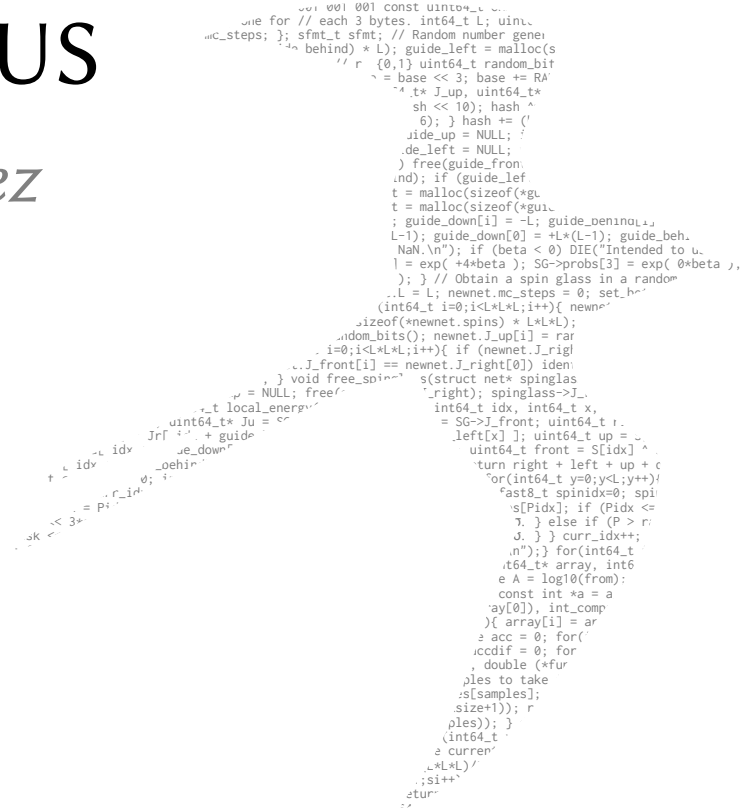
Memoria y rejuvenecimiento en vidrios de espín desde la perspectiva de JANUS

Alejandro Clavero Álvarez



Universidad Zaragoza
1542

¿Qué es un vidrio de espín?

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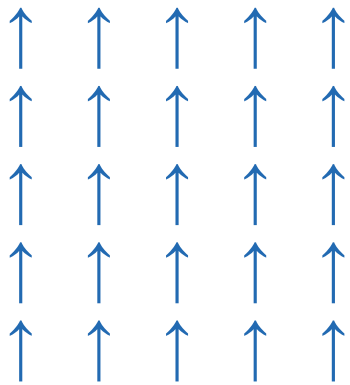
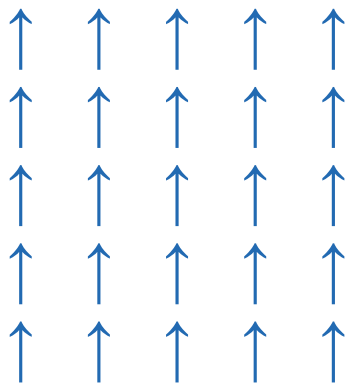
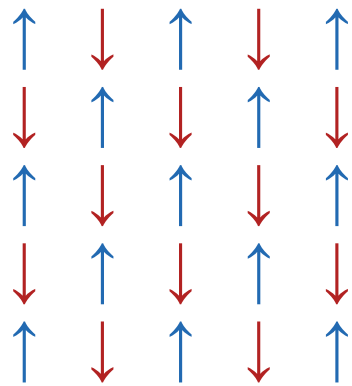


Ferromagnetismo

$$J_i = 1$$

¿Qué es un vidrio de espín?





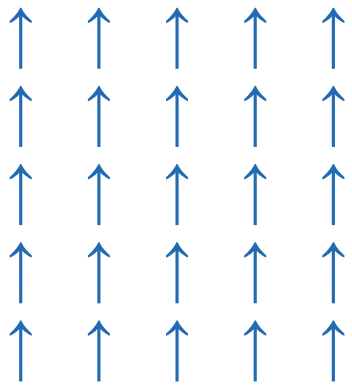
Ferromagnetismo

Antiferromagnetismo

$$J_i = 1$$

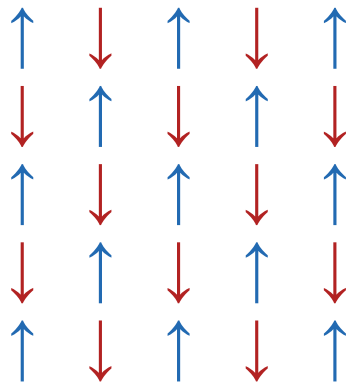
$$J_i = -1$$

¿Qué es un vidrio de espín?



