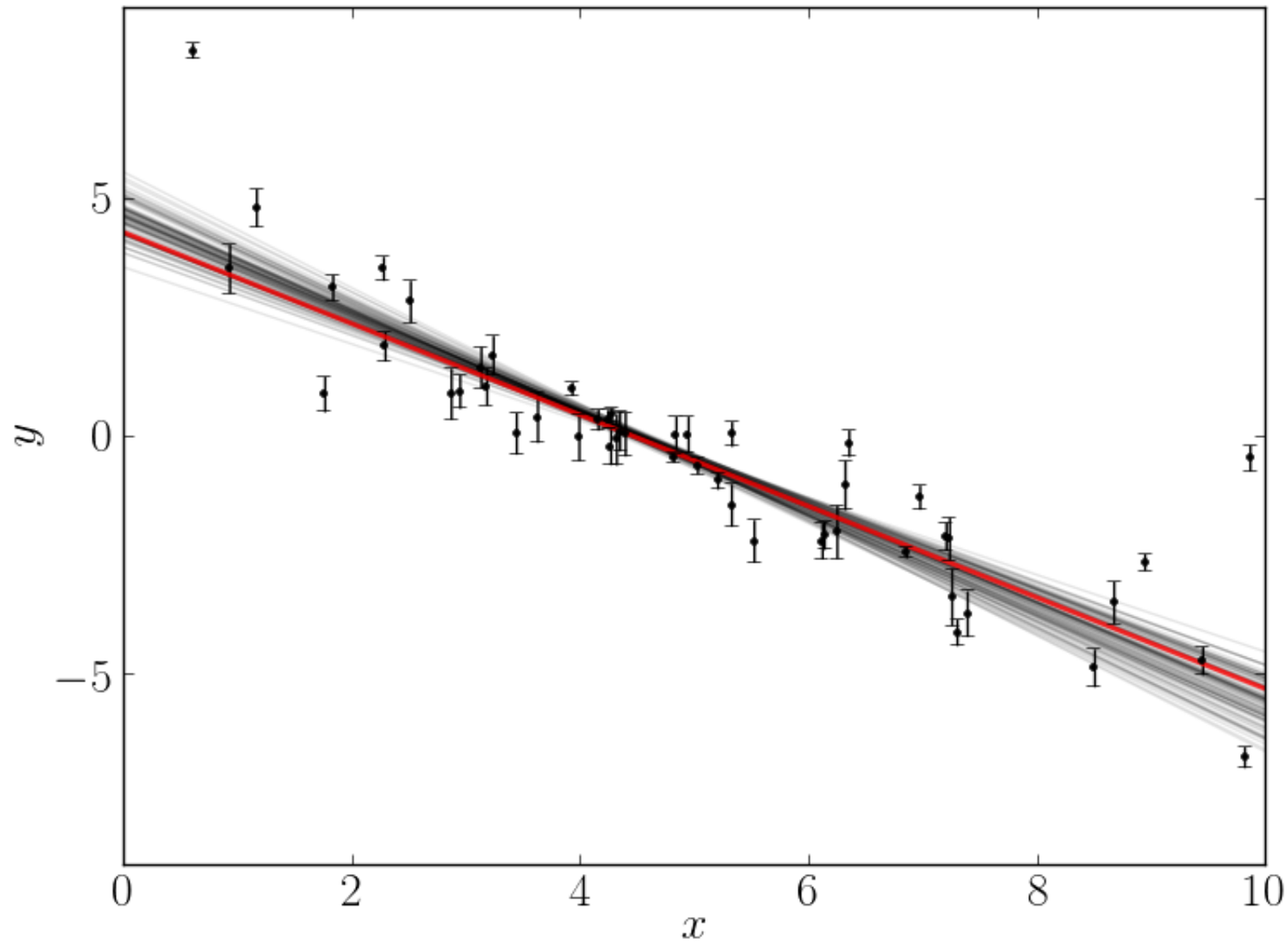
$$P(x, y)$$

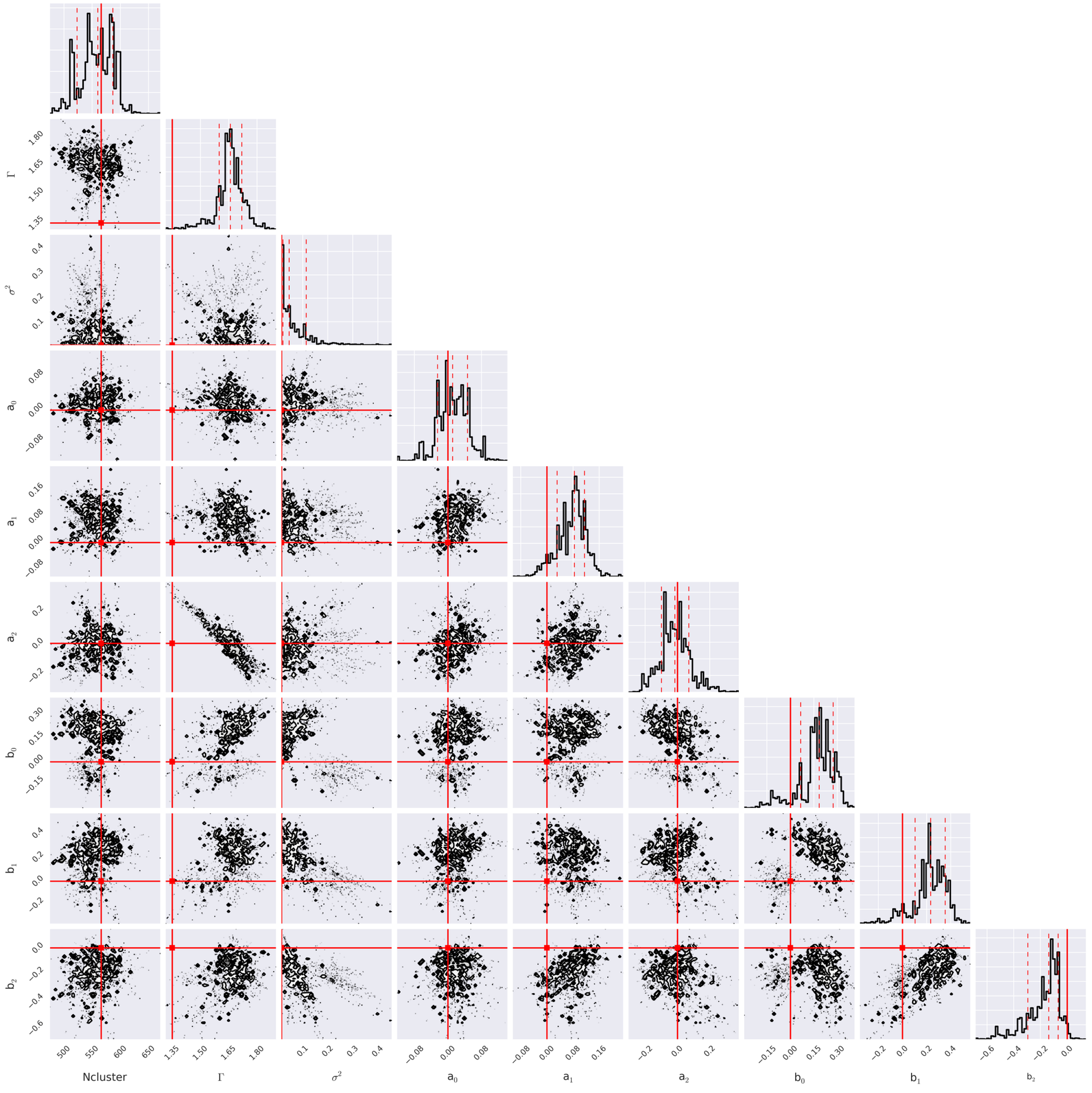
$$P(x, y|D)$$

Marginalized distribution

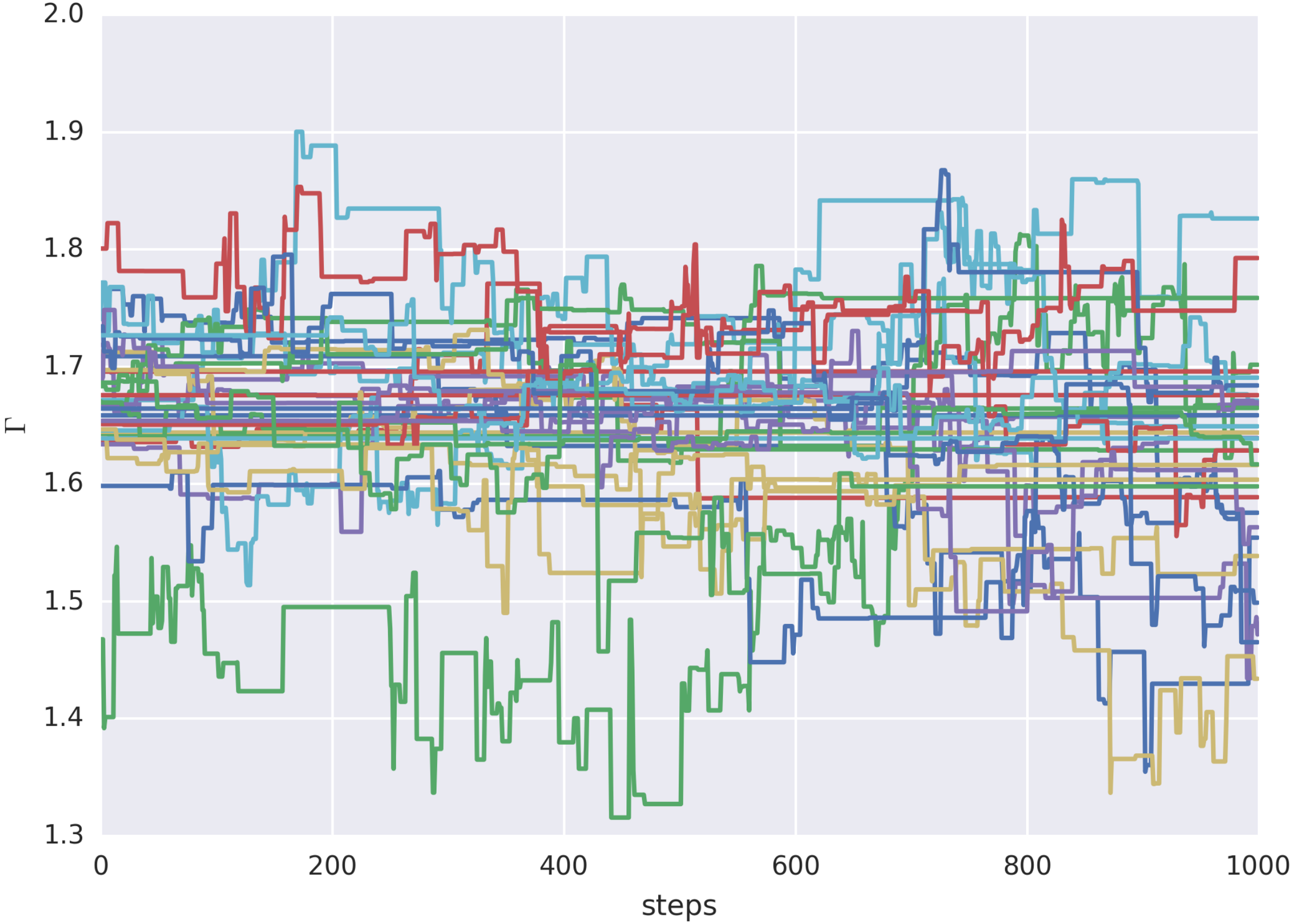
$$P(x) = \int P(x, y|D)dy$$


−0.6
−0.8
m
−1.0
−1.2
−1.4
5.6
4.8
b
4.0
3.2
step number


5
0
−5
y
0
2
4
6
8
10
x


Ncluster
Γ
σ^2
a_0
a_1
a_2
b_0
b_1
b_2
500
550
600
650
1.35
1.50
1.65
1.80
0.1
0.2
0.3
0.4
−0.08
0.00
0.08
0.16
−0.2
0.0
0.2
−0.15
0.00
0.15
0.30
−0.2
0.0
0.2
0.4
−0.6
−0.4
−0.2
0.0


3940
3935
3930
3925
3920
3915
3910
lnp
0
200
400
600
800
1000
steps


2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
Γ
0
200
400
600
800
1000
steps