Machine Learning techniques applied to cosmological problems.

Martín de los Rios

Director: Dr. Mariano Domínguez

Resumen

Introduction to Machine Learning techniques.

The MeSsI (Merging Systems Identification) Algorithm.

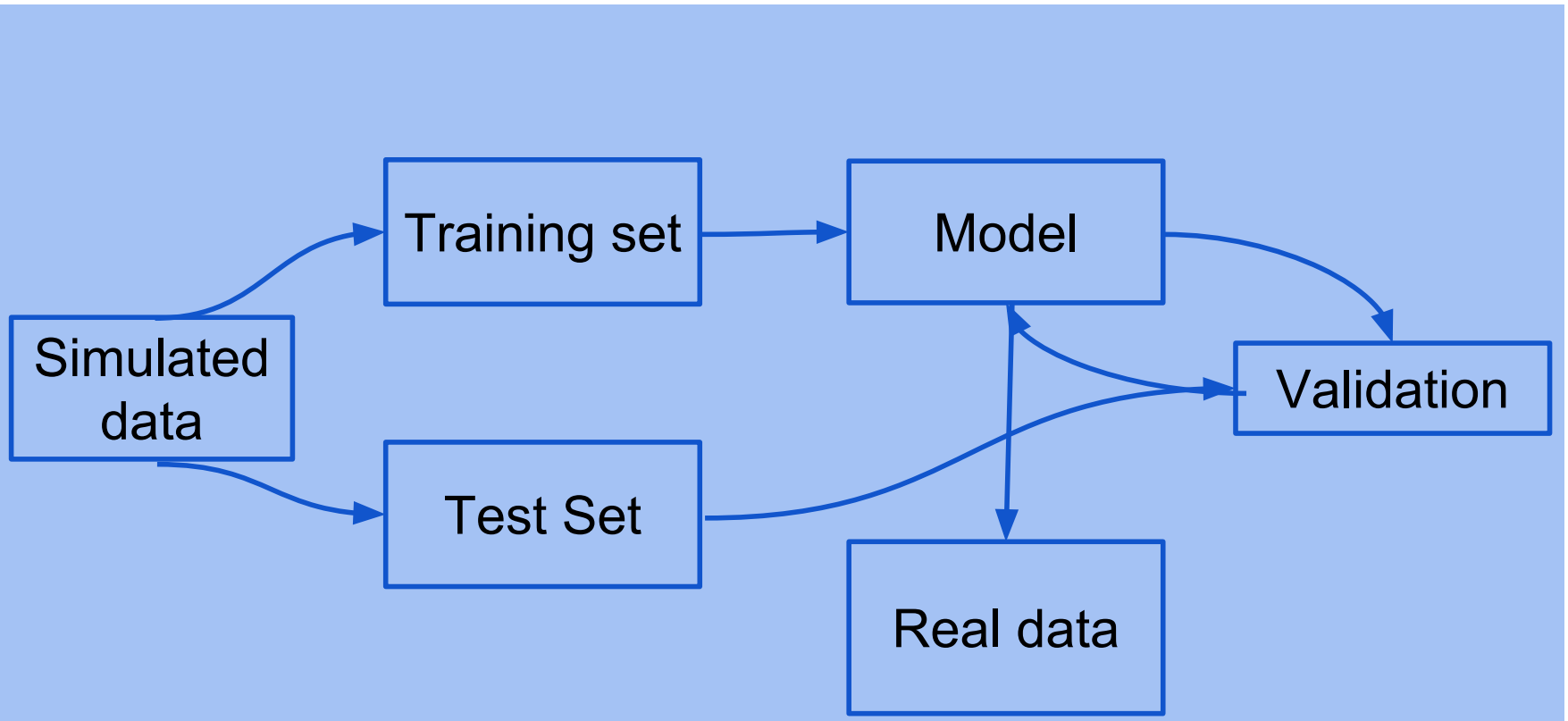
Analysis of individual merging clusters candidates.
- A2029/2033.
- A1204.
- A267.
- Statistical analysis of the magnetic fields in merging clusters.

CosmoMl:Machine Learning techniques applied to the CMB.
- Construction of the data set.
- Supervised methods.
- Cosmological parameters Angular distributions.

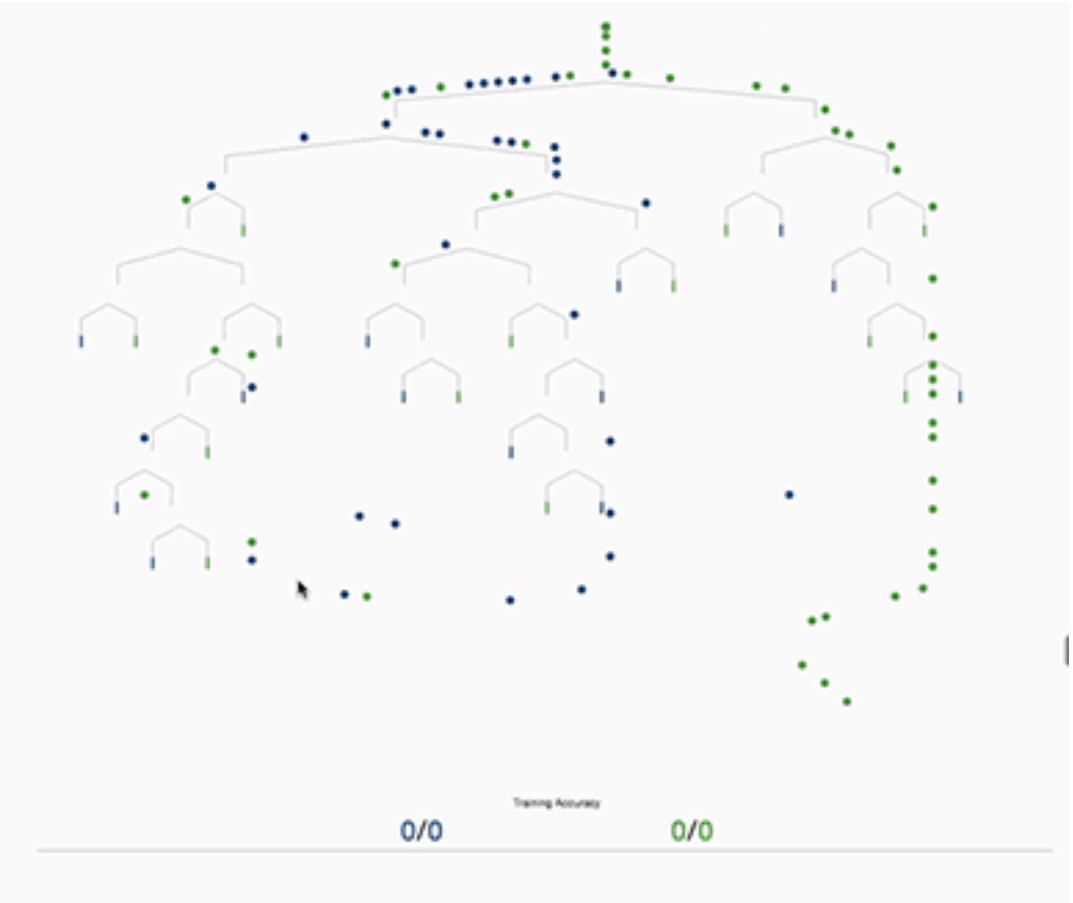
Conclusions.