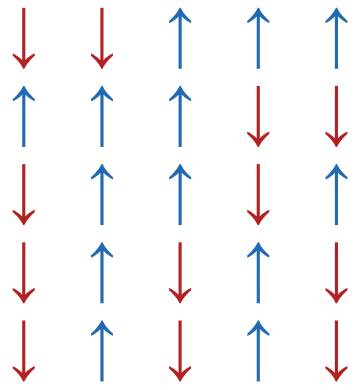
Ferromagnetismo

$J_i = 1$



Antiferromagnetismo

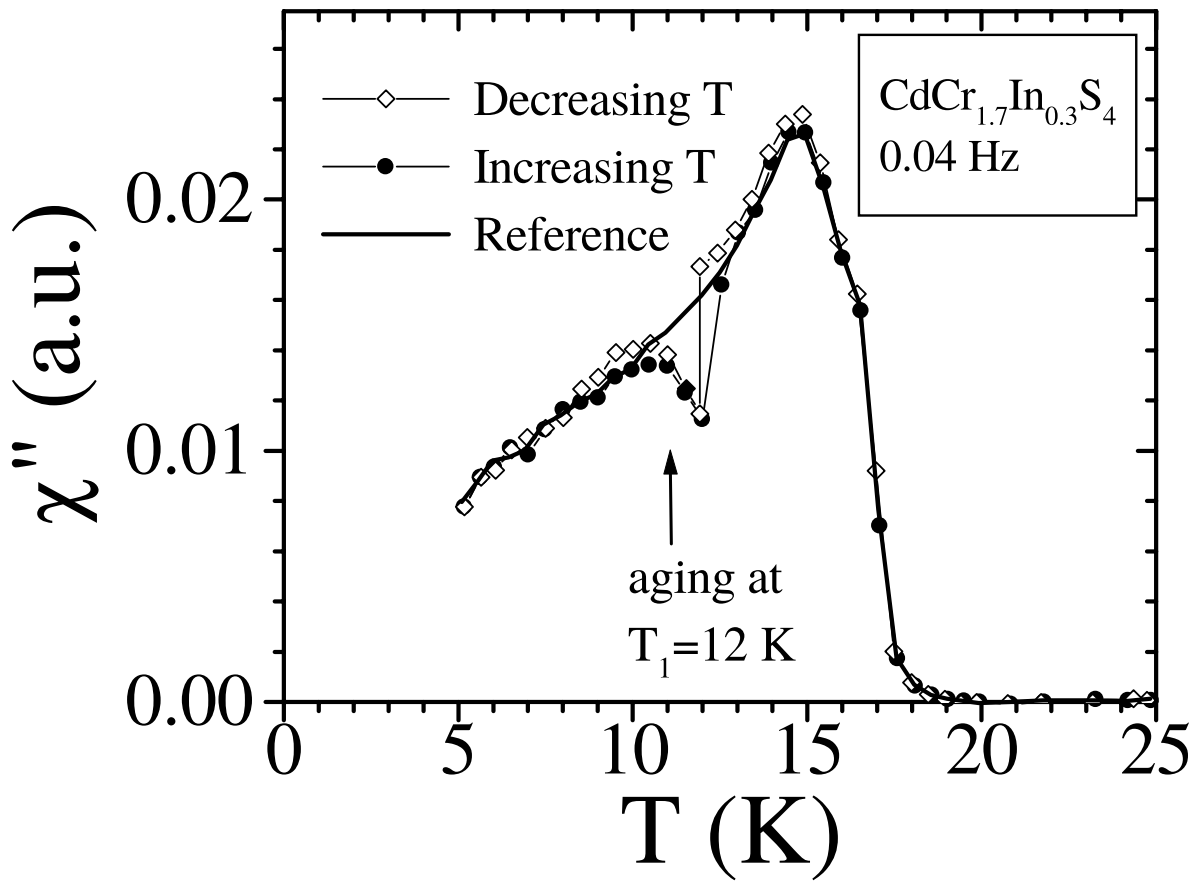
$J_i = -1$



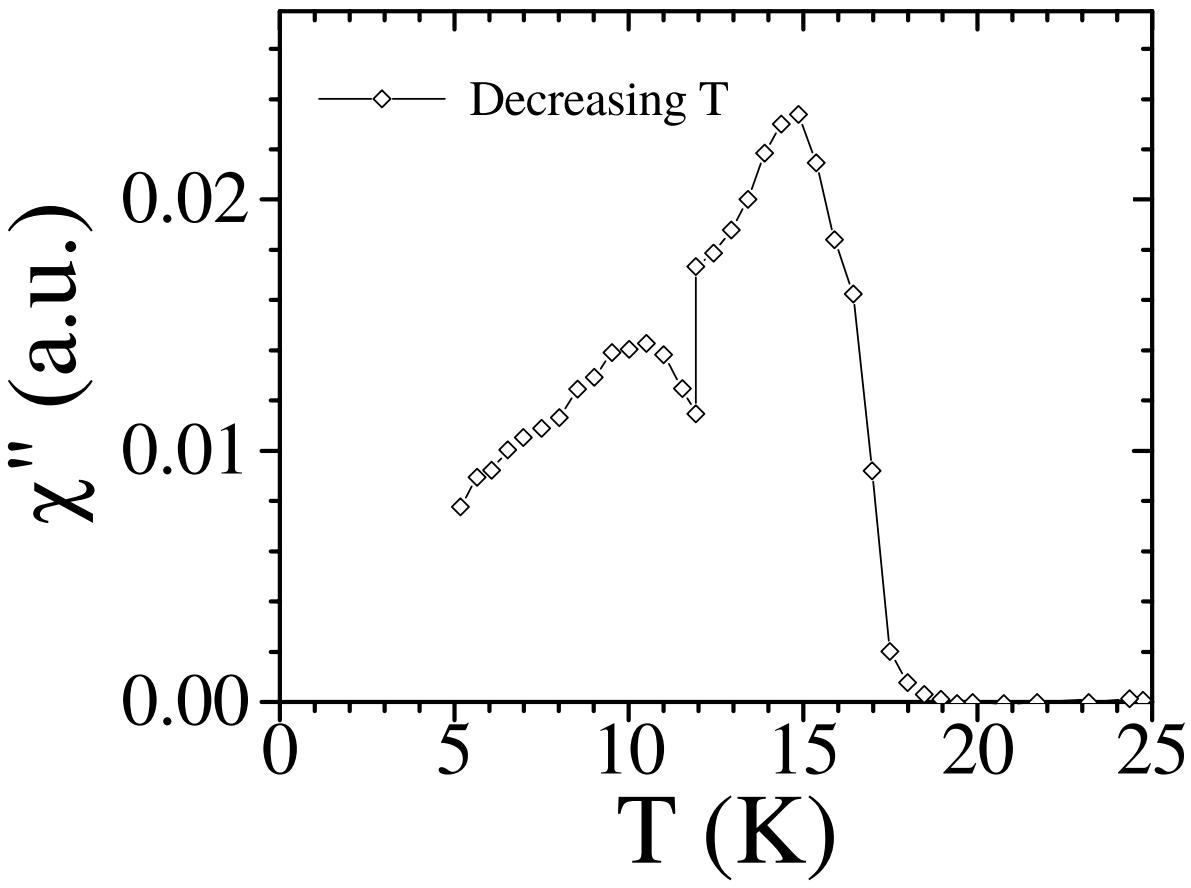
Vidrio de espín

$J_i \in \pm 1$

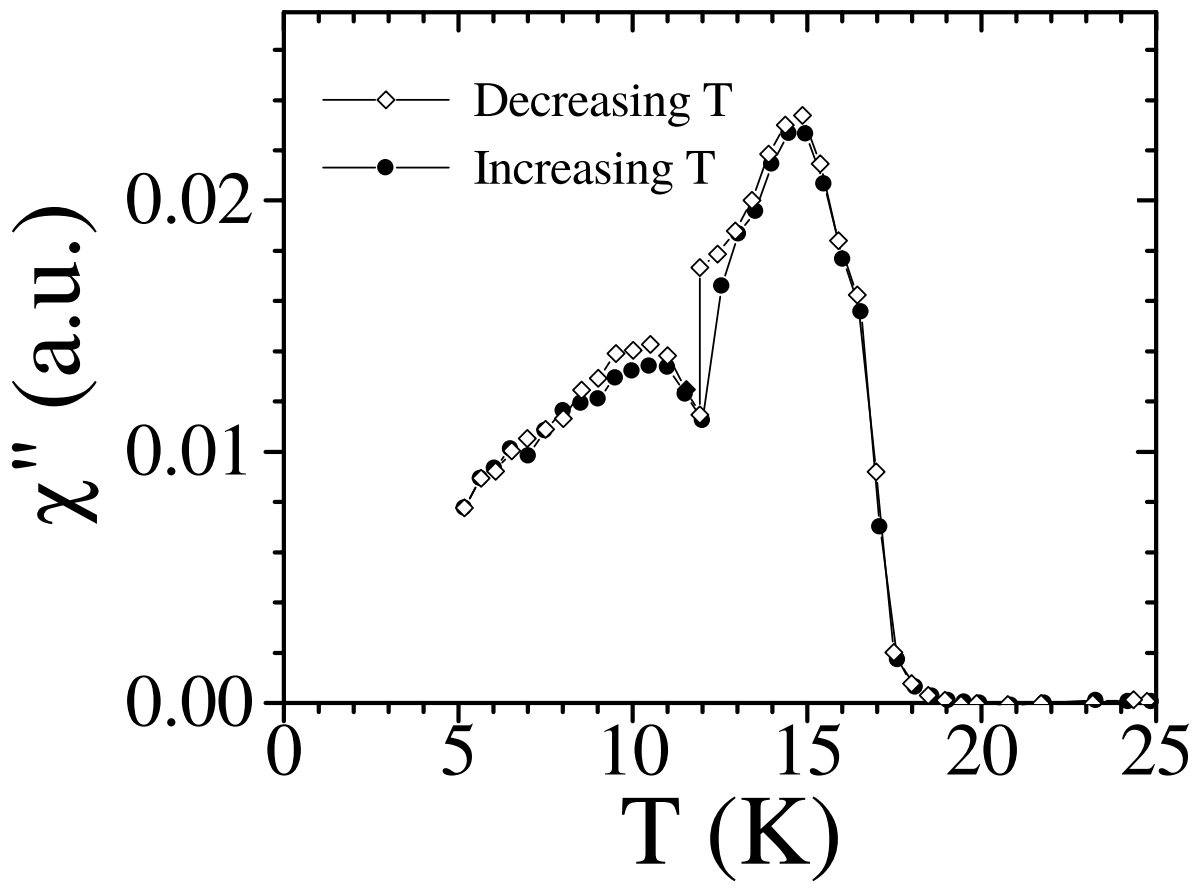
Dip experiment protocol



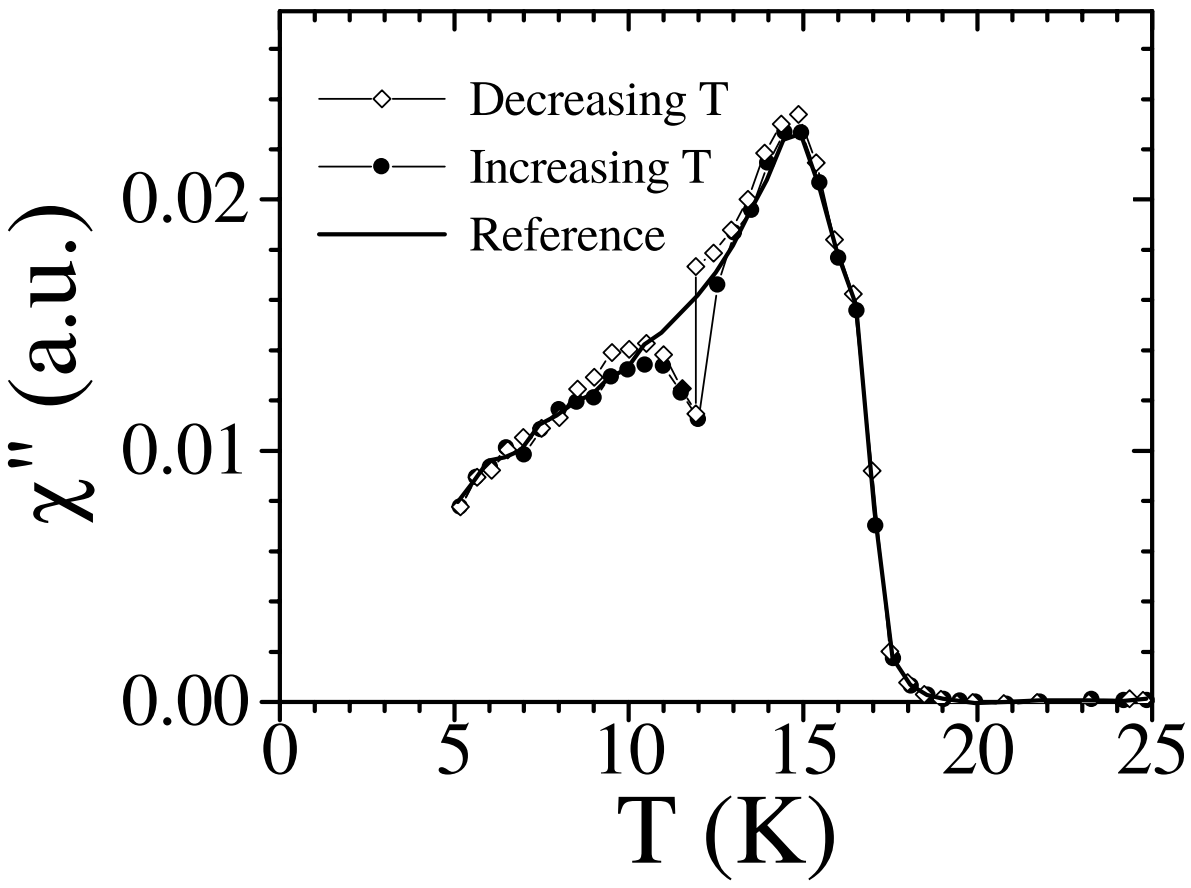
Dip experiment protocol



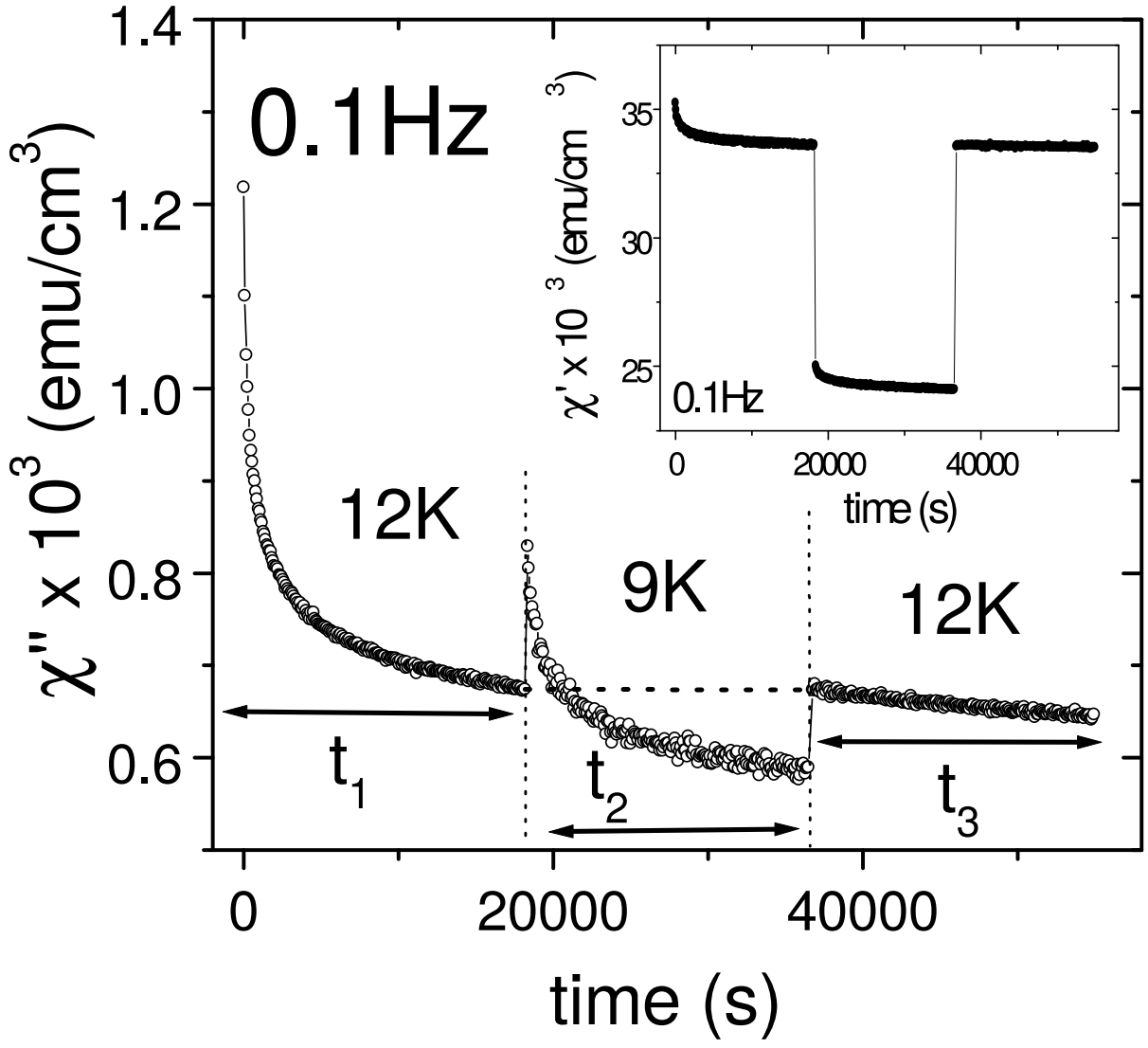
Dip experiment protocol



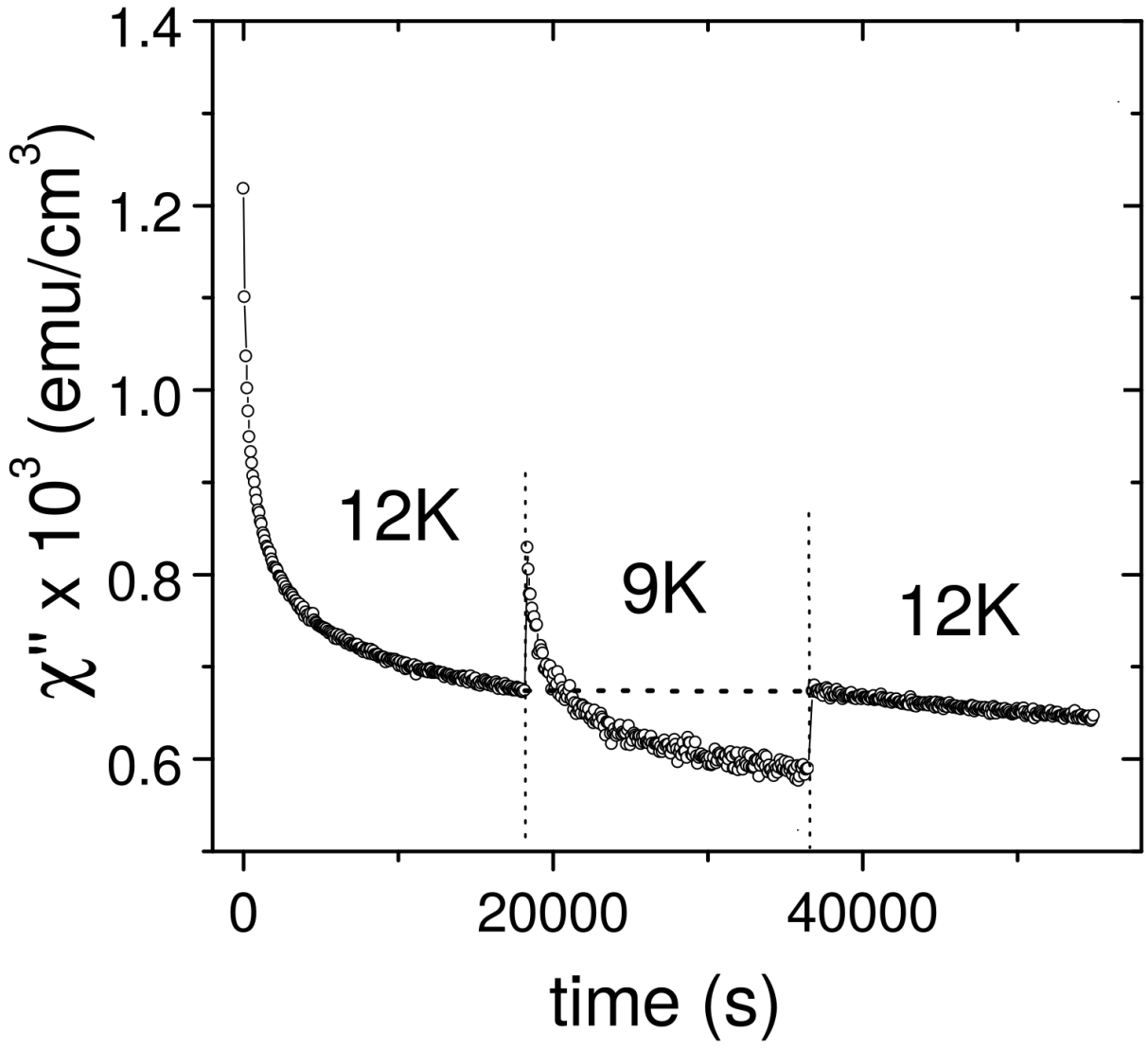
