

DIVISIÓN DE CIENCIAS E INGENIERÍAS CAMPUS LEÓN UNIVERSIDAD DE GUANAJUATO

MONTEPYTHON

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IV Taller de Métodos Numéricos y Estadísticos en Cosmología

ICF-UNAM, 30 de Julio de 2018

¿Dónde descargar MontePython?

http://baudren.github.io/montepython.html

https://github.com/baudren/montepython_public

Paquetería Python a usar:

- numpy
- scipy
- cython
- astropy
- pyfits
- pandas

Para instalarlos escriba en la terminal:

pip install cython

(si Python fue instalado a través de Anaconda o miniconda):

conda install cython

Datos de las observaciones

- BAO
- BICEP
- Cosmic Clocks
- JLA
- Planck
- WIGGLEZ

Para JLA los datos deben ser descargados manualmente desde

http://supernovae.in2p3.fr/sdss_snls_jla/jla_likelihood_v4.tgz

Para Planck los datos deben ser descargados manualmente desde

http://pla.esac.esa.int/pla/#home

Vinculación de CLASS con MontePython

Dentro de la carpeta montepython_public encontrarán un archivo llamado default.conf.template

Copiar ese archivo y llamarlo default.conf

¿Cómo correr MontePython?

ANTES: asegurarse de haber compilado CLASS

make clean make

Para correr MontePython se debe ejecutar el siguiente comando una vez ubicados en montepython_public:

montepython/MontePython.py run -p archivo_de_parámetros.param -o archivo_de_salida -N número_de_pasos

Al terminar la corrida, en el archivo de salida se encontrarán los siguientes archivos

- fecha_número_de_pasos_.paramnames
- fecha_número_de_pasos__número_de_cadenas.txt
- log.param

Análisis de las cadenas

Dentro de la carpeta montepython_public ejecutar lo siguiente en la línea de comando

montepython/MontePython.py info archivo de salida --want-covmat

Al terminar el análisis, en el archivo de salida se encontrarán los siguientes archivos

- archivo_de_salida.bestfit
- archivo_de_salida.covmat
- archivo_de_salida.h_info
- archivo_de_salida.v_info
- archivo_de_salida.tex
- archivo_de_salida.log

Carpeta plots con los siguientes archivos

- archivo_de_salida_1d.pdf
- archivo_de_salida_triangle.pdf

-want-covmat

posteriors

Ejemplo con JLA

Corriendo MontePython

MacBook-Air-de-Francisco montepython_public fran2015(montepython/MontePython.py run -b | | 1a | param -b | taller_duerna -\ 10000 Running Monte Fython | v2.2.2

with CTASS vs.5.0

Testing likelihoods for > JLA

Creating tslier_cuerna/9018-07-2/_10000__1.txt

```
Deduced starting covariance matrix
"Our ga_tribu"
               alpha , 'bela , M'.
                                       'Dolla_M'
   6.40a-05
               0.009 \pm 00
                           0.009 + 00
                                       0.00a - 00
                                                   0 00e-001
   0.00a+00
               1.00a-06
                           0.00a+00
                                       0.00a+00
                                                   0.00e-001
   0.00e+00
               0.00e+00
                           4.006-04
                                       0.00e-00
                                                   0 00e-00]
   0.006+00
               0.005+00
                           0.005+00
                                       1.606-05
                                                    0.006-001
   0.005(00)
               0.005100
                           0.005100
                                       0.005 00
                                                    1 60c Tell
```

```
-1.0qTkT
              Oraga odni
                               alibha.
                                                bate
              2.444470a-01
 372,511
                                  E00000e+01
                                                 3 559000e+00
 370,629
              2,444470e-01
                               1,51000008-01
                                                 3 545959e+00
270,699
              2,444470 01
                               1,5193745 01
                                                3 5645796100
              2,714589c 01
                                                 8 5649766 (00)
368,141
                               1.7198745 01
                                                 3 565198e+00
 $64,492
              2.714585e-01
                                1.508398a+01
 364,372
              2.714585a-01
                                1.4915156-01
                                                3 555555e+00
 364,208
              2,714585e-01
                               1,4076466-01
                                                3 541450e+00
263,809
              2,7145950 01
                               1,4943915 01
                                                3 5235996 (00
361,276
              2,7145896 01
                                                 8 4690336100
                               1,4691115 01
$64,888
              9.714585e-01
                                1.456482a+01
                                                 3 509748e±00
365,308
              2.71/585e-01
                               1.4577756-01
                                                3 525508e+00
 362,590
              2,714585e-01
                               1,4593696-01
                                                3 502038e+00
360,772
              3,1025846 01
                               1,4598695 01
                                                3 5020386100
260,008
              3,1025940 01
                               1,4796185 01
                                                 3 4798790:00
$60,099
              3.102584e-01
                                1.480154a-01
                                                3 481999e+00
360,324
              3.102584e-01
                               1.466529a+01
                                                3 P54769e+00
 353,174
              3.102584e-01
                               1,453497e-01
                                                3 429289e+00
 357,791
              3,1025846 01
                                                3 4183840:00
                               1,4503815 01
257,974
              3,102594c 01
                                1,4490805 01
                                                3 381 (190)00
 357, 379
              3.102584e-01
                               1.460852e-01
                                                 3 3918SSe+00
```

$$\mu = 5\log_{10}(d_L/10pc))$$

$$\mu = m_B^{\star} - (M_B - \alpha \times X_1 + \beta \times C)$$

https://arxiv.org/pdf/1401.4064.pdf

```
Dalta M
                                 Onega mi
-1.802000e-01
                                 9.9444704-0
               -1 000000e-01
-1,802502e-01
               -9 579727e-02
                                 2.8444706-01
 1,9027046 01
                1 0029556 01
                                 2.5444706 71
                1 0023356 01
 1,5027046 01
                                 3.214585c 01
-1.904020e-01
               -1 0/3950e-01
                                 S.914585e-0
-1.803780a-01
               -9.988716e-02
                                 3.214585a-0
-1,803665e-01
               -9 090000e-02
                                 3.214585e-01
 1,9035006 71
                9 004 686 02
                                 8,2145856 01
                8 9003916 02
 1,5034746 01
                                 3.214585c 01
-1.902966a-01
               -8 4 99450e-02
                                 S.914585e-0
-1.803108A-01
               -8 070105e-02
                                 3.211585A-0
-1.903470e-01
               -9 072834e-02
                                 3.214585e-01
1,9034706 01
                9 0728846 02
                                 3,6025846 01
 1,5037866 01
                8 0145210 02
                                 3.6025846 01
-1.908654e-01
               -8 388974e-02
                                 S.602584e-0
-1.302823A-01
               -8 596770e-02
                                 3.602584e+0
-1.903279e-01
               -8 022757e-02
                                 3.602584e+01
 1,9032066 01
                8 3976126 02
                                 3,6025846 01
 1,9025426 01
                                 8.6025846 01
                8 4385900 02
-1.902972e-01
               -8 435575e-02
                                 3.602584e+01
```