Introduction to Machine Learning techniques.

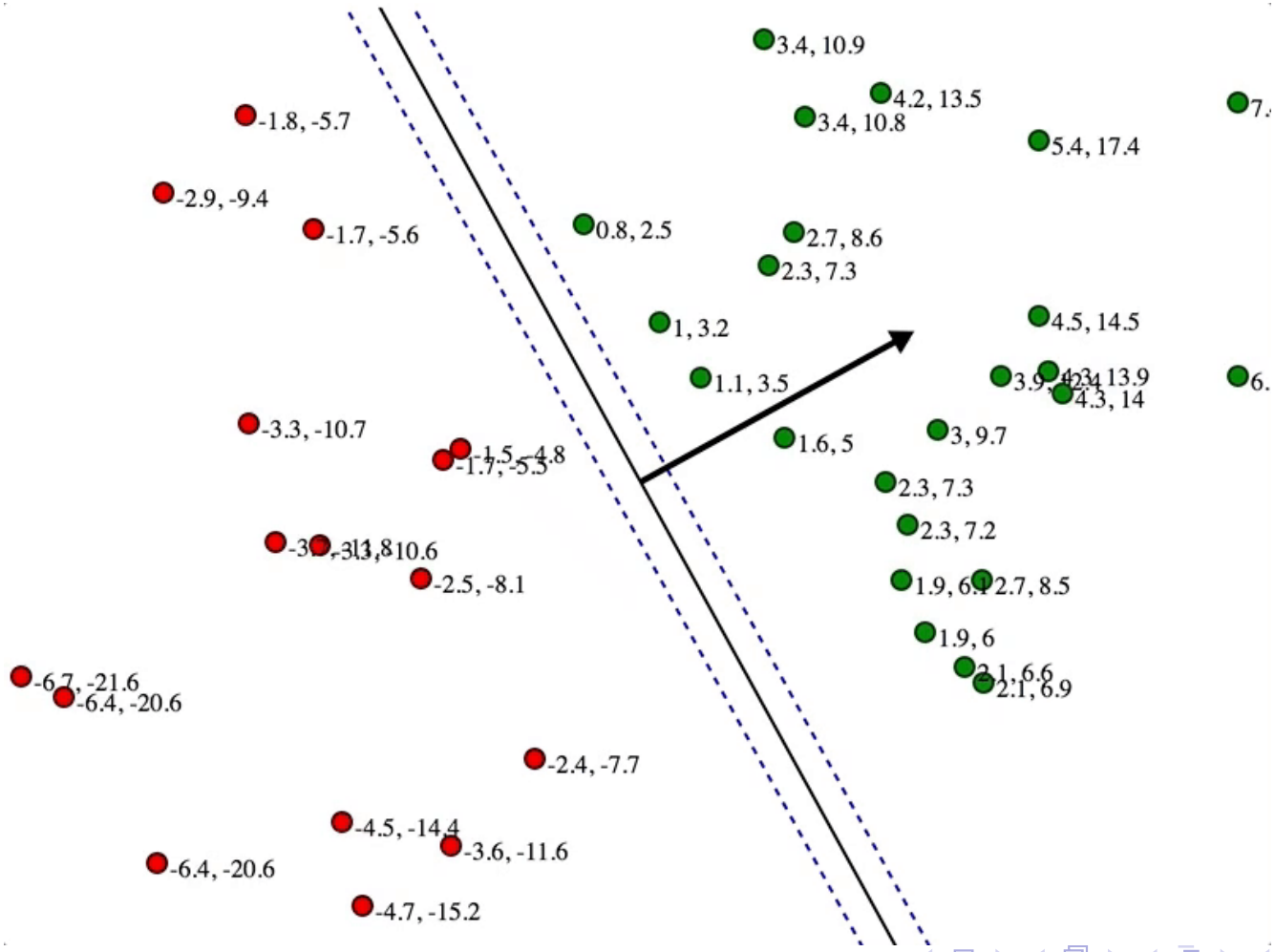
Supervised Learning.