Dip experiment protocol



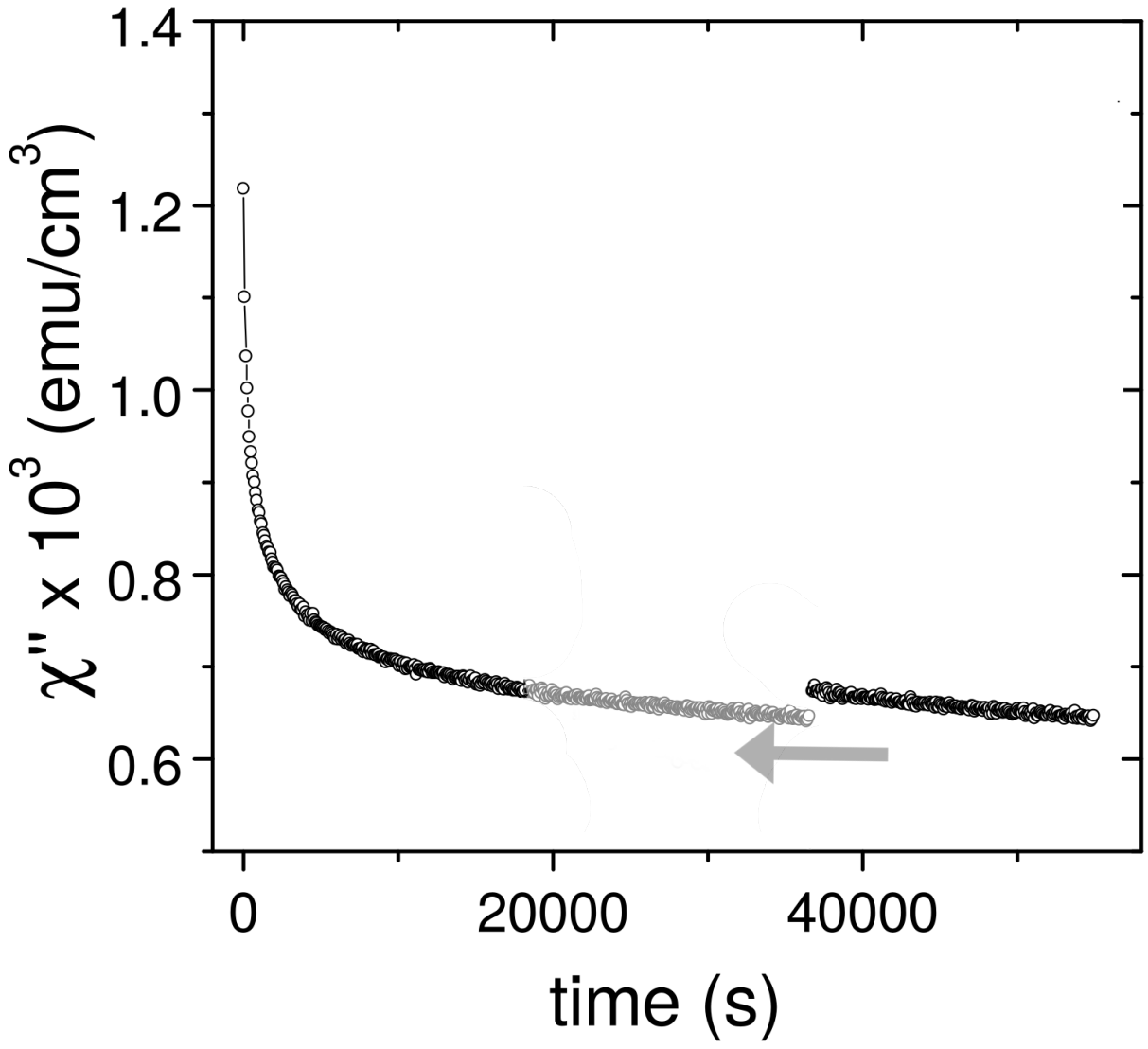
Protocolo de dos temperaturas



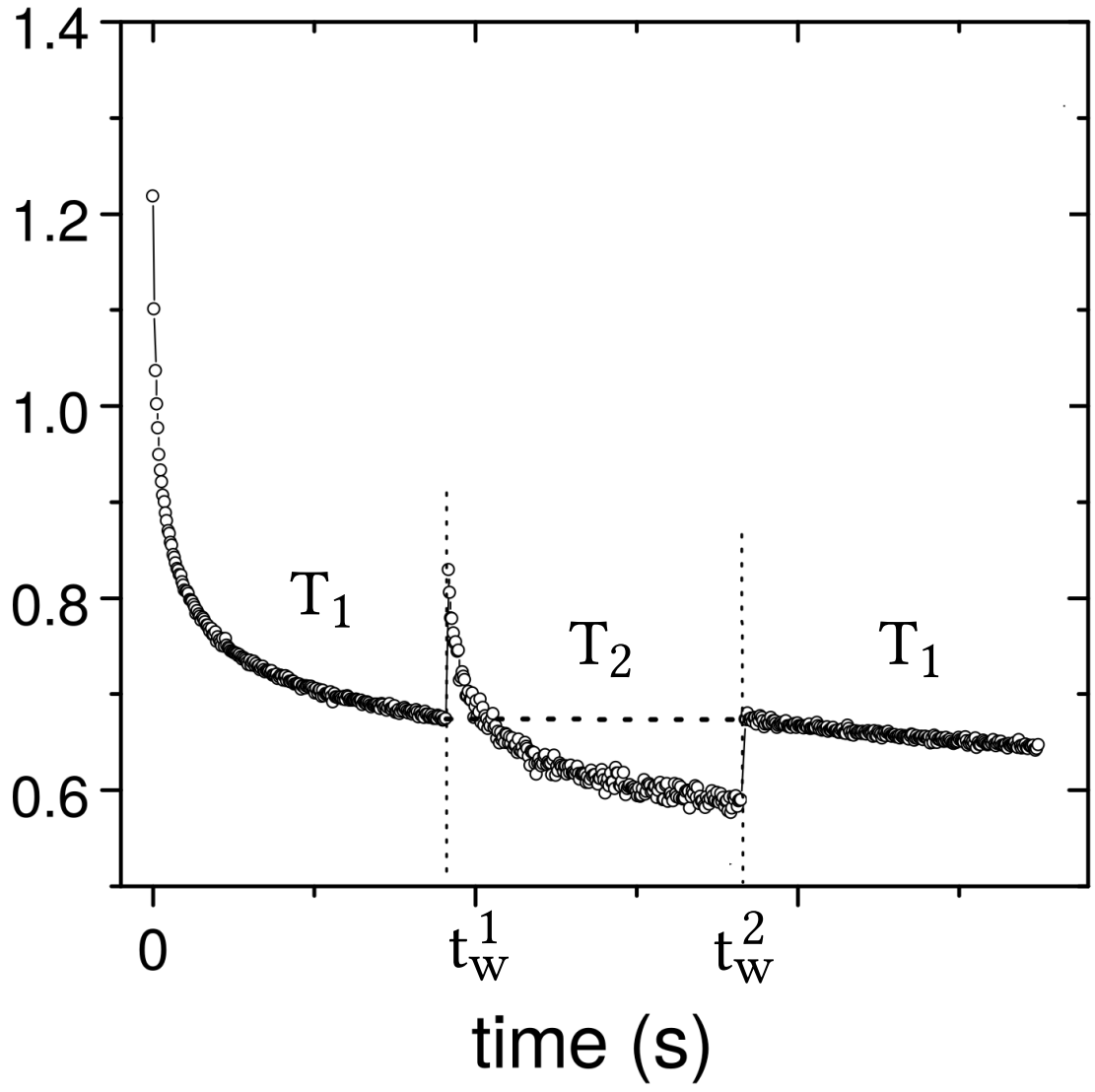
Protocolo de dos temperaturas



Protocolo de dos temperaturas



Protocolo de dos temperaturas



Modelo

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$$J(r) \propto \frac{\cos(2K_F r)}{r^3}$$

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$$\mathscr{H} = -\sum_{\langle i,j \rangle} J_{ij} s_i s_j$$