Corriendo MontePython

```
345.447
                2 150909c 01
                                 1.5679625 01
                                                  3 1916820 (00
                                                                   1,912754c 01
                                                                                   1 0582660 01
                                                                                                    2,6509095 71
   344,899
                                   553876a-01
                                                  8 147270e+00
                                                                   -1.915139e-01
                                                                                  -1 078537e-01
                                                                                                    9.650909a+01
                2 150909e-01
   045,422
                                 1.562837e-01
                2 150909e-01
                                                  3 146074e+00
                                                                  -1.912931e-01
                                                                                  -1 125541e-01
                                                                                                    2.650309e-01
2 347,834
                2 170909e-01
                                                  3 116200e+00
                                                                                  -1.101905e-01
                                 1:581960a-11
                                                                  -1.913229e-01
                                                                                                    2.650909a-01
  045,805
                2 150909e-01
                                 1.576913e-01
                                                  3 122300e+00
                                                                  -1.912976e-01
                                                                                  -1 137125e-01
                                                                                                    2.650909e-01
                2 150909c 01
                                                  3 0766990100
                                                                                   1 188257c 01
  345.526
                                 1.5674025 71
                                                                   1,912868c 01
                                                                                                    2,6509095 71
   045.720
                  150903e-01
                                   5605216-01
                                                  3 059763e+00
                                                                  -1.913038a-01
                                                                                  -1 159725e-01
                                                                                                    0.6503096-01
                2 357621c 01
                                                                                   1 189728c 01
   345,957
                                 1.5605215 71
                                                  3 0897696100
                                                                   1,9190886 01
                                                                                                    2,8676219 01
                2 367621e-01
                                 1.562451a-01
                                                  3 0711916+00
                                                                  -1.919766e-01
                                                                                  -1 150601e-01
                                                                                                    9.867821a-01
                2 057621e-01
  044,477
                                 1,5272446-01
                                                  3 042788e+00
                                                                  -1,912558e-01
                                                                                  -1 113225e-01
                                                                                                    2.3675216-01
   344.478
                2 367621e-01
                                 1.557888a-01
                                                  3 059918e+00
                                                                  -1.911825e-01
                                                                                  -1 056661e-01
                                                                                                    9.867921a-01
  044,315
                2 087621e-01
                                                                  -1.911562e-01
                                 1,554766e-01
                                                  3 072290e+00
                                                                                  -1 045174e-01
                                                                                                    2.367821e-01
   344,305
                2 433708c 01
                                 1,5547665 01
                                                  8 0722916 (00
                                                                   1,9115620 01
                                                                                   1 045174c 01
                                                                                                    2,9337065 01
                                 1.561809e-01
                                                  3 051562e+00
   044,402
                2 433705e-01
                                                                   -1.911368e-01
                                                                                  -1 007008e-01
                                                                                                    2,900706e-01
                2 49370%c 01
   345,379
                                 1.5919155 71
                                                  3 0525496 (00
                                                                                   9 489129c 02
                                                                   1.9110186 01
                                                                                                    2,9337065 71
   345,715
                2 ×38705e-01
                                 1.603902a-01
                                                                                                    9.933706a-01
                                                  3 075985e+00
                                                                  -1.911350e-01
                                                                                  -8 551415e-02
  345.989
                2 483708c 01
                                 1.6000475 01
                                                  3 0404136 (00)
                                                                   1,9178850 01
                                                                                   8 575437c 02
                                                                                                    2,9337065 71
  346,167
                2 789568e-01
                                 1.600047a-01
                                                  3 040413e+00
                                                                  -1.910885e-01
                                                                                  -8 775437e-02
                                                                                                    S. 239368a-01
   045.518
                2 739568e-01
                                 1.584496e-01
                                                  3 053949e+00
                                                                   -1.911359e-01
                                                                                  -3 452409e-02
                                                                                                    3.209563e-01
   349,168
                2 739568e-01
                                 1.575998a-01
                                                  3 034098e+00
                                                                  -1.911340e-01
                                                                                  -8 244241e-02
                                                                                                    3.239768e-01
   044.728
                2 503442e-01
                                                                                  -3 244240e-02
                                 1.575393e-01
                                                  3 054098e+00
                                                                  -1.911340e-01
                                                                                                    3.000442e-01
   344,363
                2 573442c 01
                                 1.5659875 71
                                                  3 0750216 (00
                                                                   1,911309c 01
                                                                                   7 895972c 02
                                                                                                    2:0034425 71
   044.65
                                                  3 081464e+00
                2 503449e-01
                                   5761576-01
                                                                  -1.911305a-01
                                                                                  -7 504294e-02
                                                                                                    3.0004426-01
  344.473
                2 573442c 01
                                 1.5702846 71
                                                  3 0771970100
                                                                   1,9115416 01
                                                                                   7 824701c 02
                                                                                                    9,0034425 71
   345.764
                                 1.570984a-01
                                                                                                    3.897088a-01
                2 897088e-01
                                                  3 077197e+00
                                                                  -1.9115416-01
                                                                                  -7 594701e-02
   044,313
                2 837088e-01
                                 1,5402306-01
                                                  3 076298e+00
                                                                  -1,911595e-01
                                                                                  -8 296575e-02
                                                                                                    3.3970336-01
                                 1.525348a-01
                                                  3 094470e+00
                                                                  -1.911278e-01
                2 897088e-01
                                                                                  -7 791453e-02
                                                                                                    5.397088a-01
   044,502
                2 897088e-01
                                 1.541523e-01
                                                  3 094421e+00
                                                                  -1.910915e-01
                                                                                  -7 513273e-02
                                                                                                    3.397033e-01
   344.672
                                 1.5384285 01
                                                  3 0269310(00
                                                                   1,9116076 01
                                                                                   6 0052170 02
                2 8570890 01
                                                                                                    3.3971885 01
   044,248
                2 705304e-01
                                 1.508428e-01
                                                  3 026901e+00
                                                                                  -6 995217e-02
                                                                  -1.910607e-01
                                                                                                    3.205304e-01
   344,219
                2 705304c 01
                                 1,5318025 71
                                                  3 0091640 (00
                                                                   1,9178500 01
                                                                                   6 87770 to 02
                                                                                                    8,2058046 71
   344, 944
                                                  2 987878e+00
                2 705304e-01
                                 1.535160a+01
                                                                  -1.911102e-01
                                                                                  -5 988319e-02
                                                                                                    S.205S04a-01
   344.472
                                                                                   5 9957526 02
                2 775304c 01
                                 1.5316405 71
                                                  3 0053946 (00)
                                                                   1,9114290 01
                                                                                                    8,2058046 71
```

