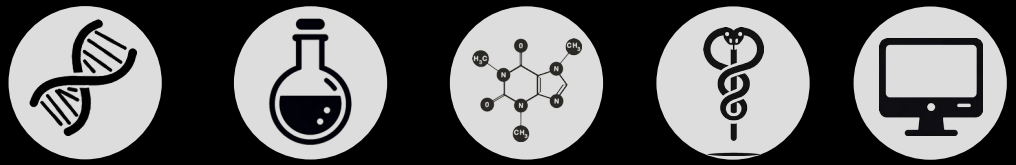
Grupo de Ciencia Computacional HIMFG



Advertencia para quienes se adentran en espacios multidimensionales

10 Julio 2024 || Diego Prada Gracia @ Grupo de Ciencia Computacional HIMFG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BY NC SA

Espacios Multidimensionales


DO NOT
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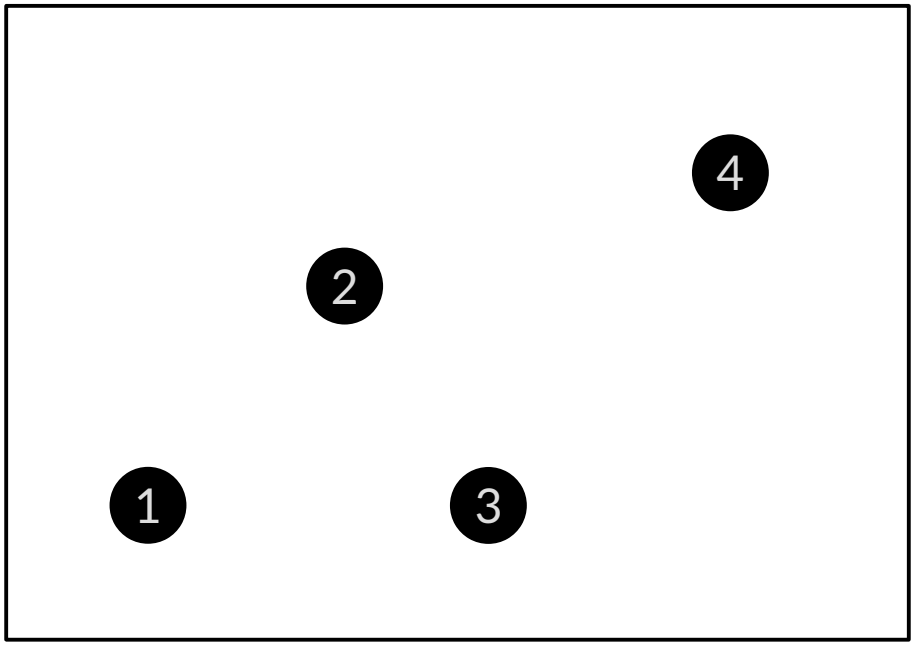
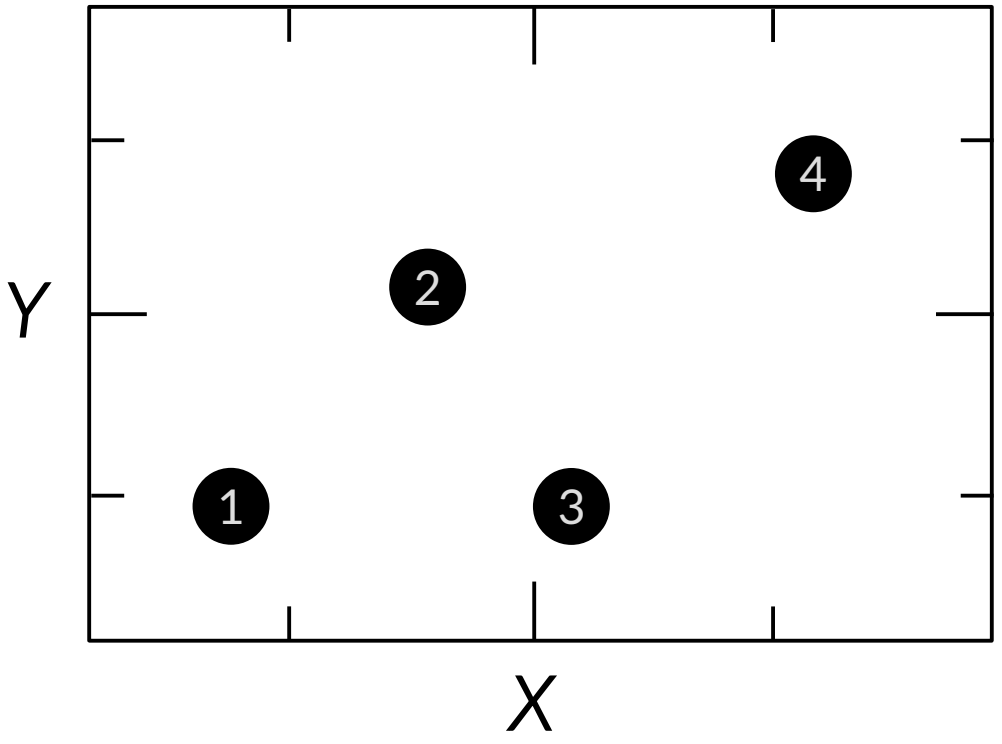
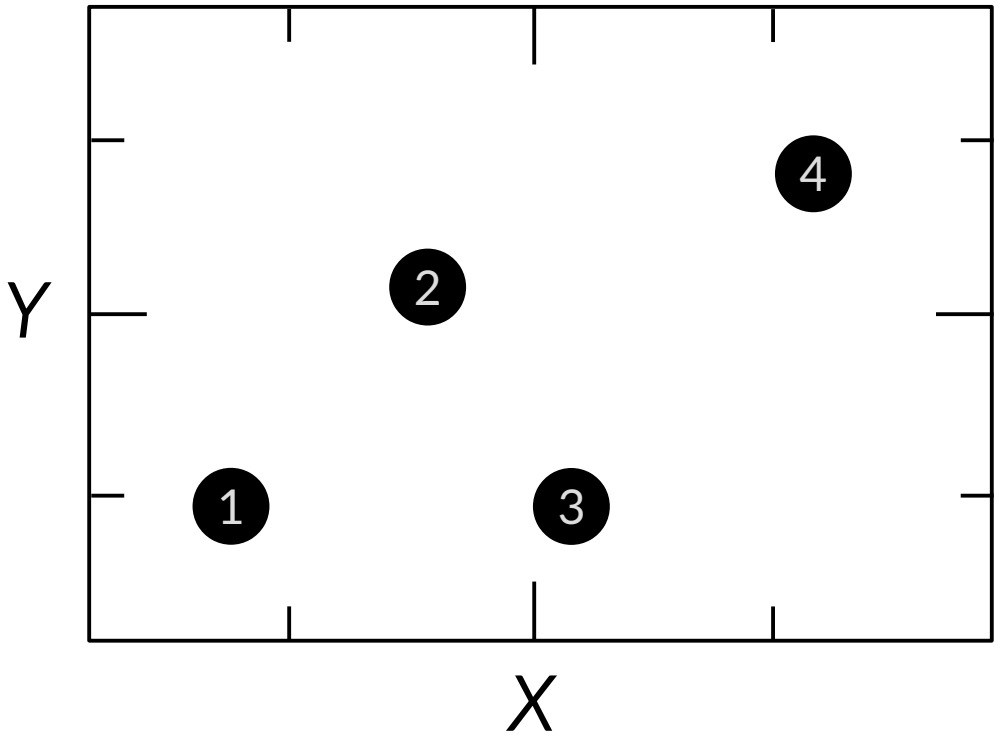
¿Por qué correr el riesgo?