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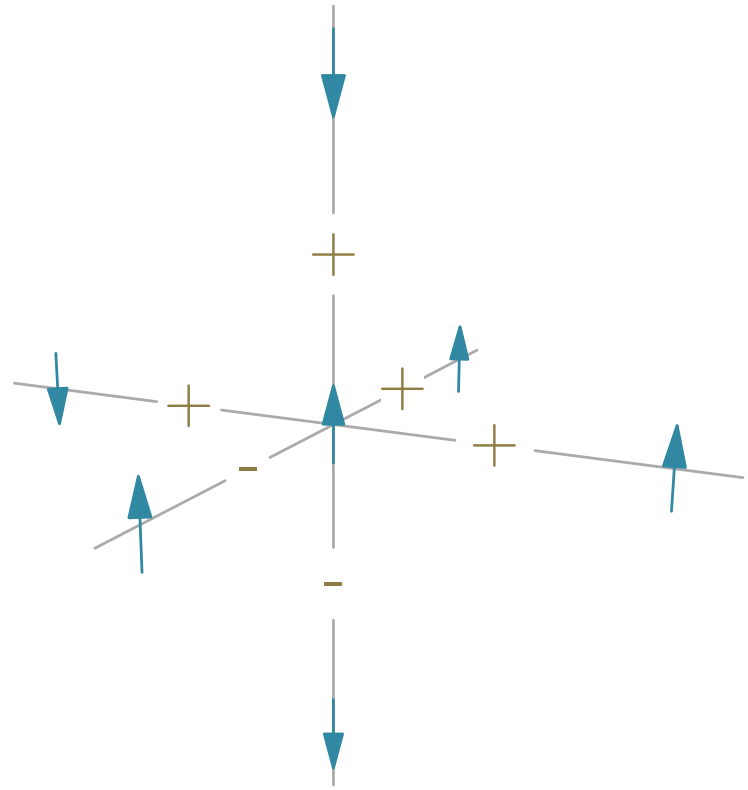
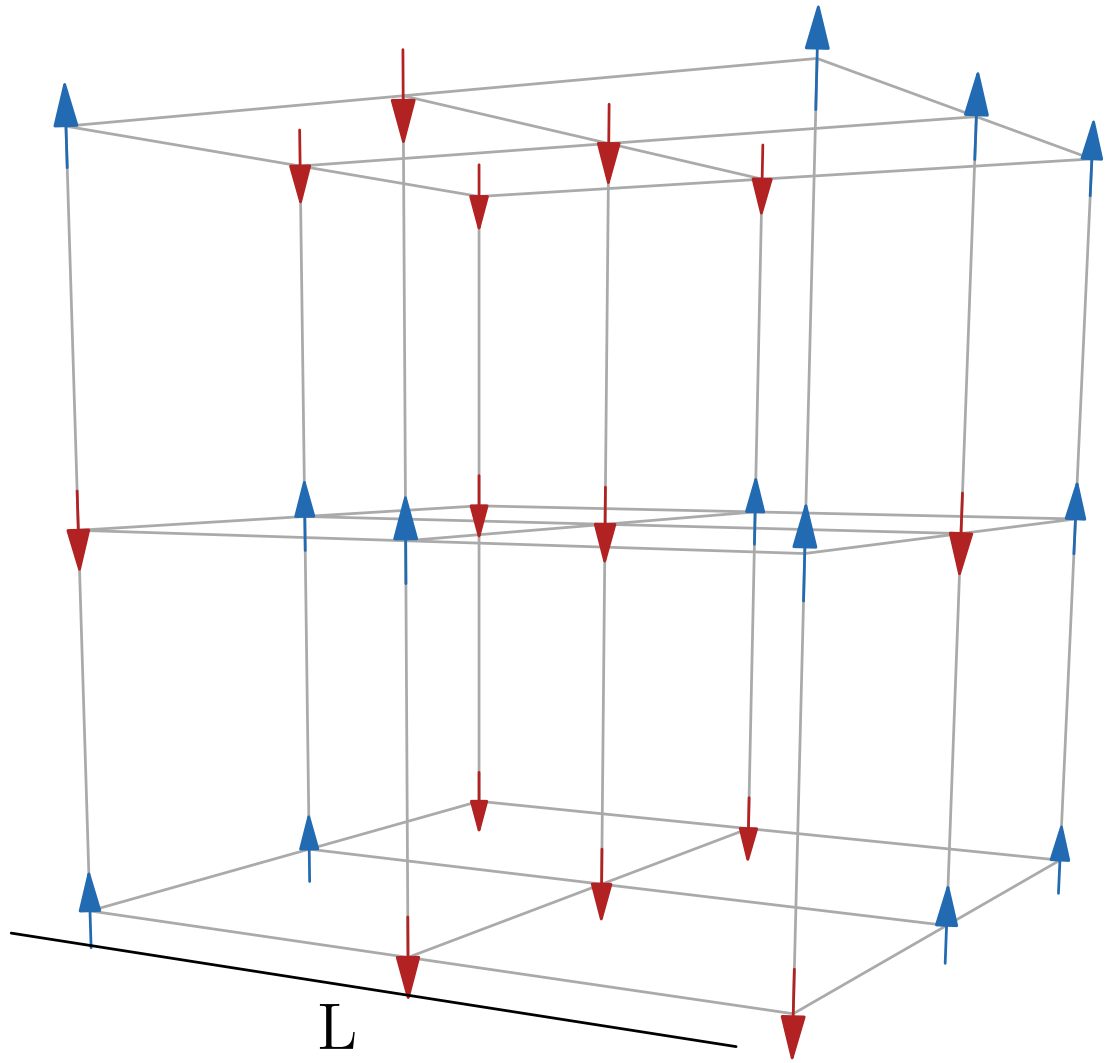


- Frustración
- Aleatoriedad

Modelo



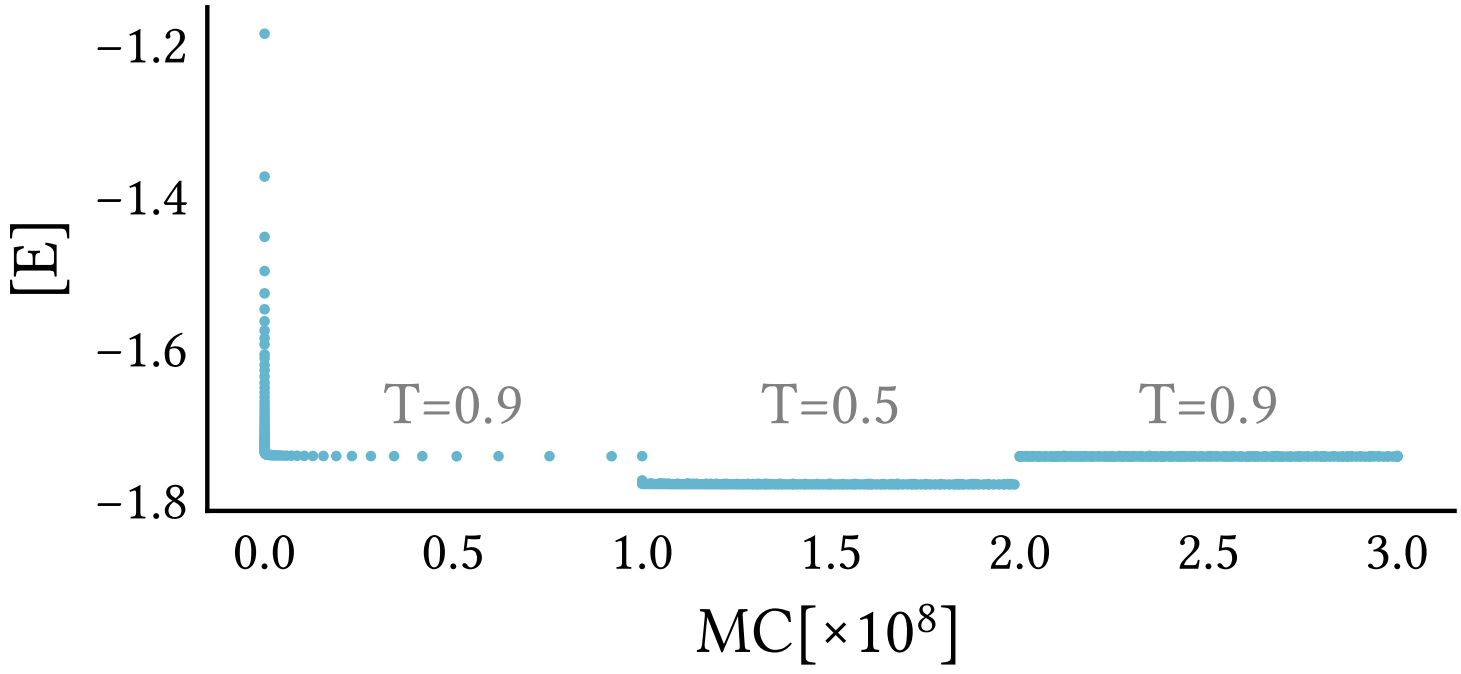
Simulación

- Memento
- Janus

Parámetro	Valores programados
t_w^1	$10^4 \longrightarrow 10^8$
t_0	$10^4 \longrightarrow 10^8$
T_i	$0.9 \longrightarrow 0.6$
L	$4 \longrightarrow 80$