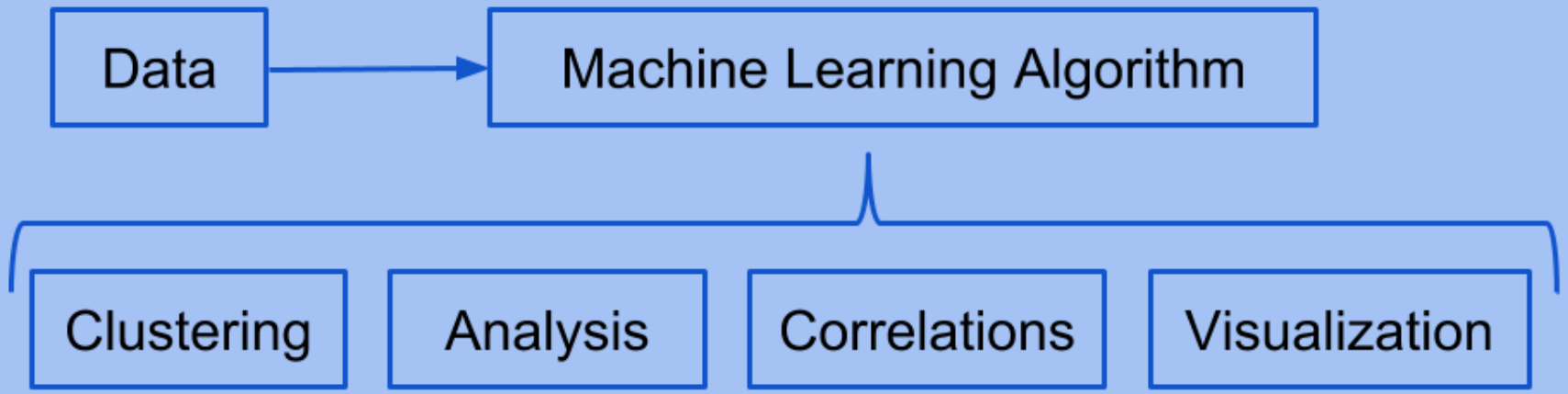
Random Forest



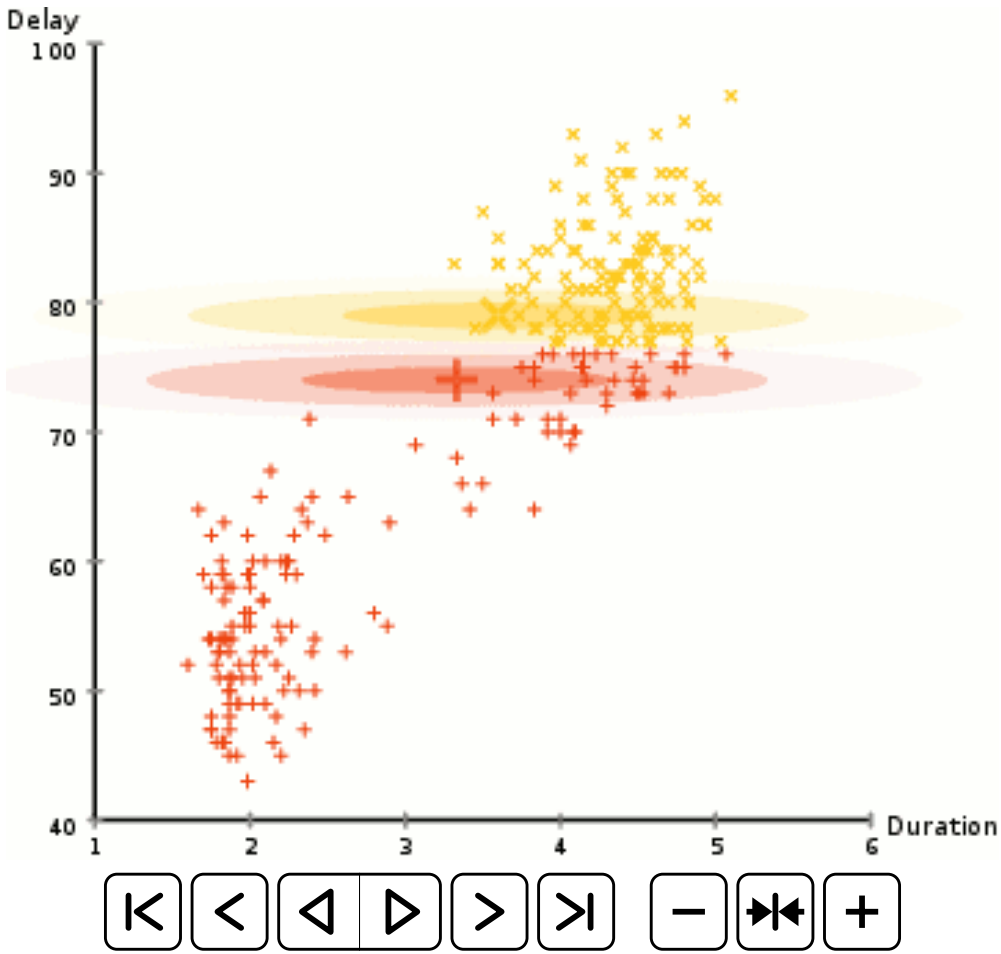
Support Vector Machines



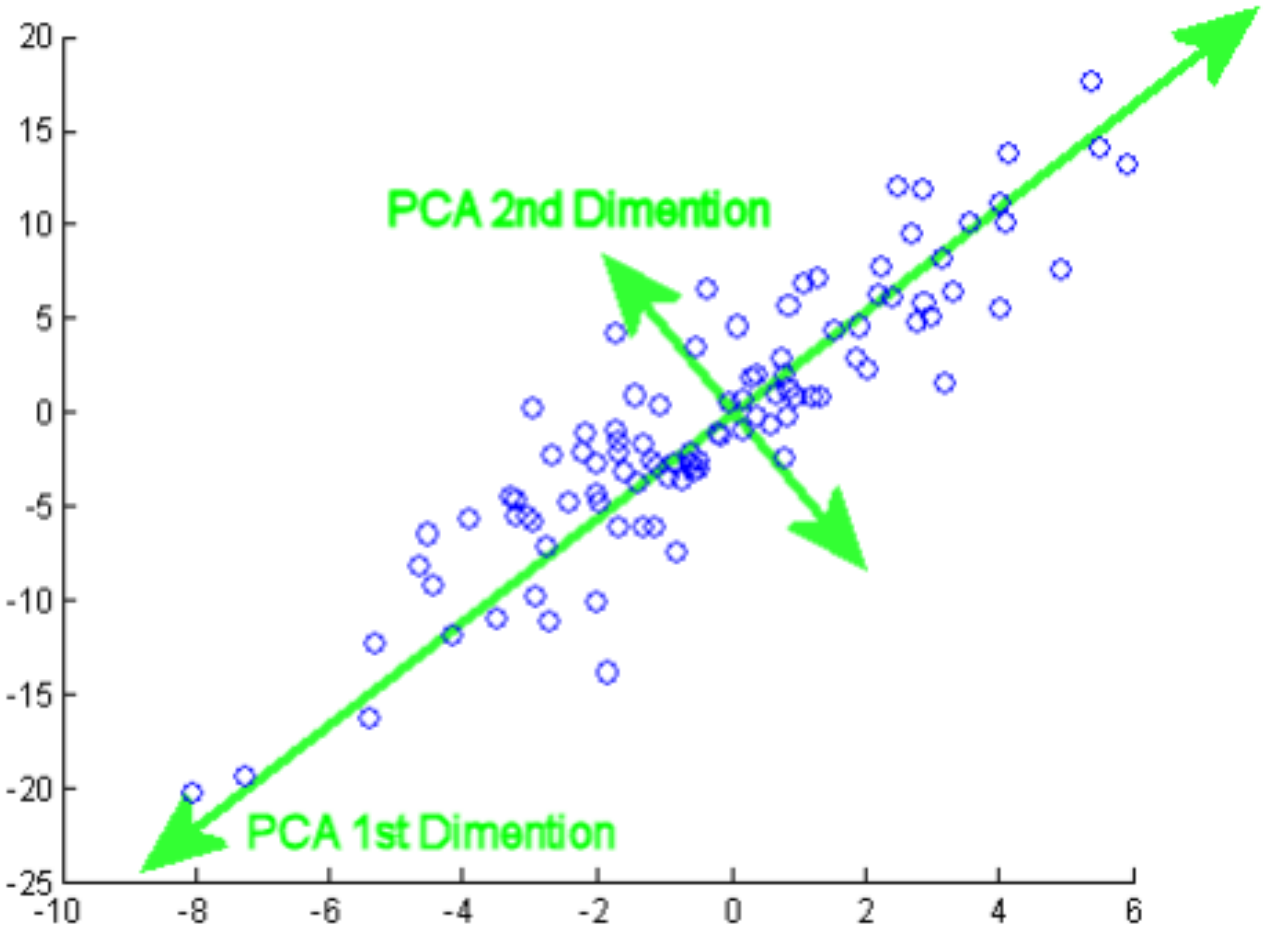
Unsupervised Learning.