La mayoría de sistemas que estudiamos necesitan de múltiples coordenadas para determinar su estado

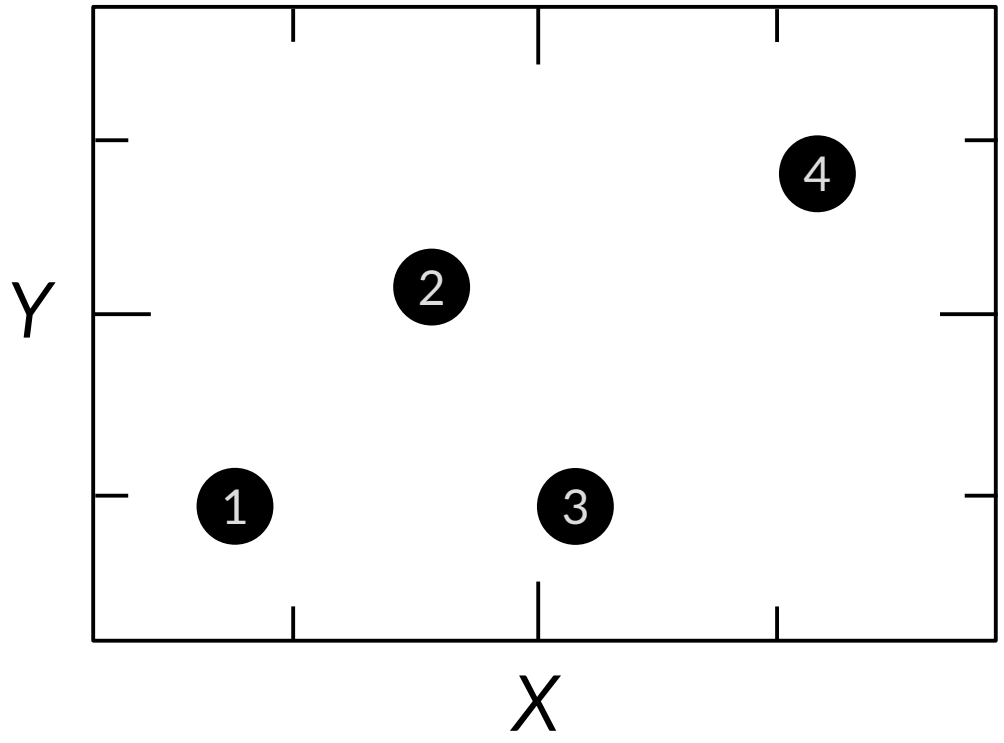


4 partículas distinguibles en una caja bidimensional cerrada...