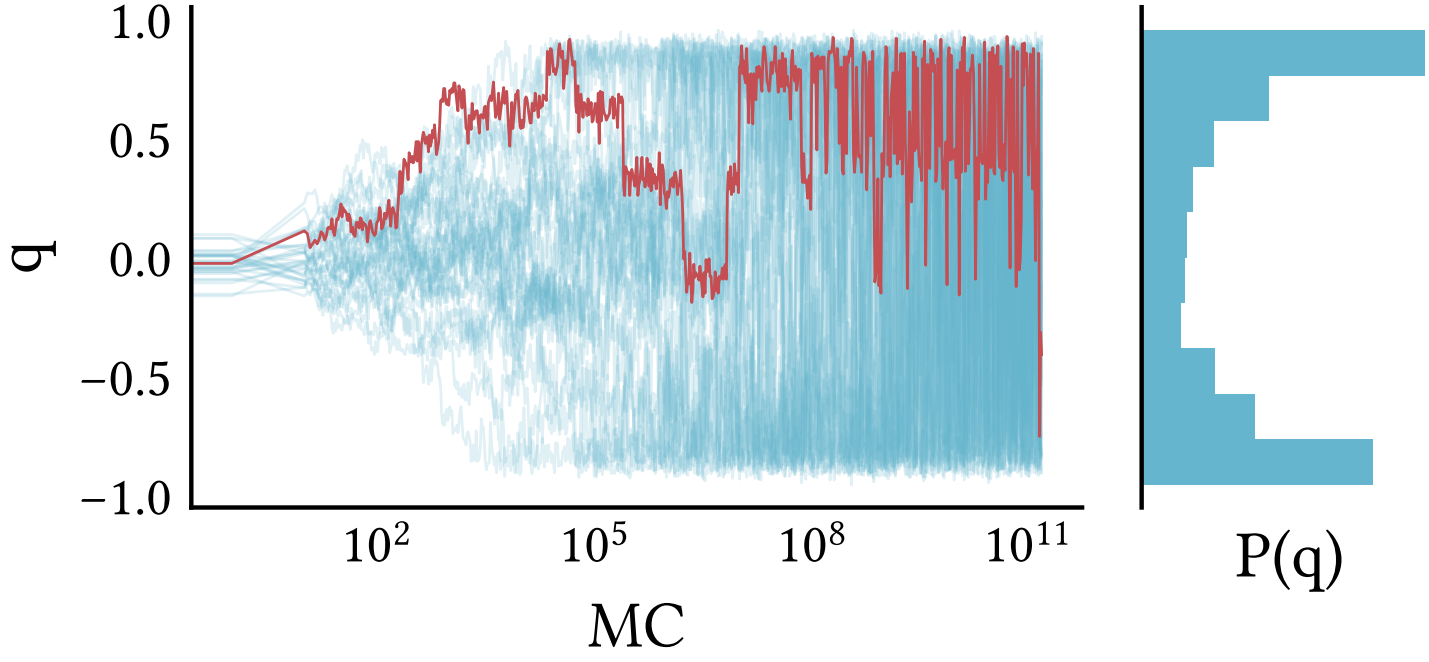
Magnitudes

Magnitudes



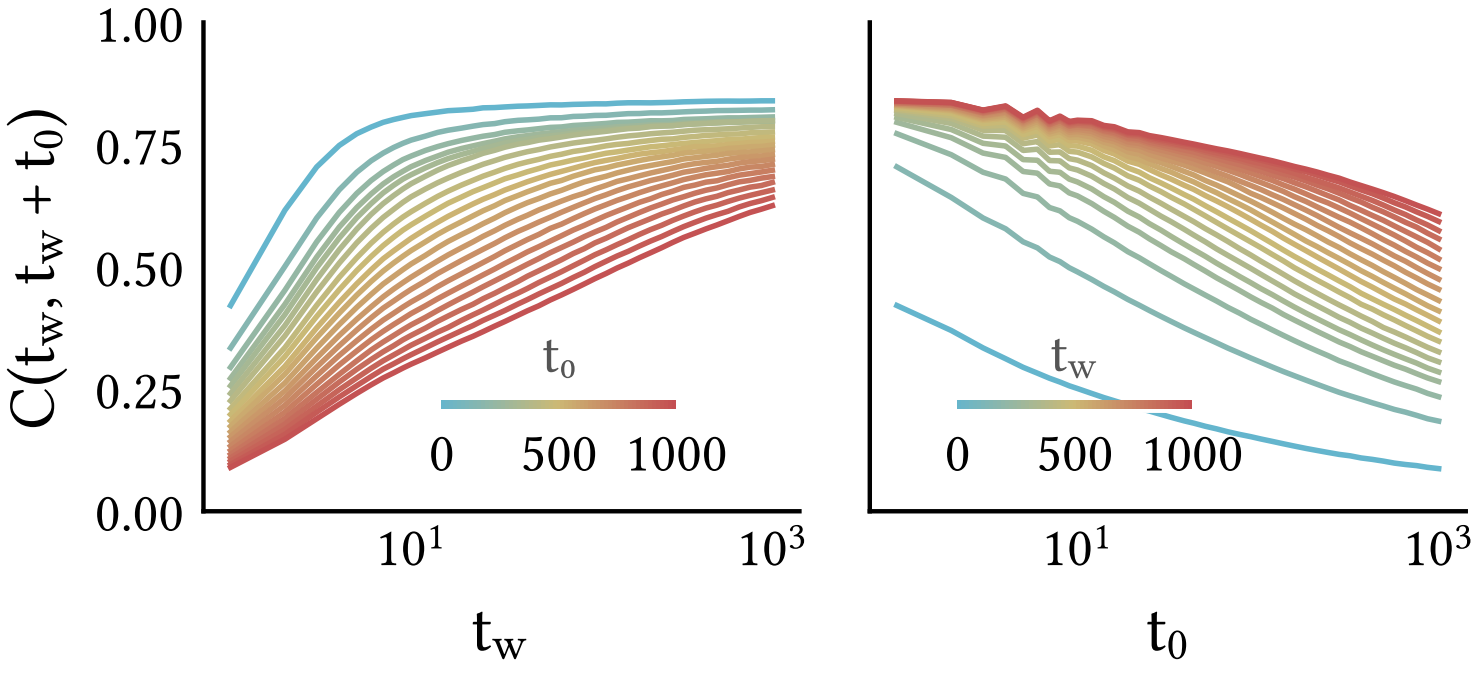
$$E = -\sum_{\langle i,j \rangle} J_{ij} s_i s_j$$

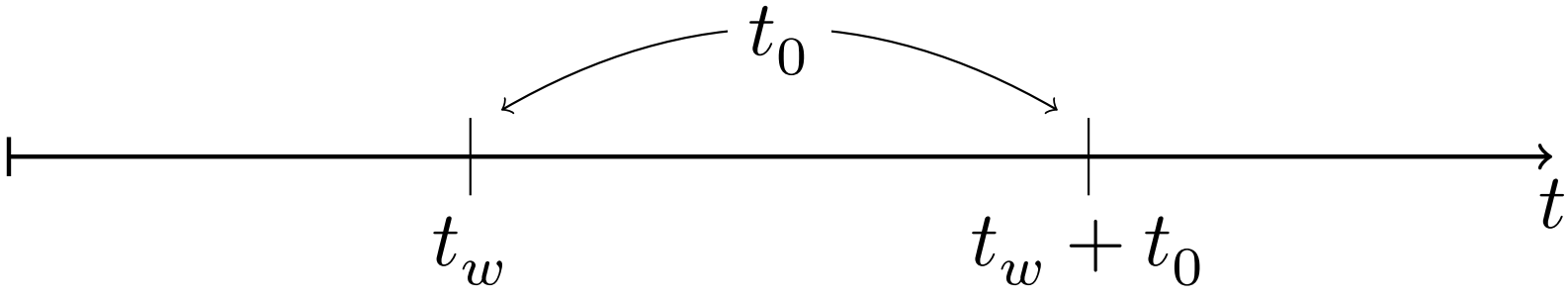
Magnitudes



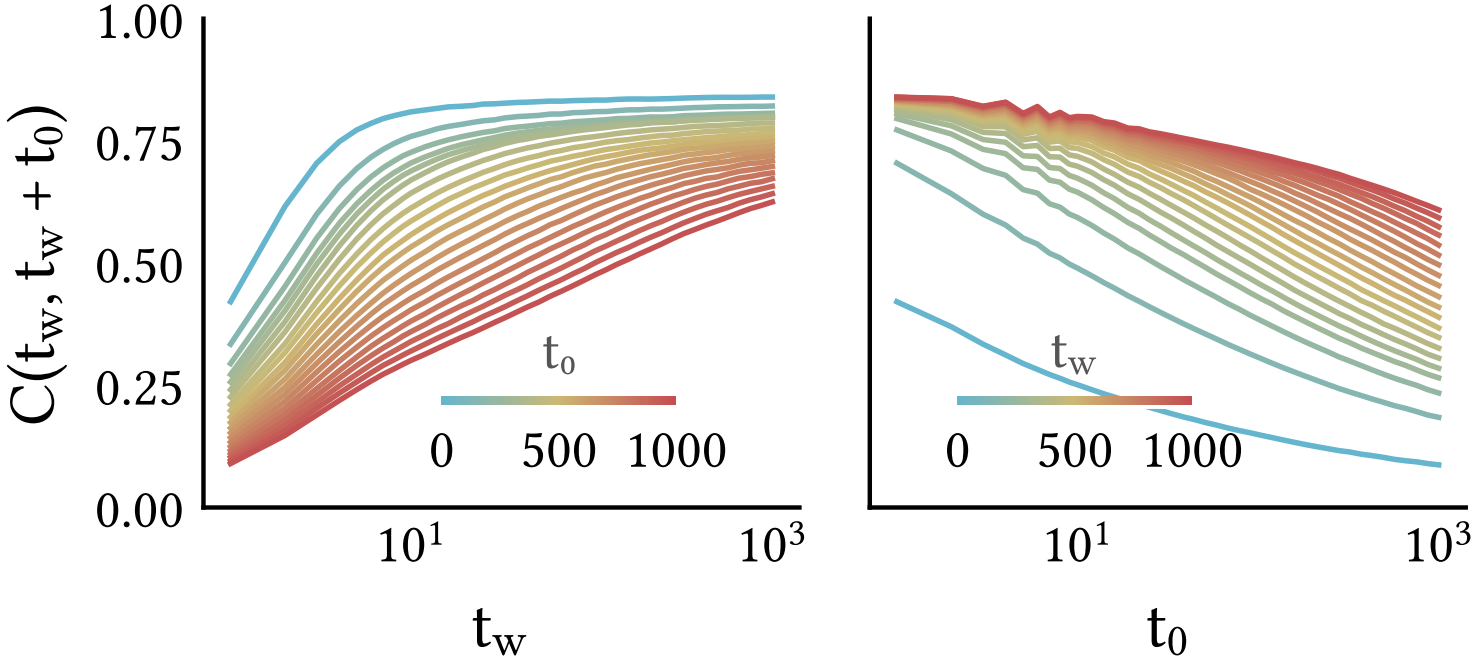
$$q = \frac{1}{V} \sum_i s_i^a s_i^b$$

Magnitudes


1.00
0.75
0.50
0.25
0.00
$C(t_w, t_w + t_0)$
t_0
0
500
1000
10^1
10^3
t_w
t_w
0
500
1000
10^1
10^3
t_0

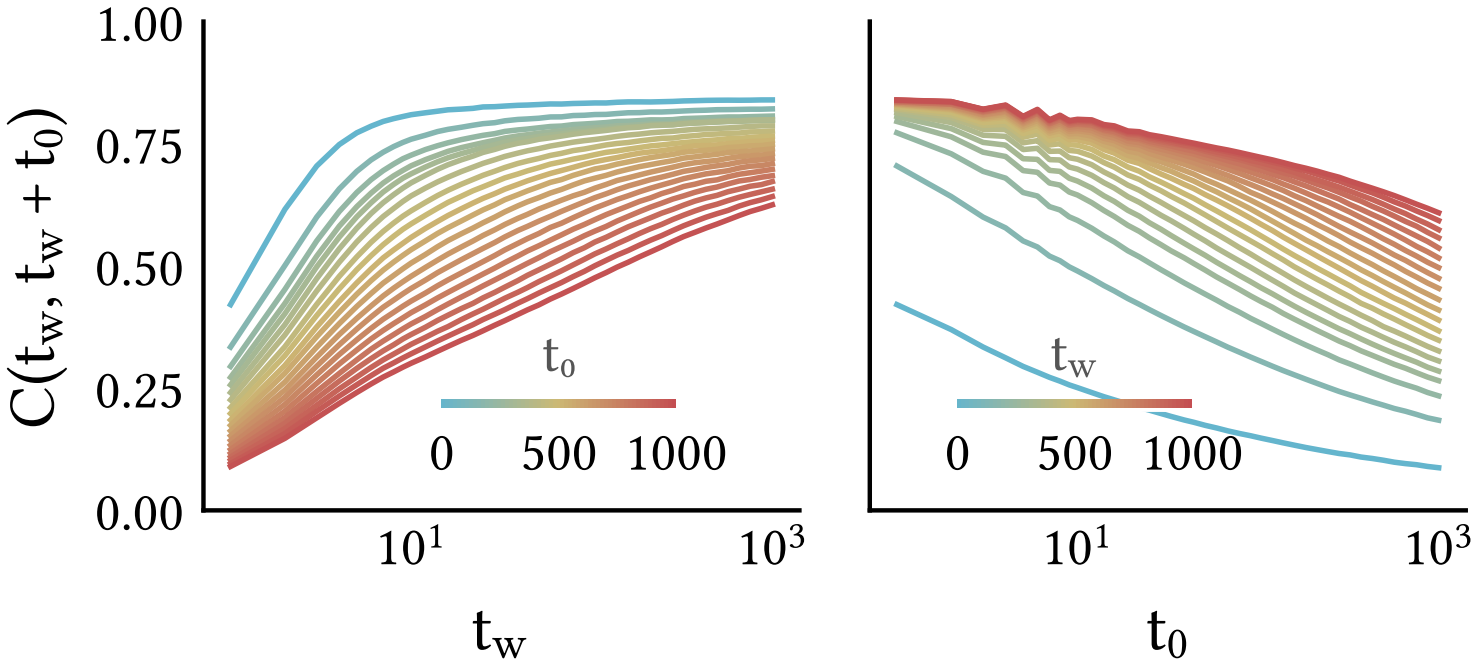

t_0
t_w
$t_w + t_0$
t

Magnitudes



$$C(t_w, t_w + t_0) = \frac{1}{V} \sum_i \langle s_i(t_w) \cdot s_i(t_w + t_0) \rangle$$