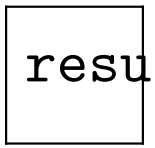
Mixture of Gaussians



Principal Components Analysis.



messi_paper.png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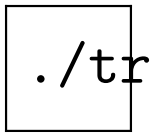
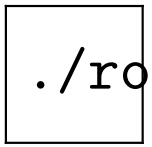
Study of the merger trees.

- Based on the subhalos merger trees, we construct the merger tree for every fof group in the simulation.



- Dressler-Shectman test.
- Non gaussianity test.
- Color.
- Number of galaxies.



- We found 61 candidates to merging clusters.
- In 32 of these we were able to identify the colliding substructures.
- 21 of these were previously classified as merging clusters by other authors.

conclusiones_messi.png

Astronomy & Astrophysics manuscript no. merger1_v3
December 4, 2017

I. Analysis of candidates for interacting gala

A1204 and A2029/A2033

Elizabeth Johana Gonzalez ⋆[1,2], Martín de los Rios[1,2], Gabriel A. Oio[1,2], Daniel He
Tagliaferro[1,2], Mariano J. Domínguez R.[1,2], José Luis Nilo Castellón[3,4], Héctor Cuevas

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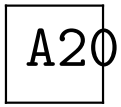
[2] Observatorio Astronómico de Córdoba, Universidad Nacional de Córdoba, Laprida 854, X5000BG
[3] Instituto de Investigación Multidisciplinario en Ciencia y Tecnología, Universidad de La Serena. B
[4] Departamento de Física y Astronomía, Facultad de Ciencias, Universidad de La Serena. Av. Juan Ci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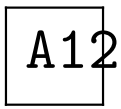
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II. Analysis of candidates for interacting galaxy cluste

A267, a merging fossil group.

Elizabeth Johana Gonzalez ⋆[1,2], Martín de los Rios[1,2], Gabriel A. Oio[1,2], Daniel Hernández Lang[4], Ta
Tagliaferro[1,2], Mariano J. Domínguez R.[1,2], José Luis Nilo Castellón[3,4], Héctor Cuevas L.[4], and Carlos

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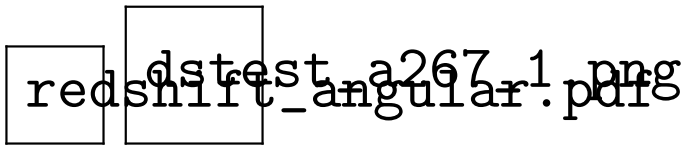
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a267_phasespace.png
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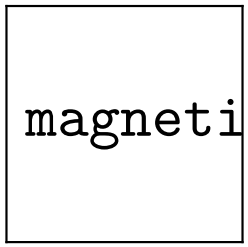
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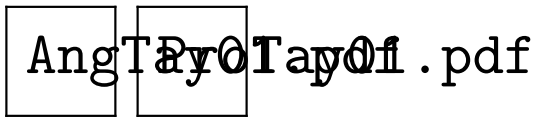
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CosmoML: Machine Learning techniques applied to the Cosmic Microwave Background.

Martín de los Rios⋆, Mariano J. Domínguez R.⋆ [1,2,3].
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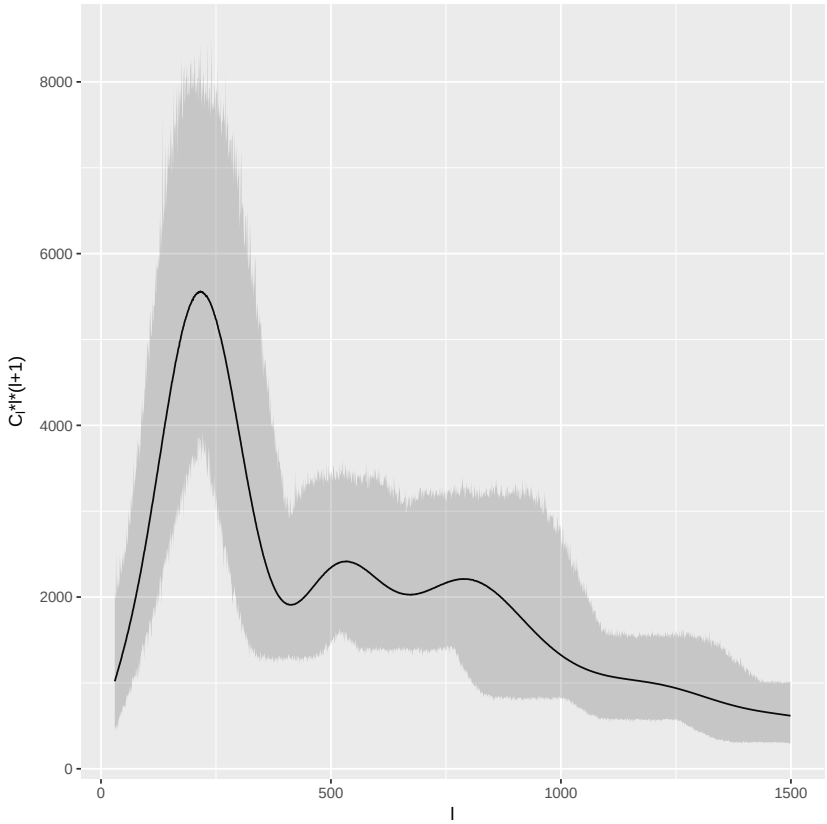
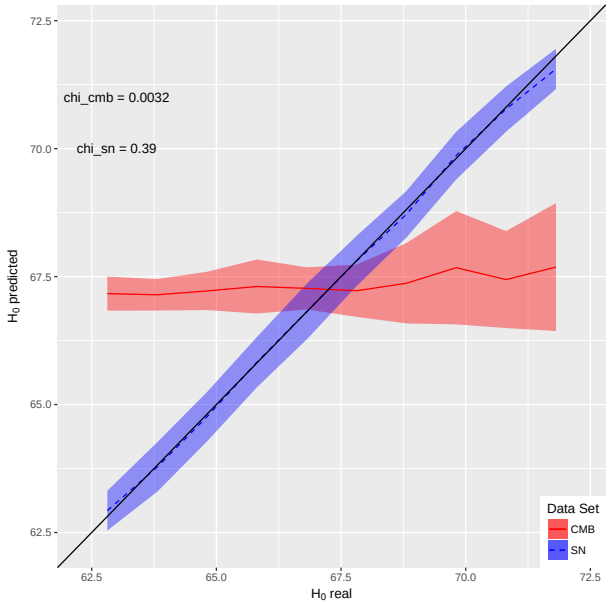
Parameter	Minimum	Maximum	Planck
$\Omega_m h^2$	0.1131	0.1263	0.1197
$\Omega_b h^2$	0.02131	0.02269	0.022
Ω_k	–0.1	0.1	0
H_0	62.31	72.31	67.31
n	0.9469	0.9841	0.9655
A_s	$1.988 * 10^{-9}$	$2.408 * 10^{-9}$	$2.198 * 10^{-9}$
τ	0.021	0.1349	0.078