¹⁰⁰⁰⁰ steps done, acceptance rate: 0.7986

^{7!}V The acceptance rate is above 0.6. which means you might have difficulties exploring the entire parameter space. Try analysing these chains, and use the emput covariance matrix to decrease the deceptance rate to a value between 0.2 and 0.4 (roughly).

Análisis de las cadenas

Running Monte Python v2.2.2

```
--> Scanning file taller_ouerna/2018-07-24_10000__1.txt Removed C non-markovian points, 99 points of burn-in, keep 7887 steps
```

- /! Convergence computed for a single file
- --> Computing mean values

$$s_j^2 = \frac{1}{n-1} \sum_{i=1}^n (\theta_{ij} - \bar{\theta}_j)^2$$

$$R - 1 < 0.01$$
 $W = \frac{1}{m} \sum_{j=1}^{m} s_j^2$

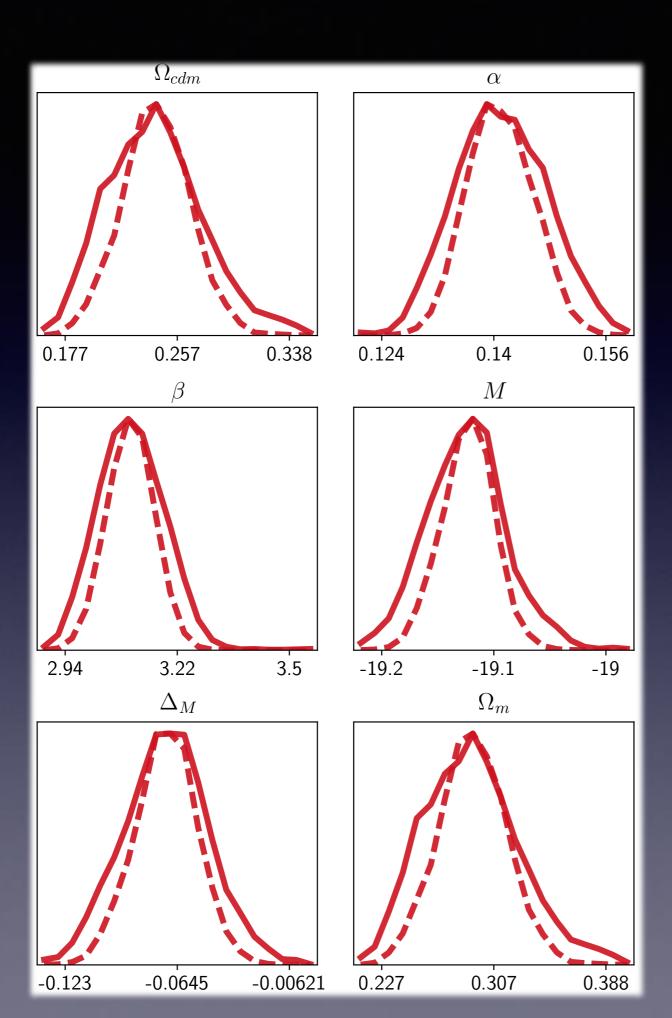
$$\hat{Var}(\theta) = \left(1 - \frac{1}{n}\right)W + \frac{1}{n}B$$

- > Computing histograms for Omoga cdm
- 7!\ The iD posterior could not be processed normally, probablyous to incomplete or obsolete numpy and/or scipy versions. So the raw histograms will be plotted.
- -> Computing histograms for alpha
- -> Computing histograms for beta
- -> Computing histograms for M
- -> Computing histograms for Delta_M
- -> Computing histograms for Omega_m
- _____
- --> Saving figures to .pdf files
- +-> Writing linfo and liex files

MacBook-Air-de-Francisco montepython_public fran20158 od taller_oterna/

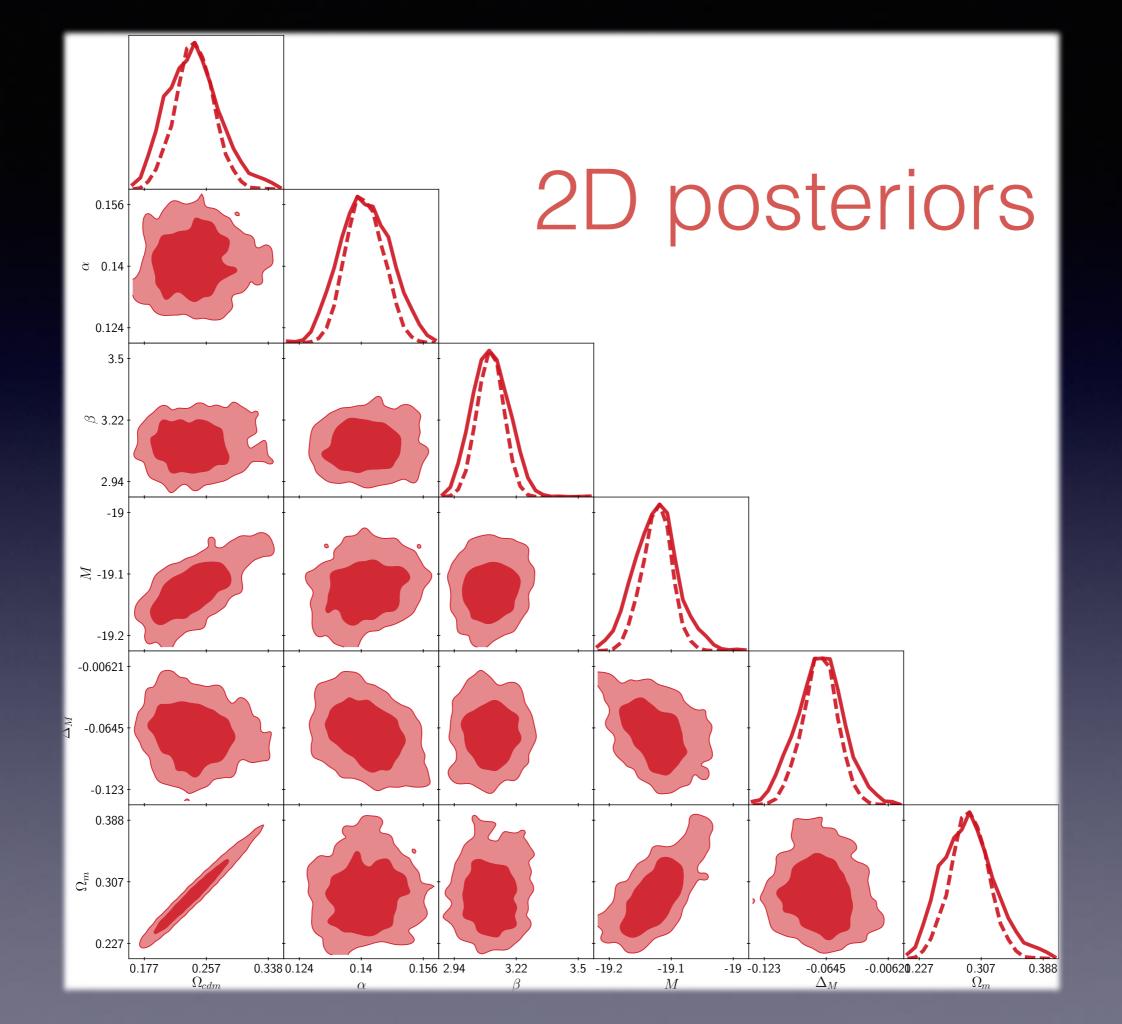
 $ar{ar{ heta}} - rac{1}{m} \sum_{j=1}^{m} ar{ heta}_j$ $B = rac{n}{m-1} \sum_{j=1}^{m} (ar{ heta}_j - ar{ar{ heta}})^2$ $\hat{P} = \sqrt{Va\hat{r}(heta)}$