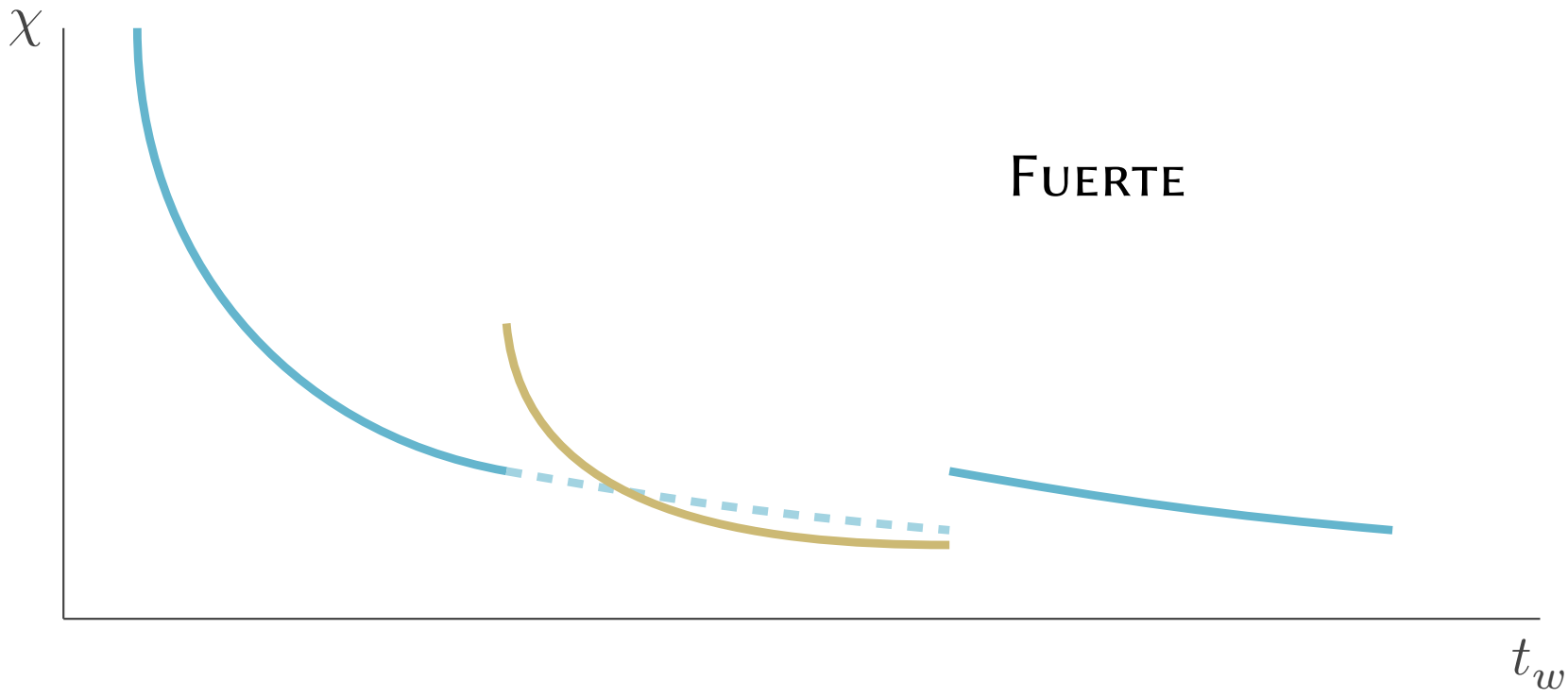
Magnitudes



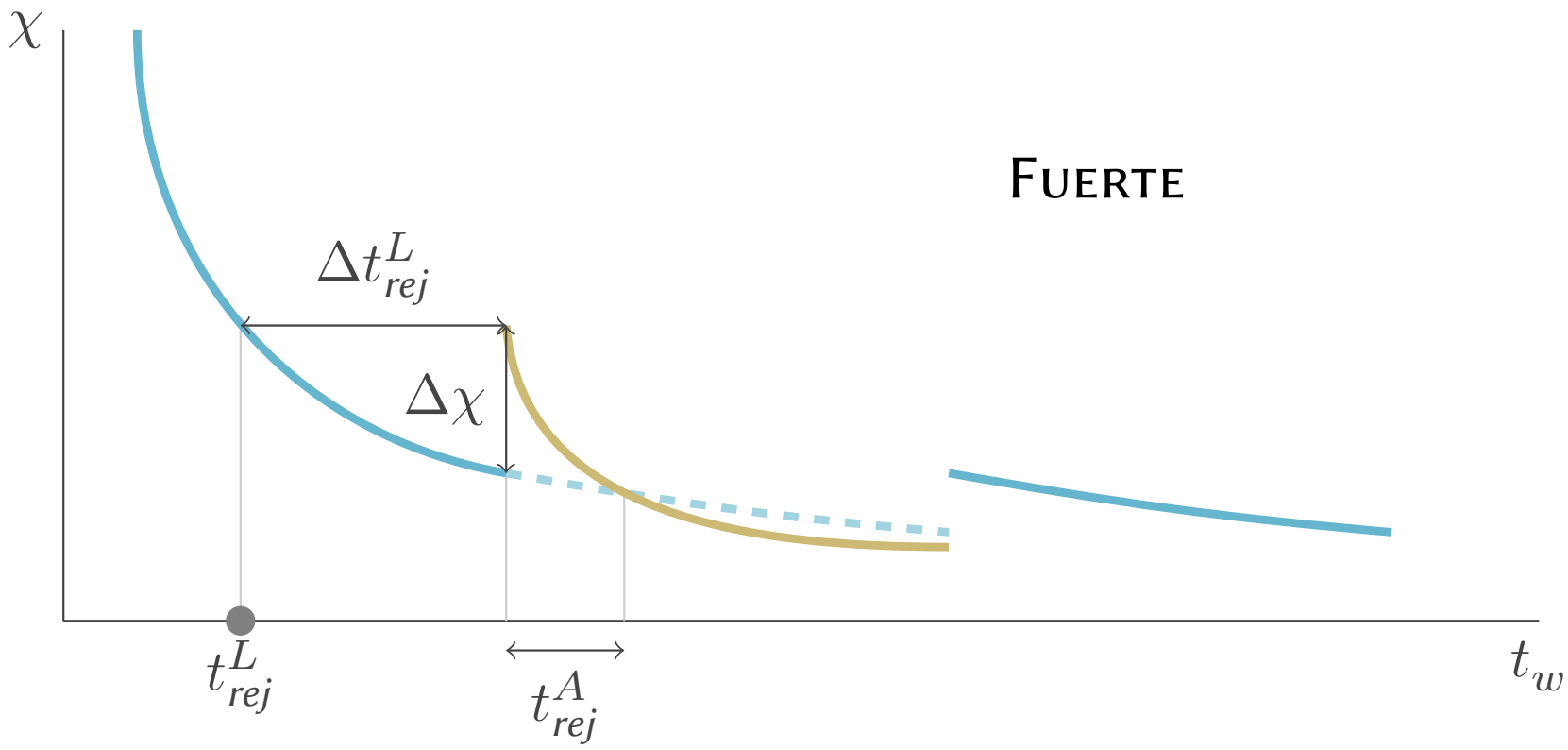
$$C(t_w, t_w + t_0) \rightarrow \boxed{\chi = \beta(1 - C)}$$