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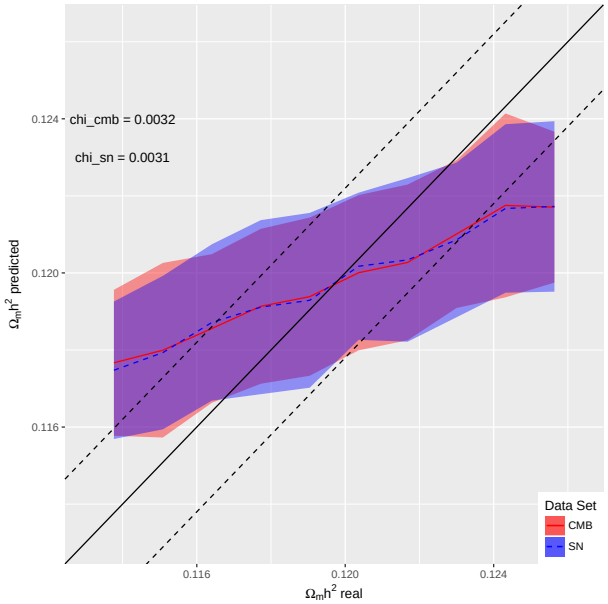
chi_sn = 0.39
H0 predicted
H0 real
Data Set
CMB
SN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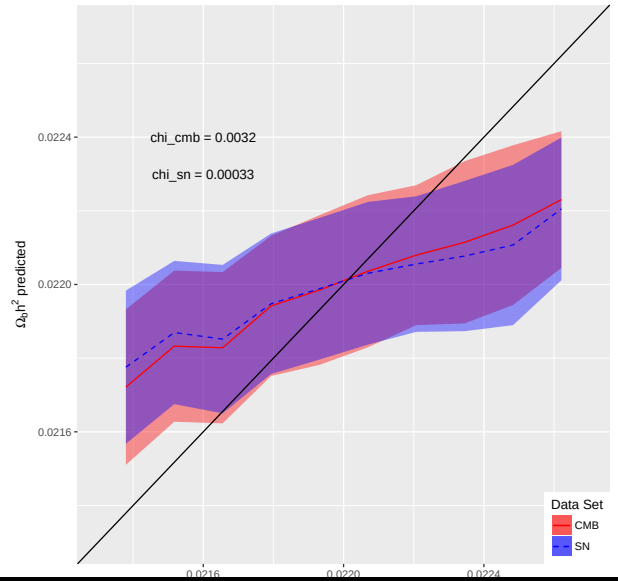
chi_sn = 0.0031