A. Gelman and D. B. Rubin, Inference from Iterative Simulation Using Multiple Sequence, 1992



1D posteriors (línea sólida)

Media (línea segmentada)



Podemos correr nuevamente Monte Python con la matriz de covarianza y los bestfit de la corrida anterior:

```
montepython/MontePython.py run -p archivo_de_parámetros.param -o
nuevo_archivo_de_salida -c archivo_de_salida/archivo_de_salida.covmat
-b archivo_de_salida/archivo_de_salida.bestfit -N número_de_pasos
```

```
MacBook-Air-de-Francisco:montepython_public fran2015$ montepython/MonteFython py run -p jla.param -c taller_cuerna_covmat_bf -c tal
Her_duernazua Ter_duerna.covmat -b taller_duernaztal er_duerna.cesufit -N 10000
Running Monto Python 92.2.2
with Class v2.5 0
Testing likelihoods for:
 > JLA
Creating taller_cuerna_covmat_bi/2013-07-24_10000__1.txt
Input covariance matrix:
               'alpha', 'beta', 'M', 'Delta M', 'Omega m']
 'Cmogaladm',
[[ 1 15e-00
               1 19e-05
                                       6 06e-04 -1 10e-04
                           1 06e-04
                                                              1 16e-03]
   1.196 \pm 0.5
               4.15e - 05
                           1.50e - 05
                                      3 90e-05 -4 60e-05
                                                              1 196-051
    1 866 04
               1 506 05
                           6 566 03
                                       3 796 04
                                                  6 000 05
                                                              1 866 041
    6 05e-04
               3 90e-05
                           3 79e-04
                                       6 54e-04 -2 40e-04
                                                              6 06e-041
  -1.109 - 02
              -4 60e-05
                          -6 \cdot 100 \Theta - 0.5
                                     -2.709-07
                                                  4 83e-07
                                                             -1.109 - 041
   I 15e-00
               1 19a-05
                           1 06e-04
                                       6 06e-04 -1 10e-04
                                                              1 16e-00]]
First unculment (sau ing)
               'alpha', 'beta', 'M ,
['Cmega_cdm',
                                      'Delta_M , 'Omega_m ]
                                       6 06e-04 -1 10e-04
   1 159-03
               1 196-05
                           1 869-00
                                                              1 109-03]
    1/196/05
               4 150 05
                           1.50c - 05
                                       3 906 05
                                                  4 600 05
                                                              1 196 05]
    1 35e-04
               1 50e-05
                           6 56e-00
                                       3 79e-04
                                                -6 00e-05
                                                              1 86e-04]
   6 059-04
               3 90e-05
                           3 796-04
                                       6 54e-04 -2 40e-04
                                                              6 06e-041
   1 100 04
               4 600 05
                           6 000 05
                                       2 400 04
                                                  4 830 04
                                                              1 100 04]
   1 15e-00
               1 19e-05
                           1 06e-04
                                       6 06e-04 -1 10e-04
                                                              1 16e-03||
Second treatment (partial roomdering and eleaning)
['Cmeqa_cdm', 'alpha'. 'beta', 'M , 'Delta_M , '']
  1 159-03
               1.196 - 05
                           1 86e-04
                                       6 U69-C4 -1 109-C4
                                                              C = \{0.06 + 0.00\}
    1 - 196 - 05
               4 166 05
                           1 506 05
                                       3 906 05
                                                  4 600 05
                                                              0.006,001
```

3 79e-04 -6 00e-05

6 54e-04 -2 40e-04

4 83e-04

C 00e-00

-2 40e-04

C 00e-00

C 00e-00]

 $C = \{0.06 + 0.00\}$

0 00e-001

C 00e-0011

Deduced starting covariance matrix:

1 50e-05

3 90e-05

0 00e-00

6 56e-03

3 79e-04

C 00e-00

-4 60a-05 -6 00a-05

1 85e-04

6 059-04

-1 10e-04

C 00e-00

4	LogI k [*]	Omogra icidni	alpha	birta	Y	Dorla, M	On organim
0	341.497	2.494796e-01	1 413309e-01	3 111889e+00	-1 912166e+01	-7.625743e-02	2.994795e-01
3	342,625	2.494796e-01	1 4070510-01	3 033931e+00	-1 913339e+01	-8.149206a-02	2.994795a-01
5	342,851	2,4947966-01	1 4739286 01	2 9975516(00	1 9124526 (01	6.2486840 02	2.994796:: 01
0	342,889	2.494796e-01	1 335445e-01	3 130004e+00	-1 913112e+01	-4.170455e-02	2.994795e-01
2	342,394	2.494796e-01	1 312594e-01	3 151776e+00	-1 912567e+01	-7.277031a-02	2.994795a-01
15	342,149	2,4947966 01	1 3776266 01	3 1176546(00	1 9119606(01	9.0161195 02	2.9947960 01
2	340,816	2.494796e-01	1 355490e-01	3 111129e+00	-1 912188e+01	-1.066655e-01	2.994795e-01
1	343.548	2.4947966-01	1 335138e+01	3 1775296+00	-1 914705e+01	-6.547004e-02	2.9947958-01
2	343,198	2,4947966 01	1 4006916 01	3 1715176(00	1 9128126(01	9.8233860 02	2.9947960 01
93	342,04	2.494796e-01	1 353902e-01	3 123336e+00	-1 911847e+01	-7.8040766-02	2.994795a-01
1	343.385	2.4947966-01	1 3571799-01	3 1882636+00	-1 9124526+01	-9.5801589-02	2.9947958-01
2	940.534	2.571709e-01	1 358960e-01	3 185092e+00	-1 911529e+01	-9.697192e-02	3.171709e-01
1	343,899	2.571709e-01	1 443733e-01	3 235560e+00	-1 909593e+01	-9.775752 ± -02	3.171709e-01
1	245.088	21.8717096-01	1 4136850 01	3 2275546100	1. 20 7 72 06 (01)	9.075178:: 02	3.171709:: 01
1	346,159	2.571709e-01	1 477775e-01	3 144406e+00	-1 907959e+01	-1.367593e-01	3.171709e-01
8	345, 372	2.330852e-01	1 4744910-01	3 139275e+00	-1 909532e+01	-1.337299a-01	2.850852a-01
1	344.27	2,3508526 01	1 3732526 01	3 1676016100	1 9127596 (01	1.109848:: 01	2.850852:: 01
2	044,350	2.350852e-01	1 375870e-01	3 235587e+00	-1 911944e+01	-1.055651e-01	2.850052e-01
2	344,549	2.350852e-01	1 4301980-01	3 267837e+00	-1 911816e+01	-1.060758e-01	2.850852e-01
2	343.595	2.8508526 01	1 4408360 01	3 2267086 (00	1 9107000 01	9.9773325 02	2.8508525 01
0	344,771	1.816405e-01	1 435360e-01	3 218162e+00	-1 913485e+01	-9.472750e-02	2.316435e-01
2	345.008	1.816485e-01	1 878787e+01	3 187492e±00	-1 914272e+01	-9.798149a-02	2.816435A-01
8	344.586	2,8670446 01	1 3930356 01	3 2042926 (00	1 9087956(01	1.0790090 01	3.3670440 01
4	346,208	2.887044e-01	1 339033e-01	3 051712e+00	-1 913750e+01	-8.817559e-02	3.367044e-01
\otimes	342.993	2.8590446-01	1 3774079-01	3 1729716+00	-1 9108756+01	-8.1851189-02	3.3670448-01
2	344,113	3,1161376 01	1 3799536 01	3 1769546(00	1 9095766(01	8.4203000 02	3.6161370 01
4	344,046	3.116137e-01	1 398636e-01	3 091526e+00	-1 908787e+01	-3.303133a-02	3.516137e-01
1	345.103	3.116187e-01	1 382089e-01	3 1653246+00	-1 9092886+01	-8.946340e-02	3.5161378-01
5	345.478	0.116107e-01	1 358780e-01	3 158137e+00	-1 911584e+01	-2.781455e-02	3.516137e-01
4	344,292	3.116137e-01	1 347003e-01	3 134808e+00	-1 907935e+01	-7.699579a-02	3.516137e-01
2	344.786	3.1161376 01	1 4873846 01	3 1485026100	1 9080626101	1.091810:: 01	3.616137:: 01
6	040.754	0.116107e-01	1 441575e-01	3 1075526+00	-1 908086+01	-8.907254e-02	3.516137e-01