Rejuvenecimiento

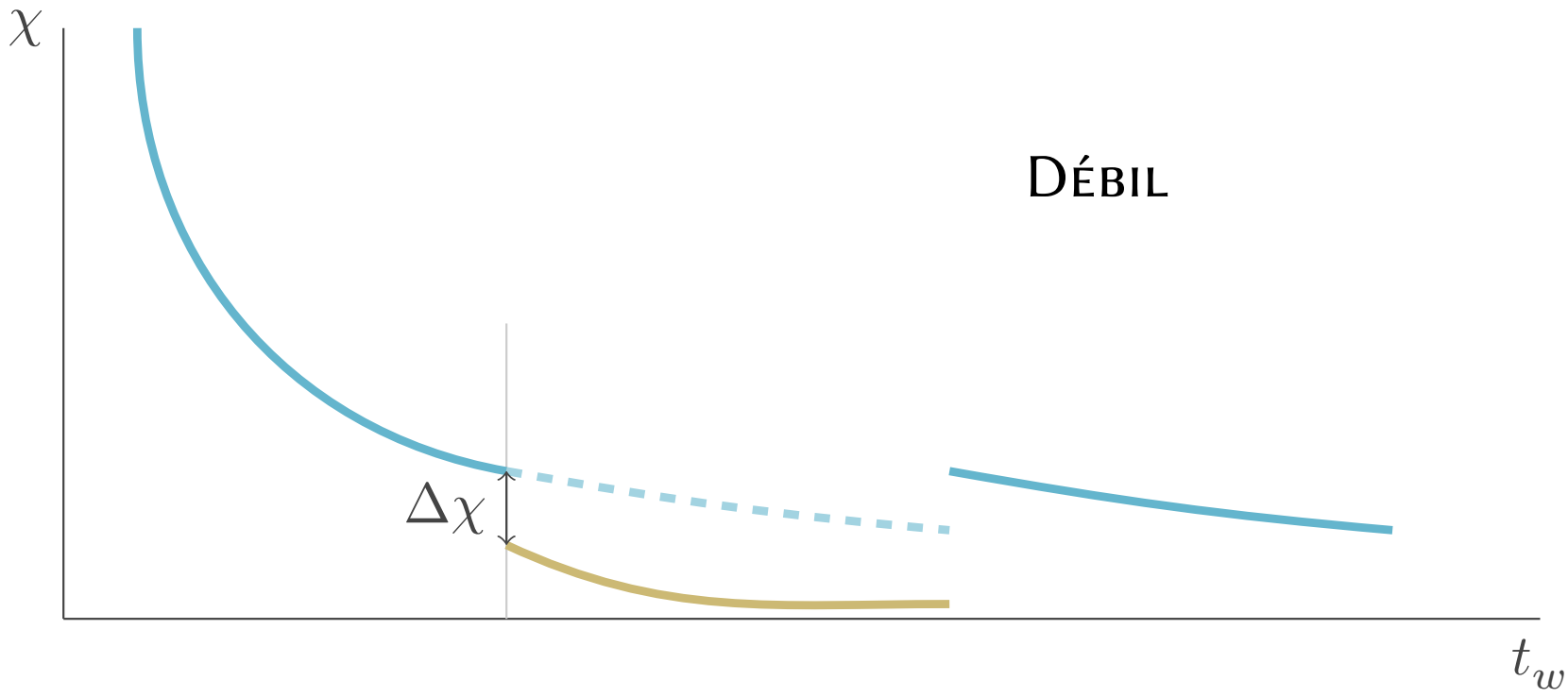
Rejuvenecimiento



Rejuvenecimiento

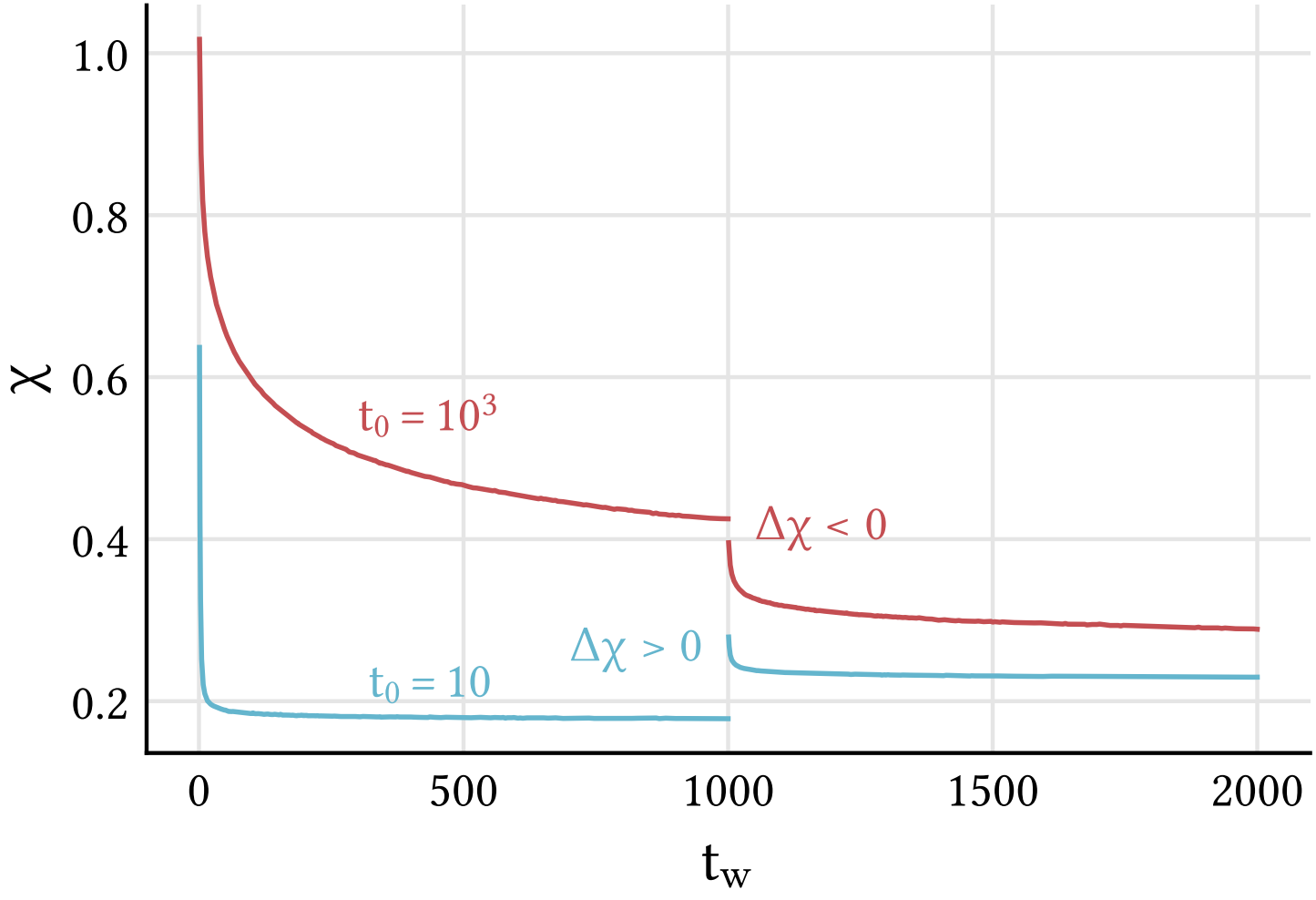


Rejuvenecimiento

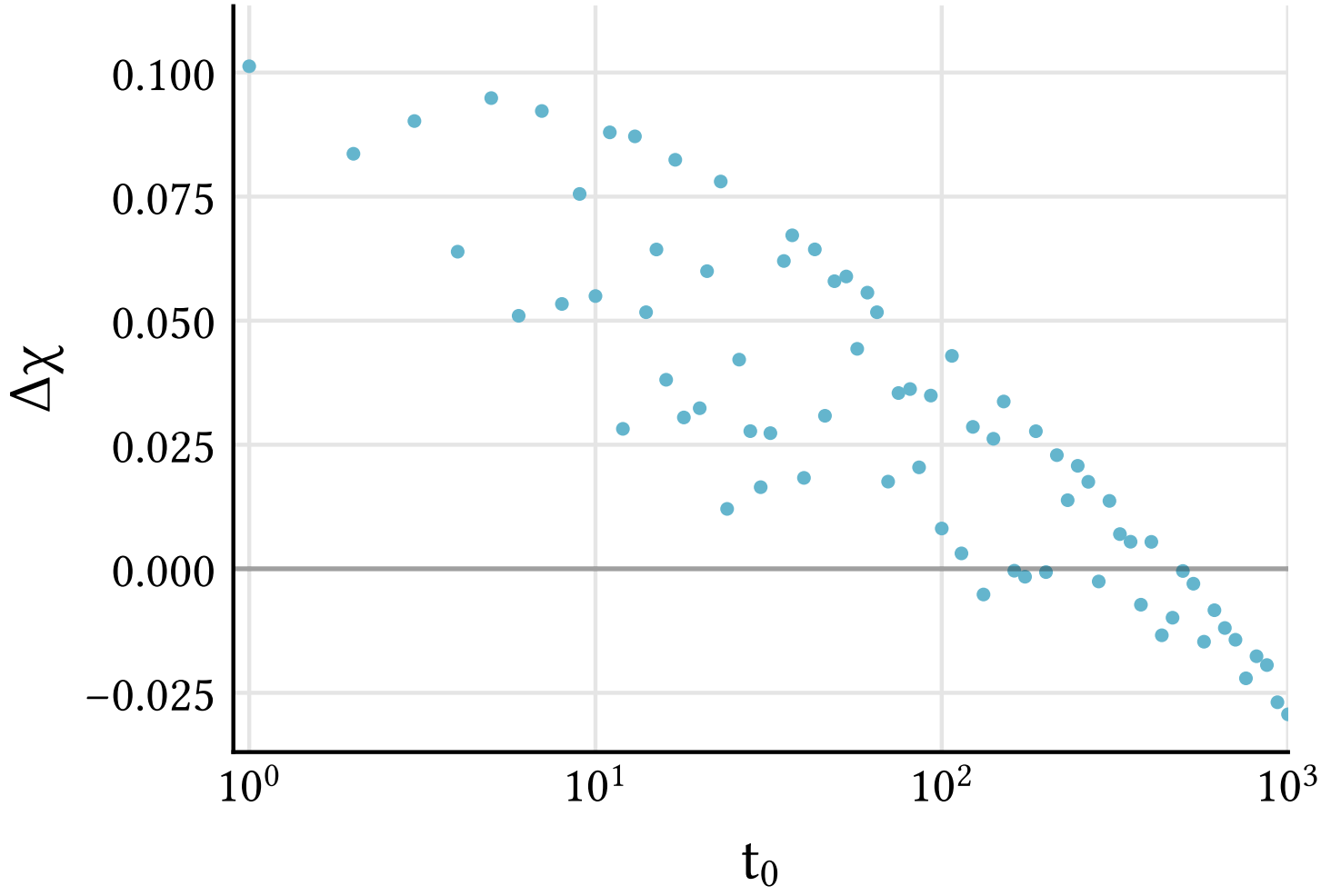


Rejuvenecimiento

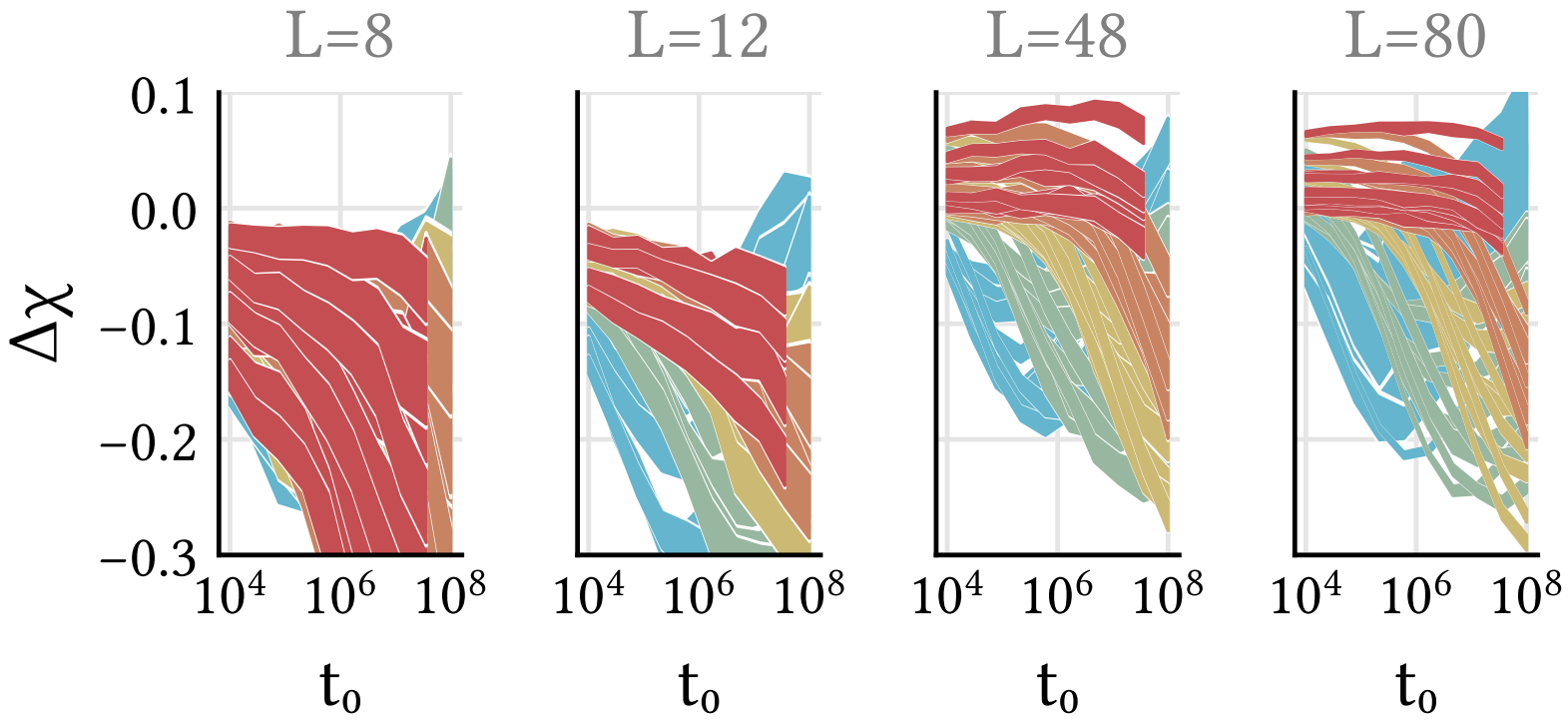
¿Por qué rejuvenecimiento débil?