Ωmh2 predicted
Ωmh2 real
Data Set
CMB
SN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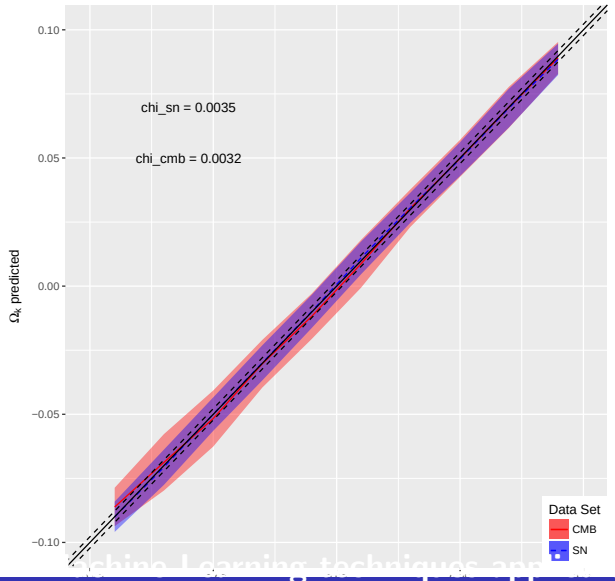
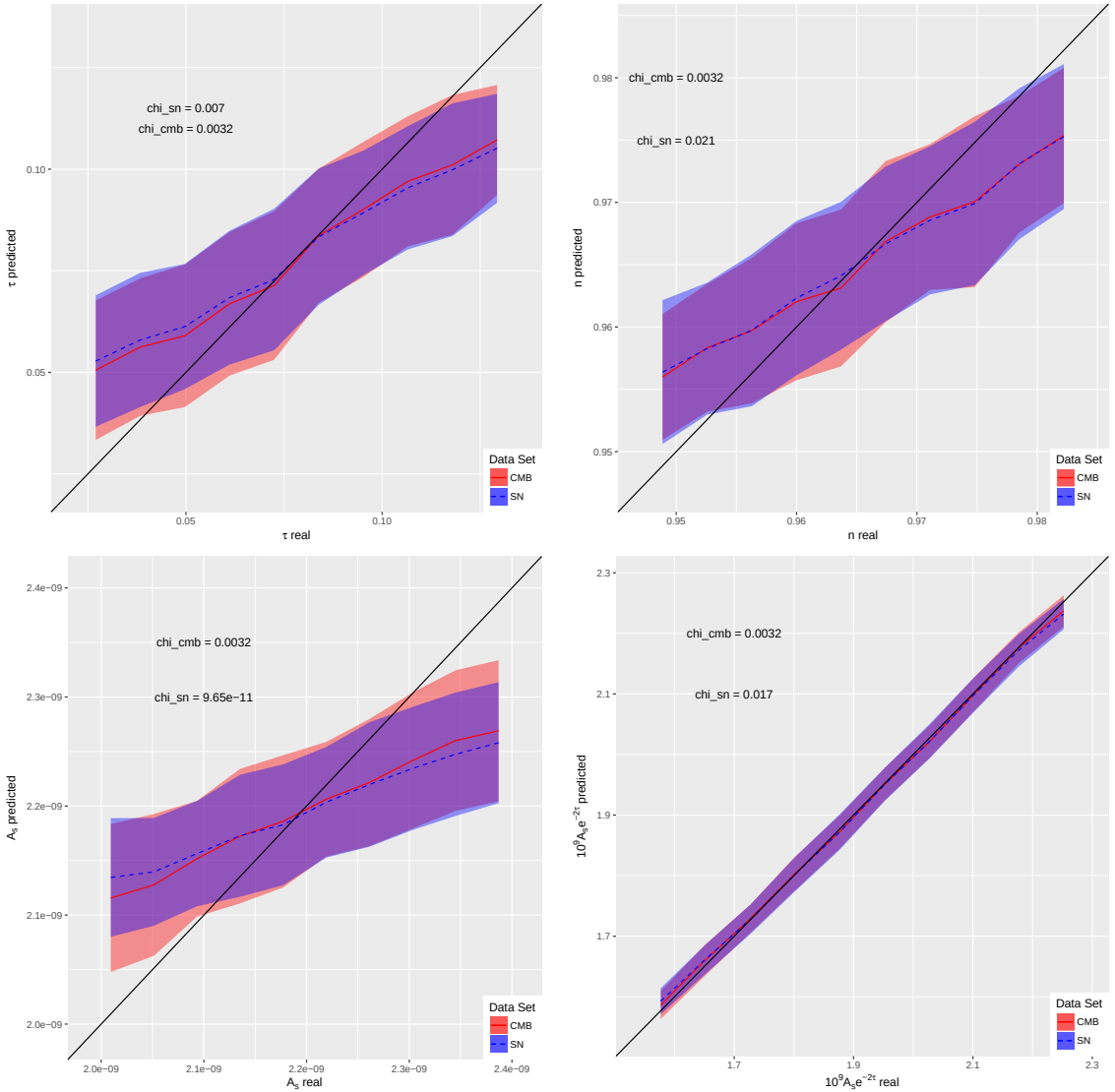
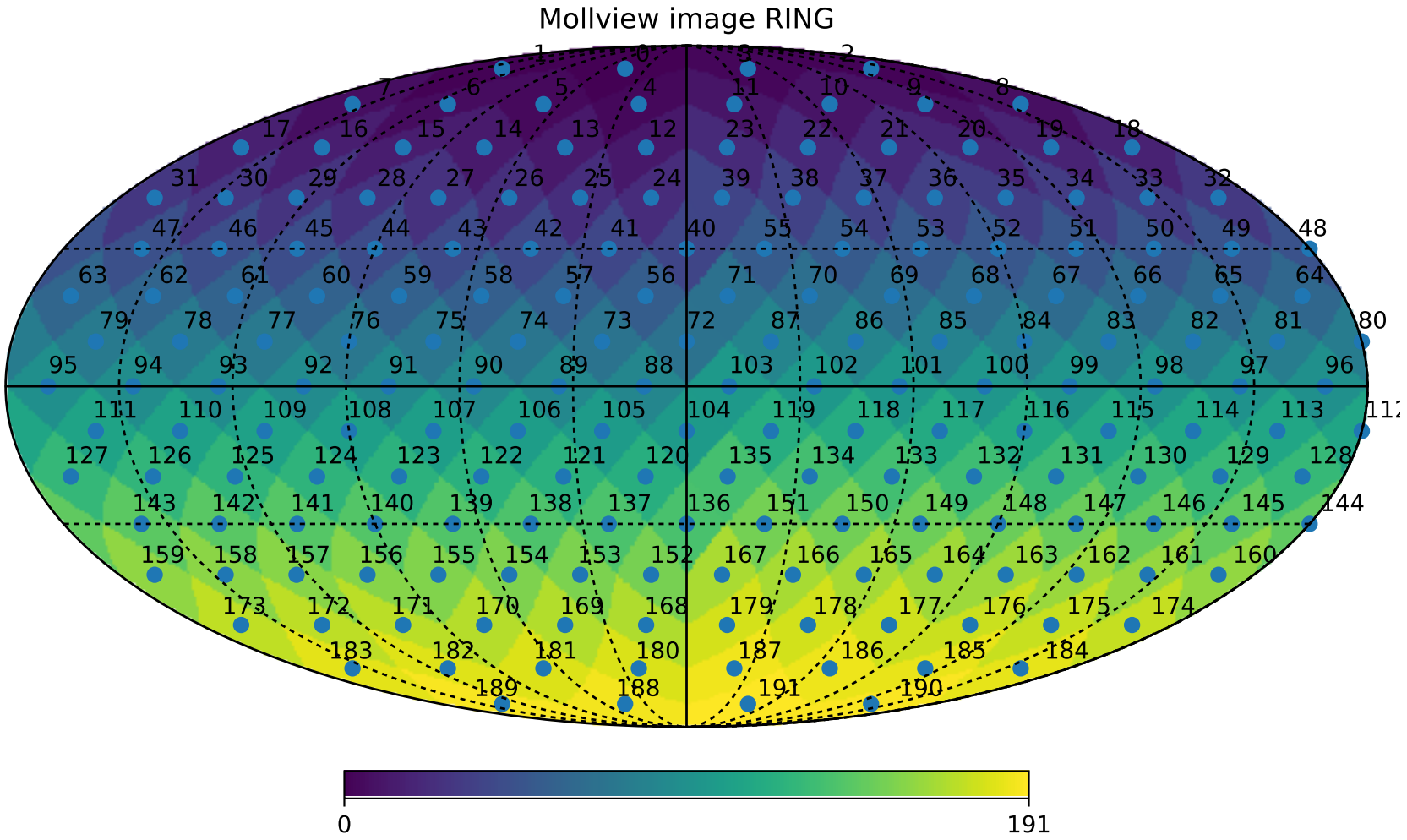
chi_sn = 0.00033
Ωbh2 predicted
Data Set
CMB
SN