0 345,054	2.723615e-01	1 515929e-01	3 148020e+00	-1 913006e+01 -4.057457e-0	
1 345,398	2.723615⊖-01	1 501058e-01	3 2489476+00	-1 912558e+01 -5.232450e+0	
6 348,935	2,7236156 01	1 4956066 01	3 3354656100	1 9127756(01 9.9791546 0	
5 348,16	2.206546e-01	1 490314e-01	3 327196e+00	-1 913471e+31 -8.890951a-0	
6 349,854	1.5724996-01	1 484850e+01	3 3185570+00	-1 918855e+01 -8.386787e+0	2 2.1787998-01
2 347,013	1.572499e-01	1 507417e-01	3 222930e+30	-1 9135276+01 -1.084855e+0	1 2.172499e-01
3 348,001	1.572499e-01	1 424271e-01	3 300695e+00	-1 913283e+01 -1.054363a-0	
2 348,313	1.6724996 01	1 4423116 01	3 3113276+00	1 9141776+01 1.108668:: 0	1 2.1724990 01
4 048,725	1.572499a-01	1 353566e-01	3 211873e+30	-1 918280e+01 -9.505694e+0	2 2.172499e-01
5 346,868	1.5724996-01	1 4037146-01	3 170007e+00	-1 917391e+01 -9.430419e-0	2 2,1724998-01
2 346,507	1.6724996 01	1 3977686 01	3 0293576100	1 918950G+01 6.890209::0	2 2.1724990 01
1 346,851	1.872499e-01	1 427299e-01	2 990996e+00	-1 915090e+01 -9.575090e+0	2 2,172499e-01
2 346,22	1.744517e-01	1 4230366-01	2 992147e+00	-1 915514e+01 -9.648089a-0	2 2,244517a-01
2 344,996	1.7445176 01	1 4109626 01	3 0164946(00	1 9158196(01 7.7042856 0	2 2.2445170 01
11 344.855	1.744517e-01	1 372829e-01	3 054891e+00	-1 915720e+01 -7.807134e-0	2 2.244517e-01
2 342.074	2.599399e-01	1 381577e-01	3 0685610+00	-1 91126/e+01 -8.644275e+0	2 3.0998998+01
2 342,397	2,5993996 01	1 3790066 01	2 1620006/00	1 9103126(01 8.2981706 0	2 3.0998990 01
2 343,072	2.399399e-C1	1 332288e-01	3 222235e+00	-1 912091e+01 -3,992539a-0	2 3.0993996-01
5 342, 552	2.599399e-01	1 389707e-01	3 1955336+00	-1 910417e+01 -8.478425e-0	2 3.0998998+01
5 340,351	2.599399 a -01	1 304992e-01	3 1307106+00	-1 911592e+01 -4.646354e+0	2 3.099999e-01
1 342,402	2.399399e-01	1 358783e-01	3 130369e+00	-1 910691e+01 -5.938422s-0	2 3.0993996-01
1 342, 859	2.5993996 01	1 3901586 01	2 1953296100	1 9113866 (01 5 5,59059 cc 0	2 3.099899: 01
1 342,233	2.599399 a -01	1 444267e-01	3 123375e+00	-1 910215e+01 -7.290489e+0	2 3.099999e-01
2 341,835	2.3993990-01	1 4170110-01	3 103657e+00	-1 910388e+01 -7.369584e+0	2 8.0993996-01
6 345,909	2,5993996 01	1 2595986 01	3 1030656100	1 9112296+01 9.8220855 0	2 3.099899:: 01
4 045,359	2.599399 e -01	1 334204e-01	3 113500e+00	-1 909381e+01 -1,184153e+0	1 3.099099e-01
2 344,524	2.599399e-01	1 4701050-01	3 088450e+00	-1 908825e+01 -1,199159s-0	1 3.099899e-01
5 343,31	2.5993996 01	1 4151016 01	3 1019786 (00	1 9090618/01 1.0614099 0	
6 340,099	2.599399 0 -01	1 408222e-01	3 122540e+00	-1 910410e+01 -1.092481e-0	1 3.099099e-01
8 343,854	N.599399e-01	1 4809696-01	8 055513e+00	-1 911599e+01 -1.138487e+0	
6 942,541	2,5993996 01	1 3834986 01	9 0485916(00	1 9139116 01 7.0572166 0	2 3.0993990 01
2 345,259	2.599399 0 -01	1 290070e-01	3 041445e+00	-1 914150e+01 -7.970001e-0	2 3.099099e-01
2 345,406	2.4270759-01	1 288609e-01	3 038590⊖+00	-1 915048e+01 -7.816180e-0	2 2.9270758-01
2 345,21	2,4270756 01	1 2621006 01	3 0046246100	1 9127576(01 5.9915536 0	2 2.9270750 01
2 345,481	2.427075e-01	1 317940e-01	3 223129e+00	-1 909304e+01 -8.317750s-0	2 2.927075e-01
2 344,538	2.4270759-01	1 342198e-01	3 2559910+00	910979e+01 -5.487955e=0	2 2.9270758-01
2 343,487	2.427075e-01	1 419755e-01	3 123236		7075e-01
				ontro 0.2×0.4	

4 | 10000 : Lopis dono, accoptanco rato | 0.3251 | MacDook-Air-de-Francisco:montepython_public_fran2015\$ |

entre 0.2 y 0.4

Luego podemos analizar las cadenas y pedir que no se grafique la media:

montepython/MontePython.py info archivo_de_salida --want-covmat --no-mean

```
MacBook-Air-de-Francisco:montegython_public fran2015$ montegython/MontePython py info taller_cuerna_cowmat_bi/ --want-cowmat --no-moun
Running Monte Python v2.2.2

> Scanning f lo tuller cuerna covmut bf/2018 07 24 10000 if ust a Removed C non-markovian points, C points of burn in, keep 3252 steps
/ N Convergence computed for a single file
> Computing mean values
--> Computing variance
--> Computing convergence oritherium (Selman-Rubin)
> R 1 to 0.000383 | for Computed a light |
0.000350 | for alpha |
0.000365 | for beta |
0.000365 | for beta |
```

--> Computing covariance matrix

⇒ Commuting histograms for Chaga adm.

for Delta_M

for Original

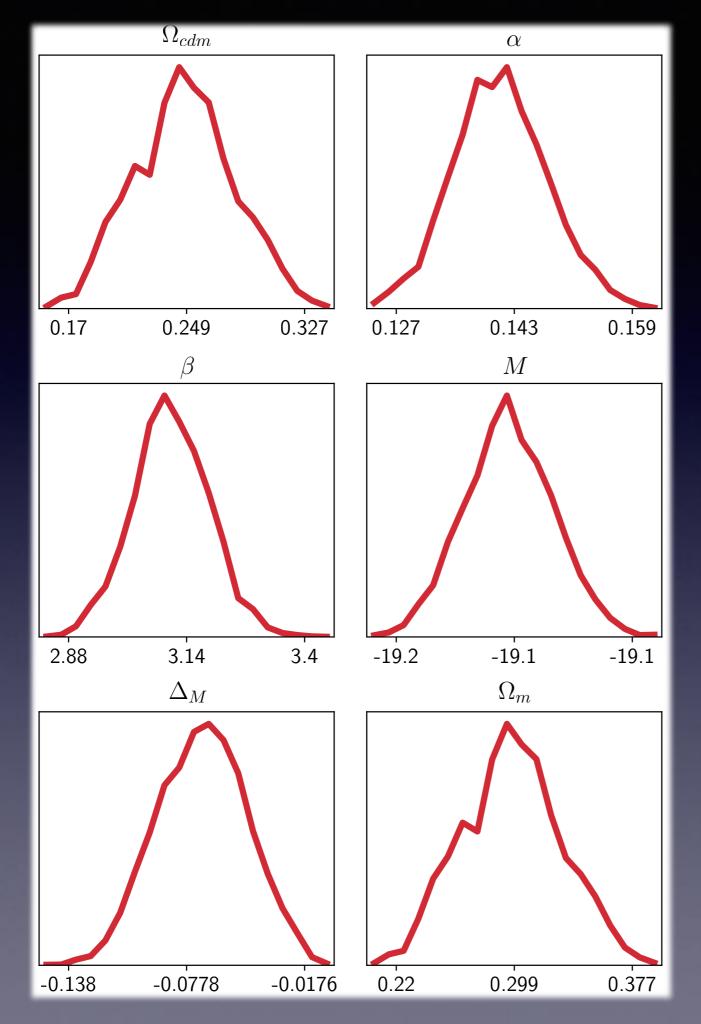
MacDook-Air-de-Francisco:montepython_public fran2015%