Rejuvenecimiento

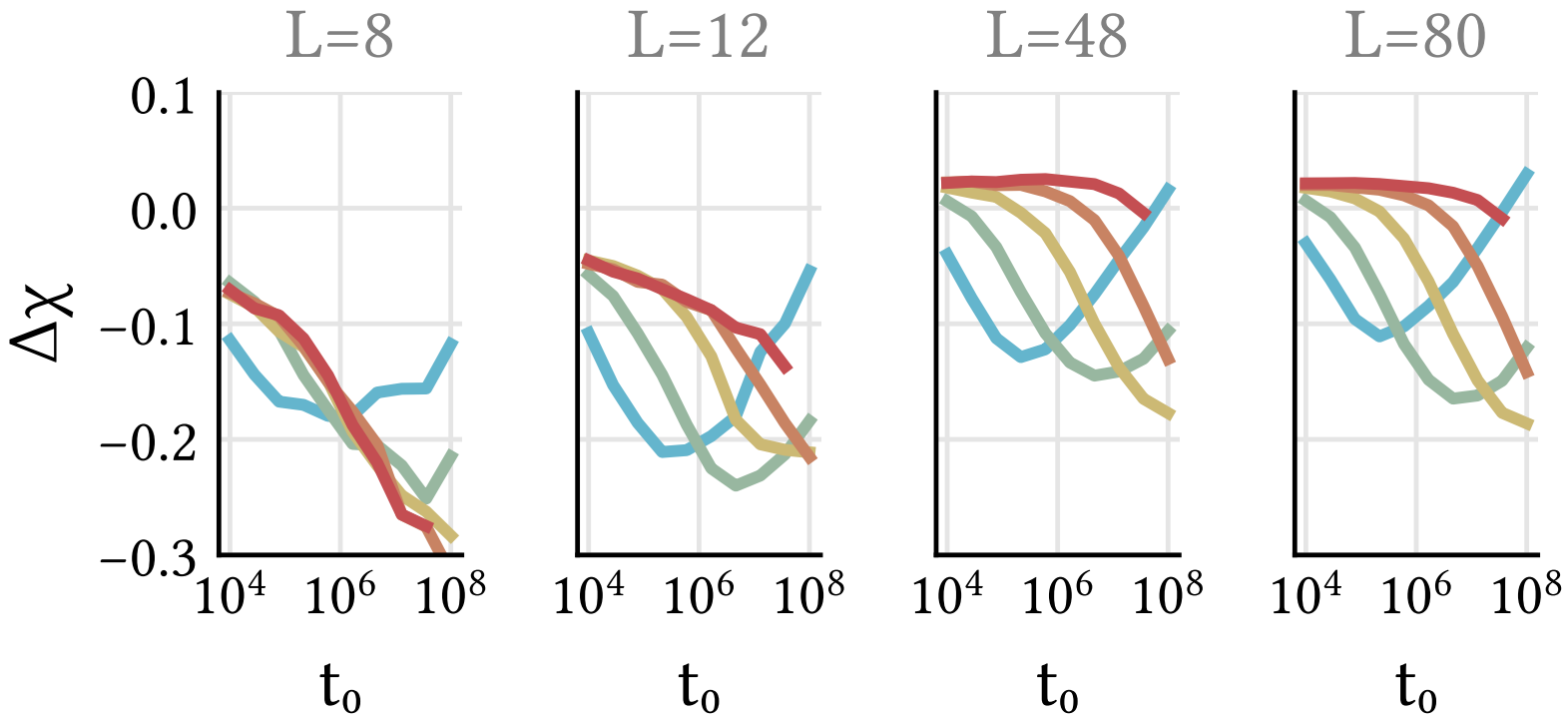


Rejuvenecimiento



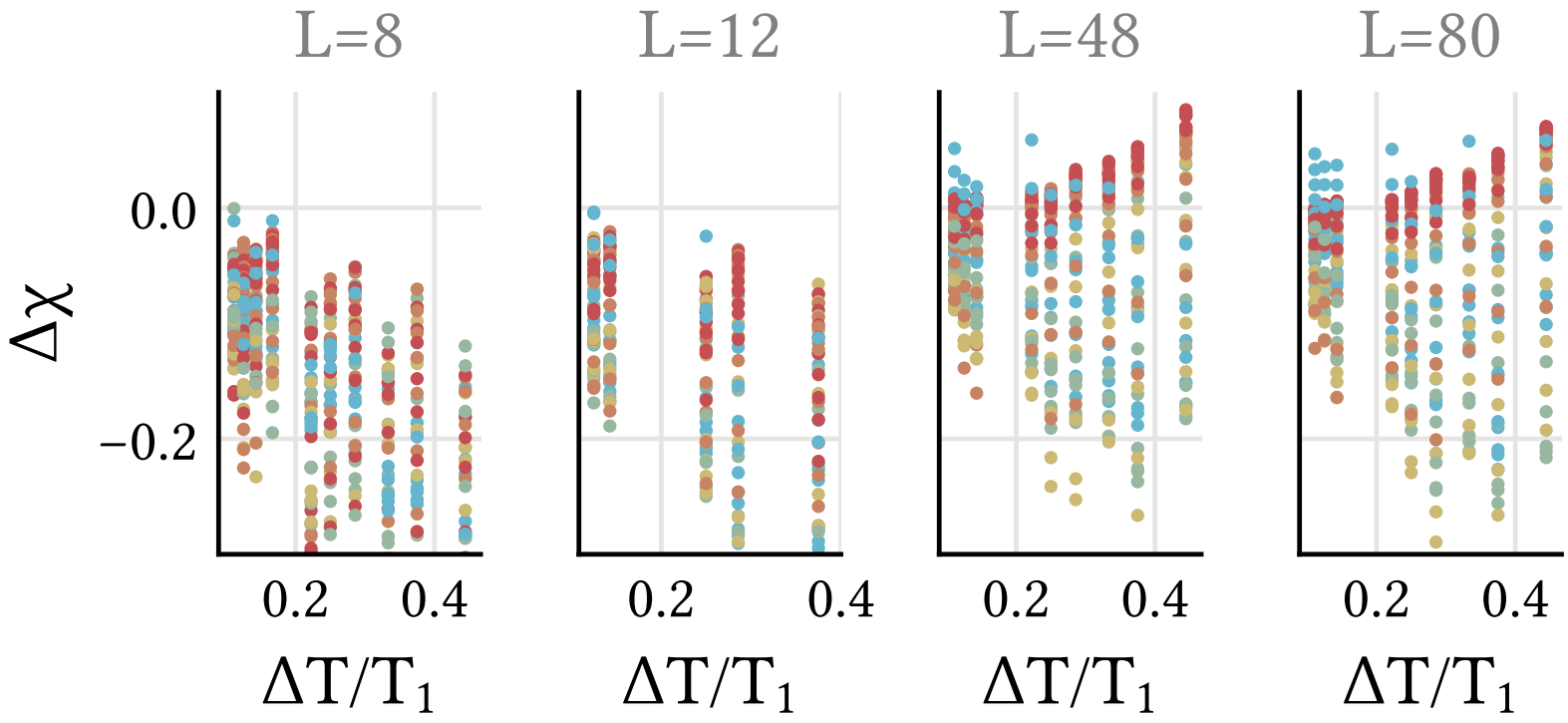
t_w^1: 10^4 (●), 10^5 (●), 10^6 (●), 10^7 (●), 10^8 (●)

Rejuvenecimiento



t_w^1: 10^4 (●), 10^5 (●), 10^6 (●), 10^7 (●), 10^8 (●)

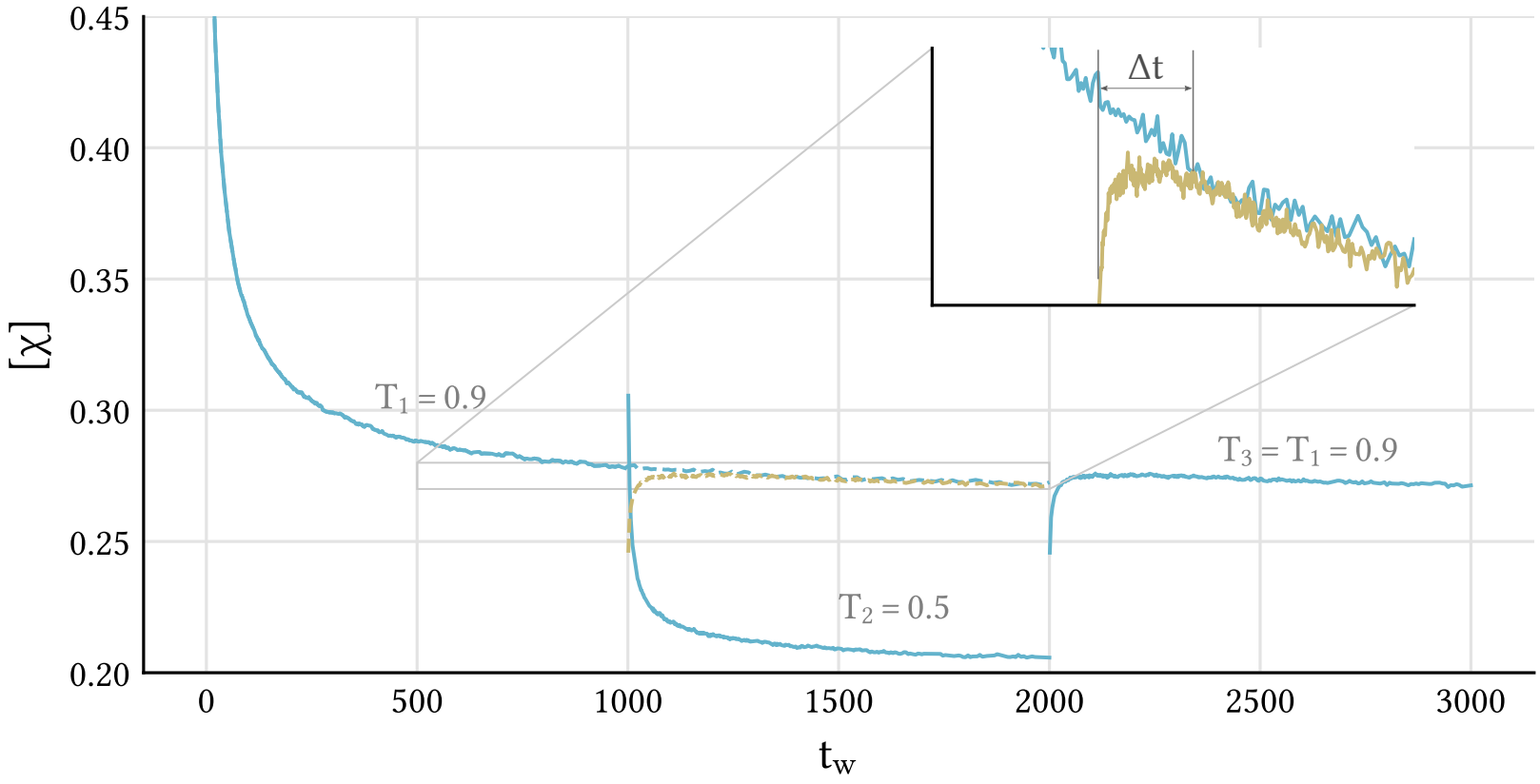
Rejuvenecimiento



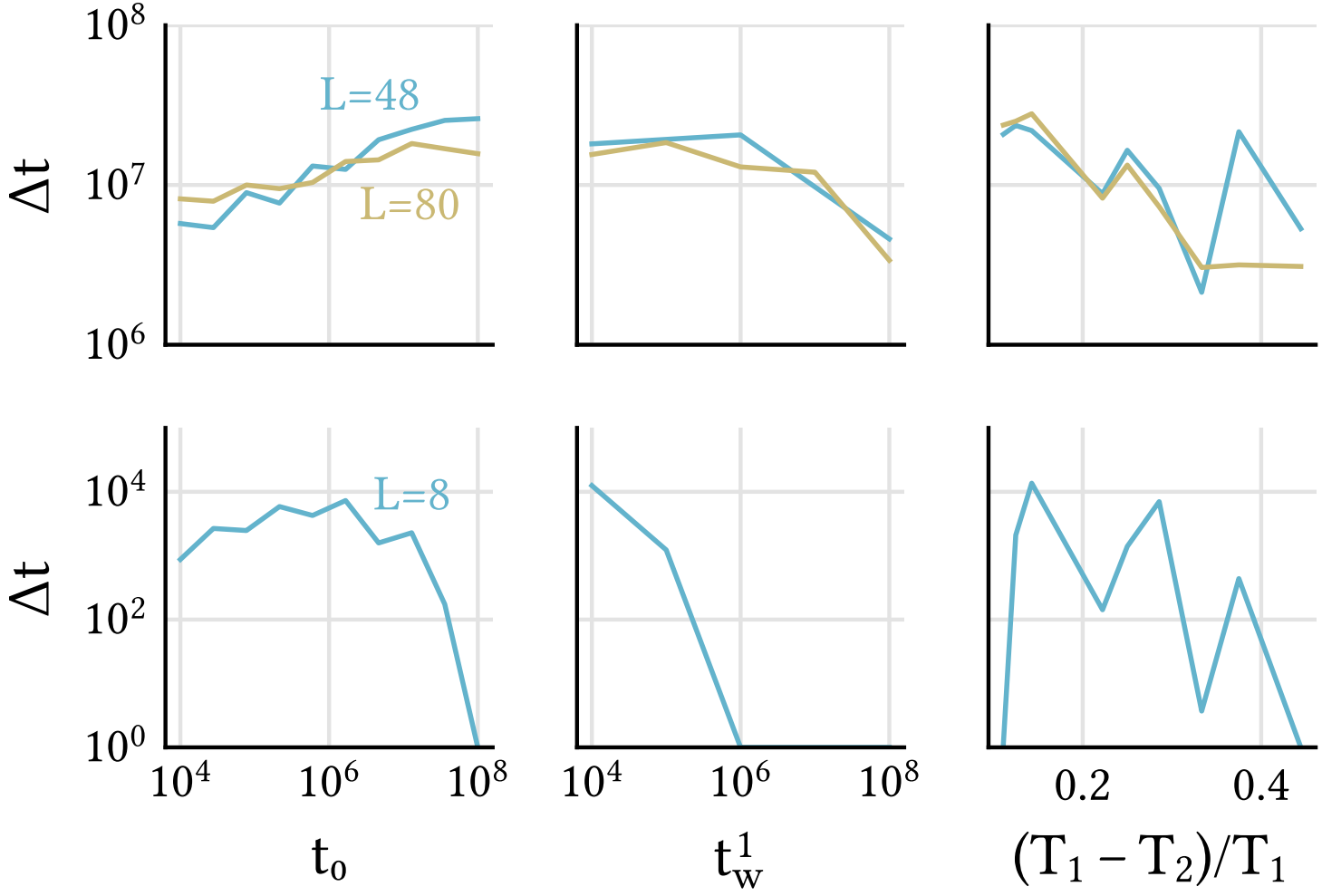
t_w^1: 10^4 (●), 10^5 (●), 10^6 (●), 10^7 (●), 10^8 (●)

Memoria

Memoria


0.45
0.40
0.35
0.30
0.25
0.20
[χ]
0
500
1000
1500
2000
2500
3000
t_w
$T_1 = 0.9$
$T_2 = 0.5$
$T_3 = T_1 = 0.9$
Δt

Memoria


10^8
10^7
10^6
Δt
L=48
L=80
10^4
10^2
10^0
L=8
10^4
10^6
10^8
t_0
t_w^1
0.2
0.4
$(T_1 - T_2)/T_1$

Conclusiones

- Dificultad computacional
- Problemas técnicos, planificación
- Rejuvenecimiento débil
- Memoria robusta

Agradecimientos a BIFI y Janus Collaboration