chi_sn = 0.0035
chi_cmb = 0.0032
Ωk predicted
Data Set
CMB
SN


chi_sn = 0.007
chi_cmb = 0.0032
τ predicted
τ real
Data Set
CMB
SN
chi_cmb = 0.0032
chi_sn = 0.021
n predicted
n real
chi_cmb = 0.0032
chi_sn = 9.65e−11
A_s predicted
A_s real
chi_cmb = 0.0032
chi_sn = 0.017
10^9 A_s e^−2τ predicted
10^9 A_s e^−2τ real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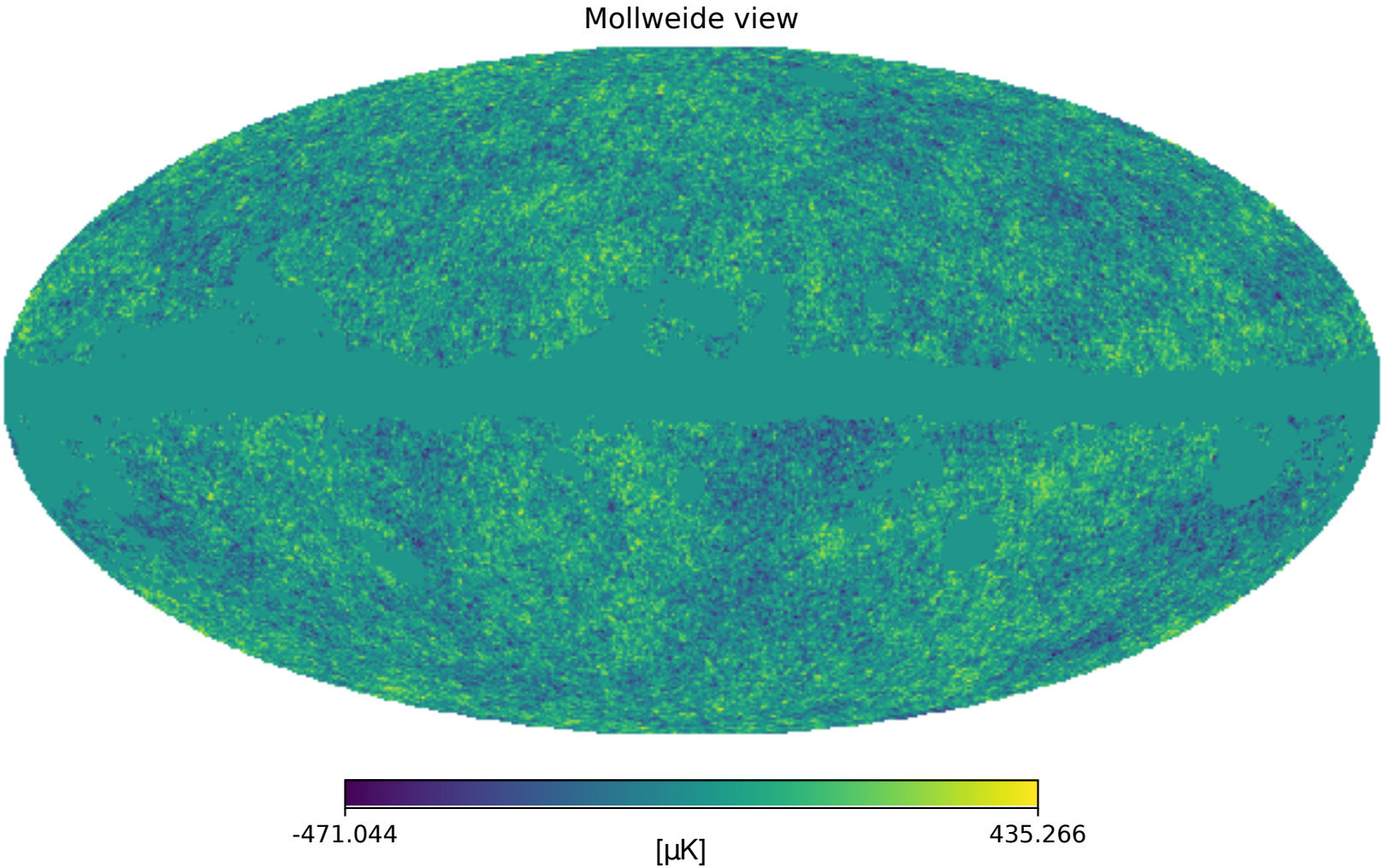