0.000748

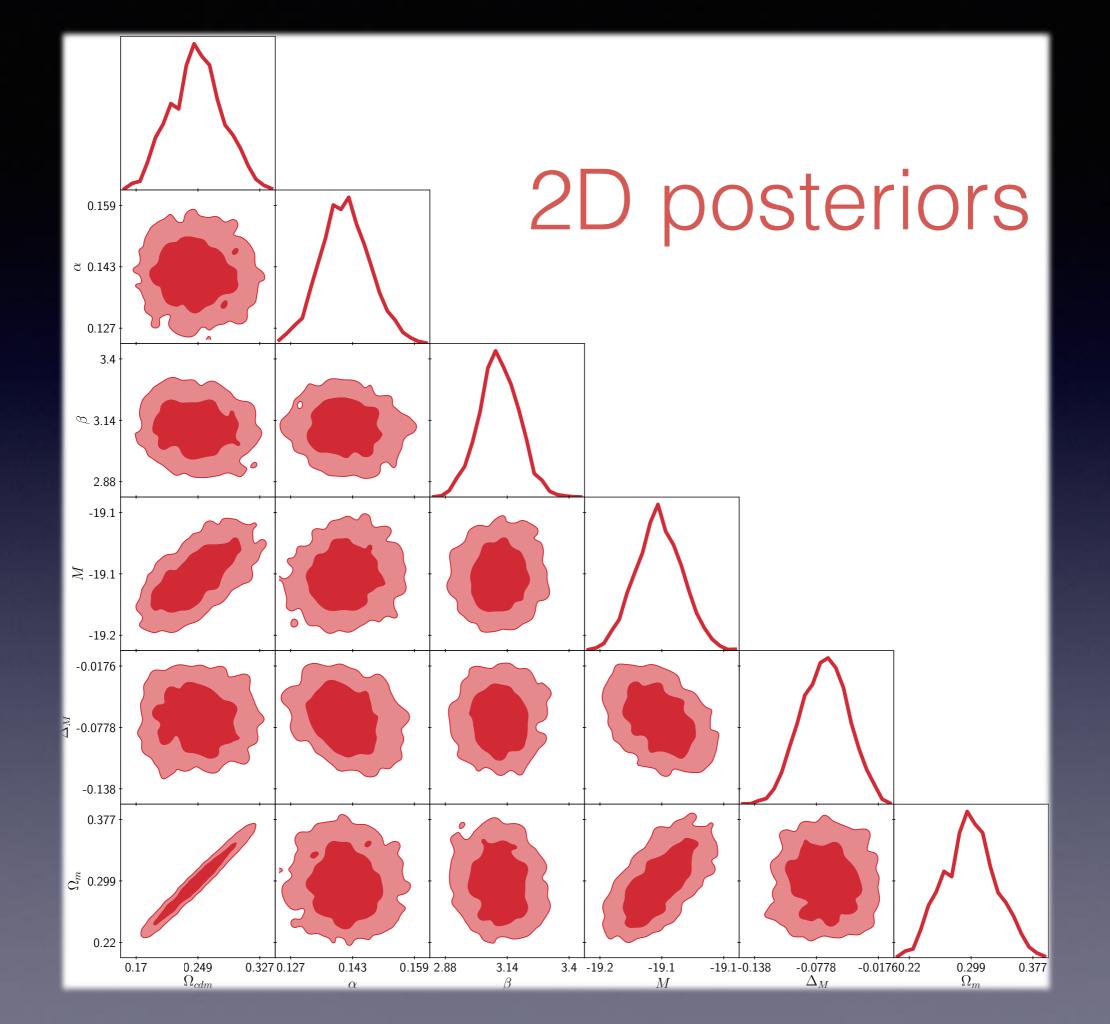
0.000333

--> Writing limbo and liex lifes

```
/ \ The ID posterior could not be processed normally, probablydue to incomplete
or obsolete numpy and/or scipy versions So the raw histograms will be
    plotted.
-> Computing histograms for alpha
-> Computing histograms for beta
> Computing histograms for M
-> Computing histograms for Delta_M
-> Computing histograms for Onega_)
--> Saving figures to .pdf files
```



1D posteriors



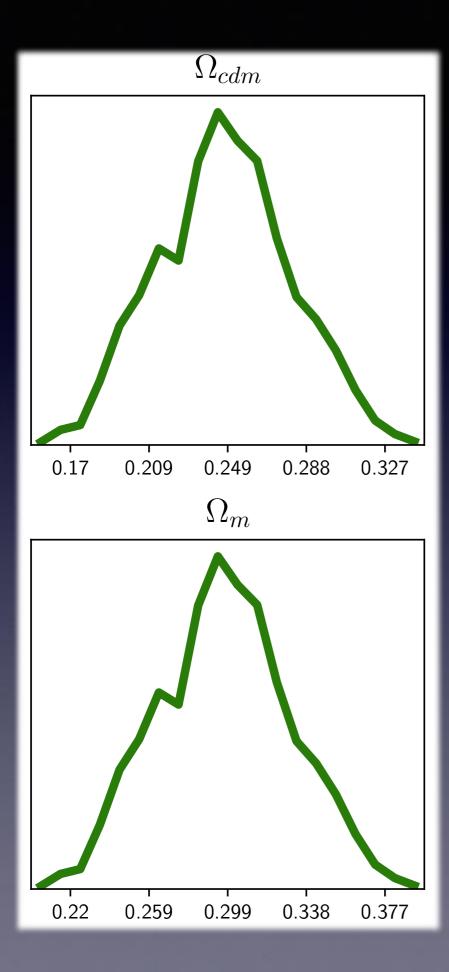
Si queremos mostrar solo los posteriors de los parámetros que nos interesen, ir a la carpeta

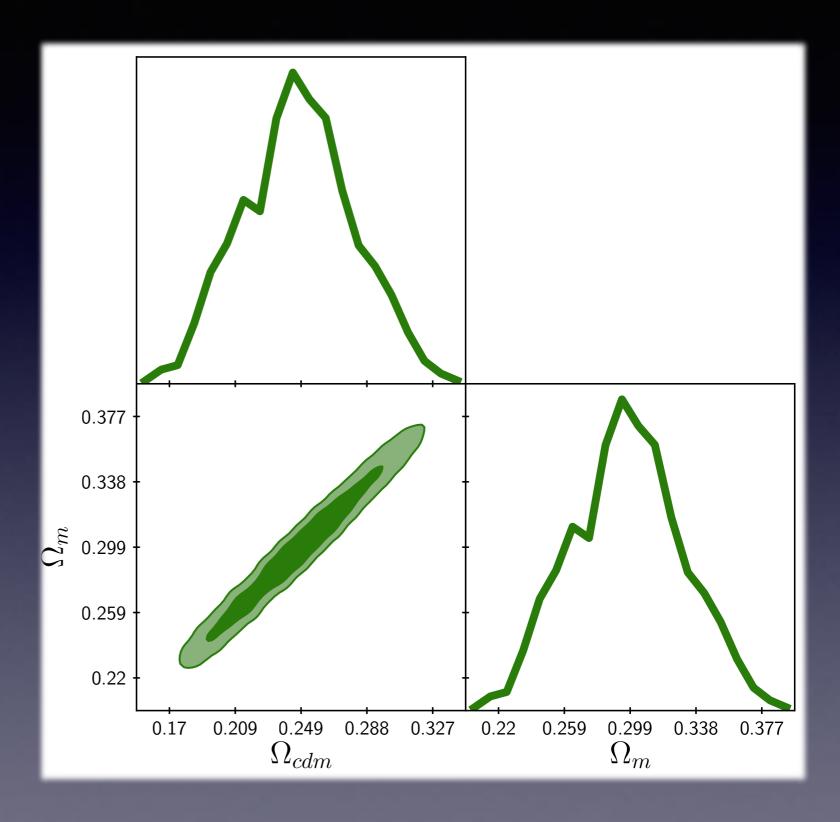
montepython public/plot files

copiar el archivo example.plot renombrarlo: new_example.plot

Una vez modificado el archivo new_example.plot, ejecutar el comando info añadiendo lo siguiente:

montepython/MontePython.py info archivo_de_salida --want-covmat --no-mean
--extra plot_files/new_example.plot

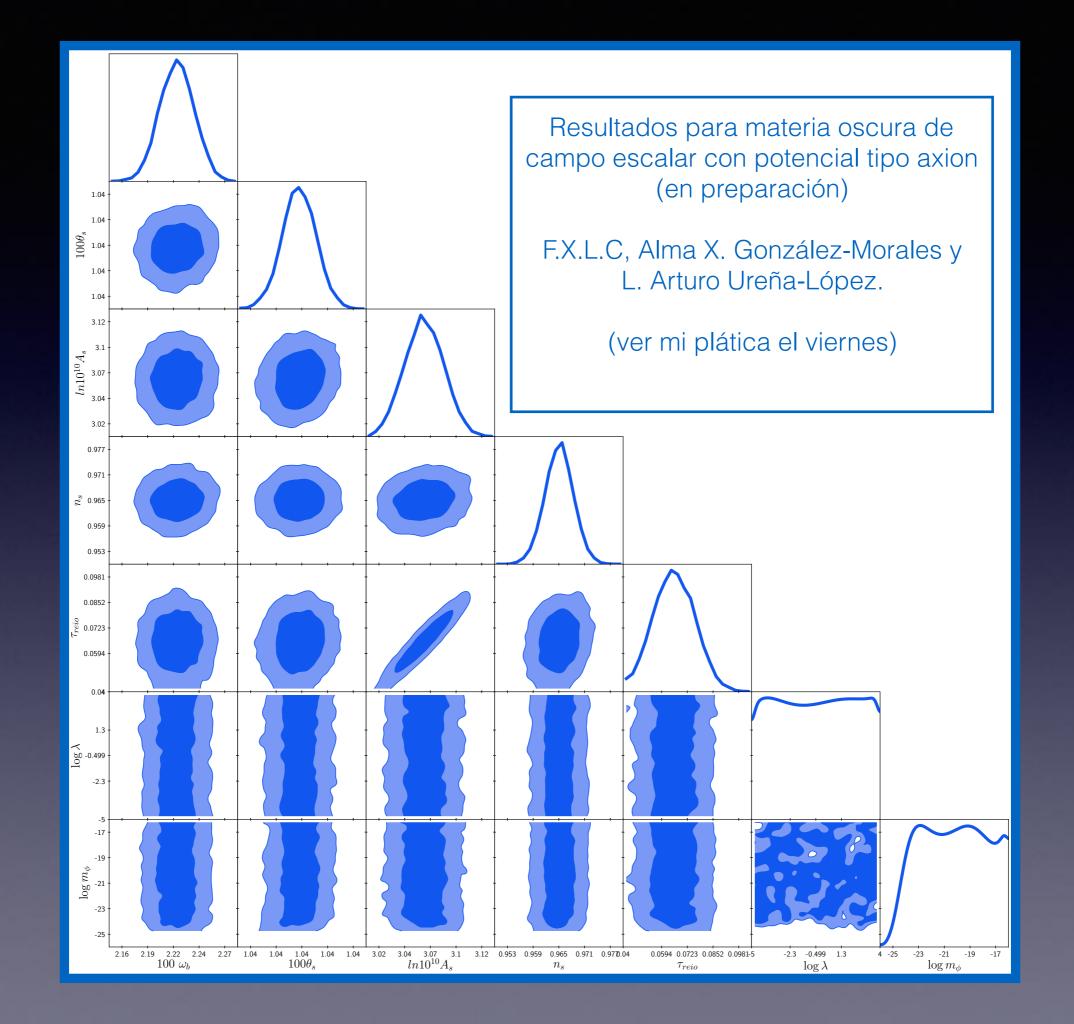




Añadiendo nuevos parámetros (Ejemplo con Planck)

· Añadir los parámetros de interés en el archivo .param correspondiente.

• De ser necesario, modificar el archivo data.py



Más opciones

How to find the help

```
python montepython/MontePython.py -h, and
python montepython/MontePython.py run -h,
python montepython/MontePython.py info -h.
```

For Metropolis Hastings

- N: number of steps asked.
- -c: covariance matrix (.covmat file)
- -b: best-fit file (.bestfit file)
- -j jumping method (fast for Cholesky)
- -f jumping factor (default 2.4)

Changing methods

-m sampling method (MH, NS, CH, IS)

Benjamin Audren, Advanced usage of Monte Python, 2014

MontePython 3: boosted MCMC sampler and other features

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Abstract

MontePython is a parameter inference package for cosmology. We present the latest development of the code over the past couple of years. We explain, in particular, two new ingredients both contributing to improve the performance of Metropolis-Hastings sampling: an adaptation algorithm for the jumping factor, and a calculation of the inverse Fisher matrix, which can be used as a proposal density. We present several examples to show that these features speed up convergence and can save many hundreds of CPU-hours in the case of difficult runs, with a poor prior knowledge of the covariance matrix. We also summarise all the functionalities of MontePython in the current release, including new likelihoods and plotting options.

Keywords: Cosmology: -parameter inference, -numerical tools

https://arxiv.org/abs/1804.07261