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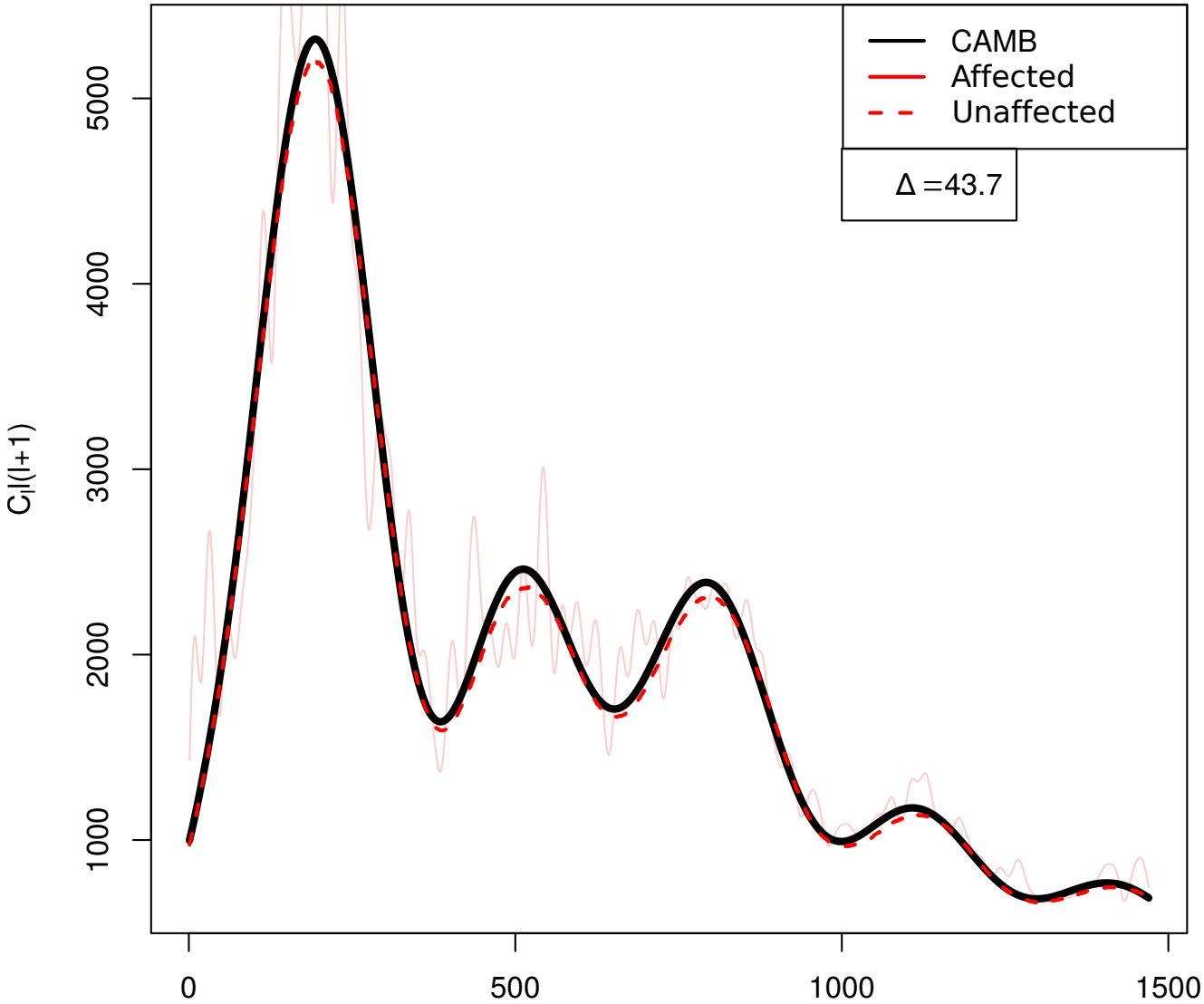
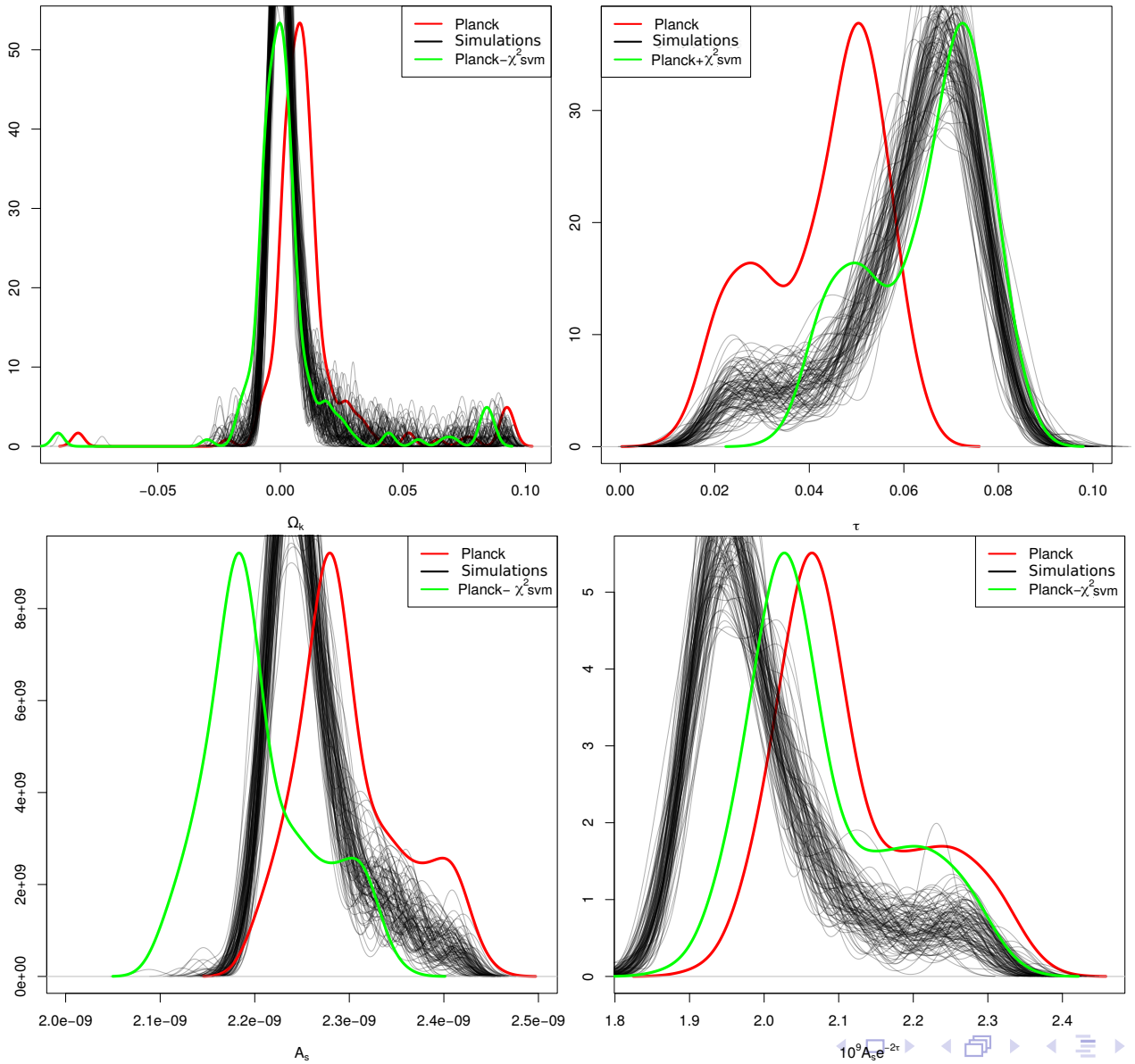

CAMB
Affected
Unaffected
Δ =43.7
C_l l(l+1)
1000
2000
3000
4000
5000
0
500
1000
1500


Planck
Simulations
Planck−χ²svm
Planck+χ²svm
Planck− χ²svm
Ωκ
τ
As
10⁹Ase⁻²τ


Muchas
Gracias