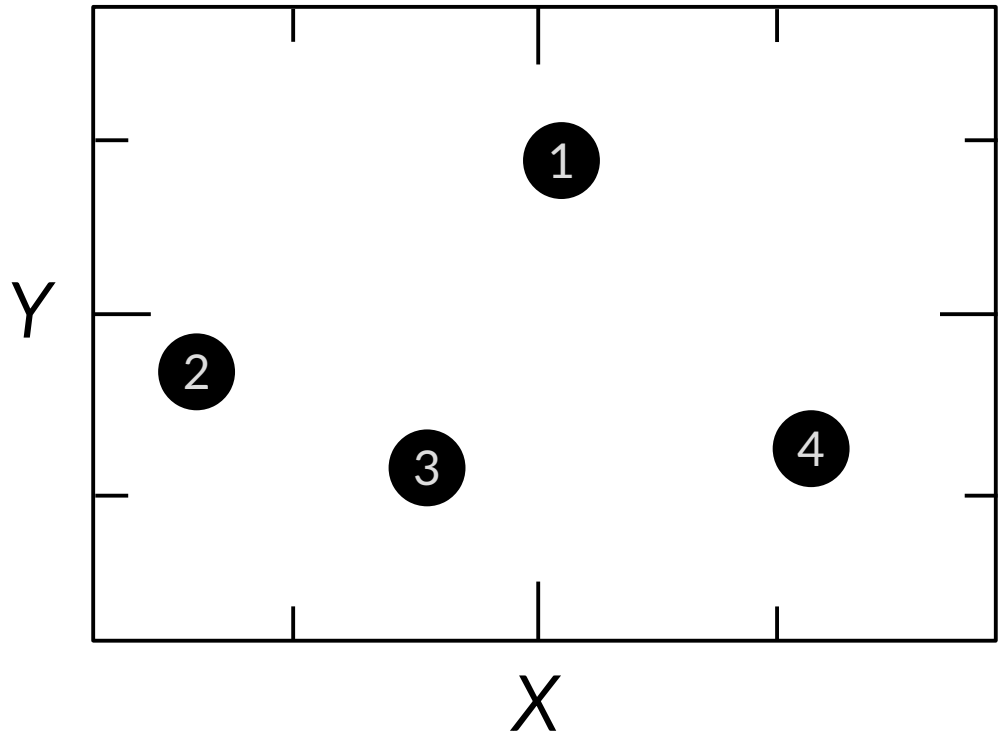

Y
X
1
2
3
4



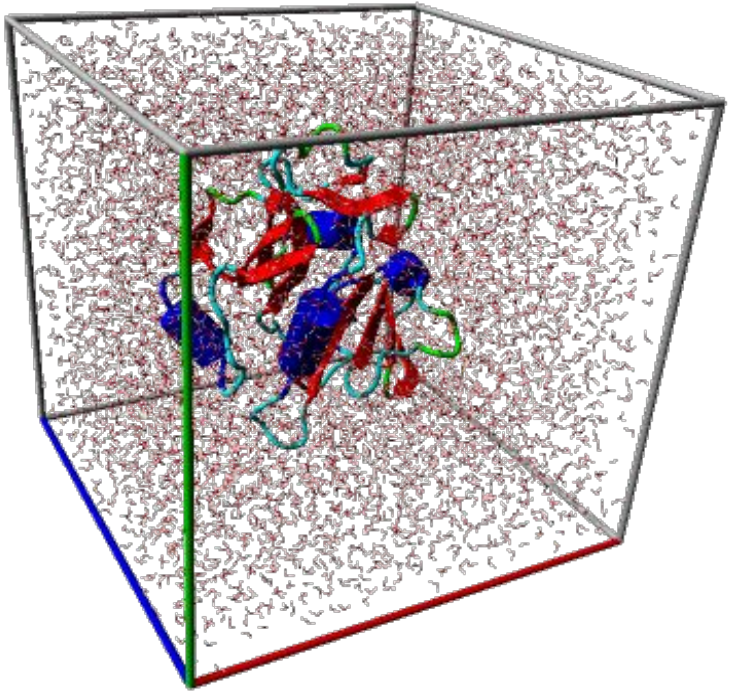
$$\vec{r} = (x_1, y_1, x_2, y_2, x_3, y_3, x_4, y_4)$$



$$\vec{r} = (0.6, 0.9, 1.7, 2.1, 2.2, 0.6, 3.2, 2.8)$$



$$\vec{r} = (2.1, 1.8, 0.6, 1.7, 1.6, 1.2, 3.1, 1.2)$$




DO NOT
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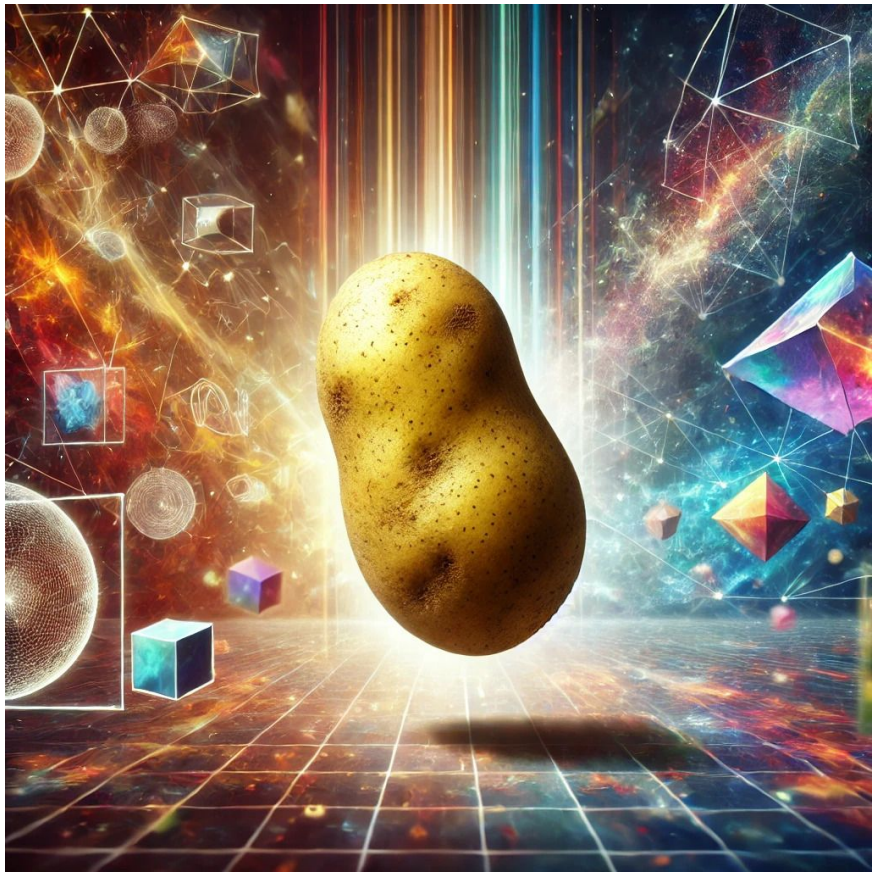


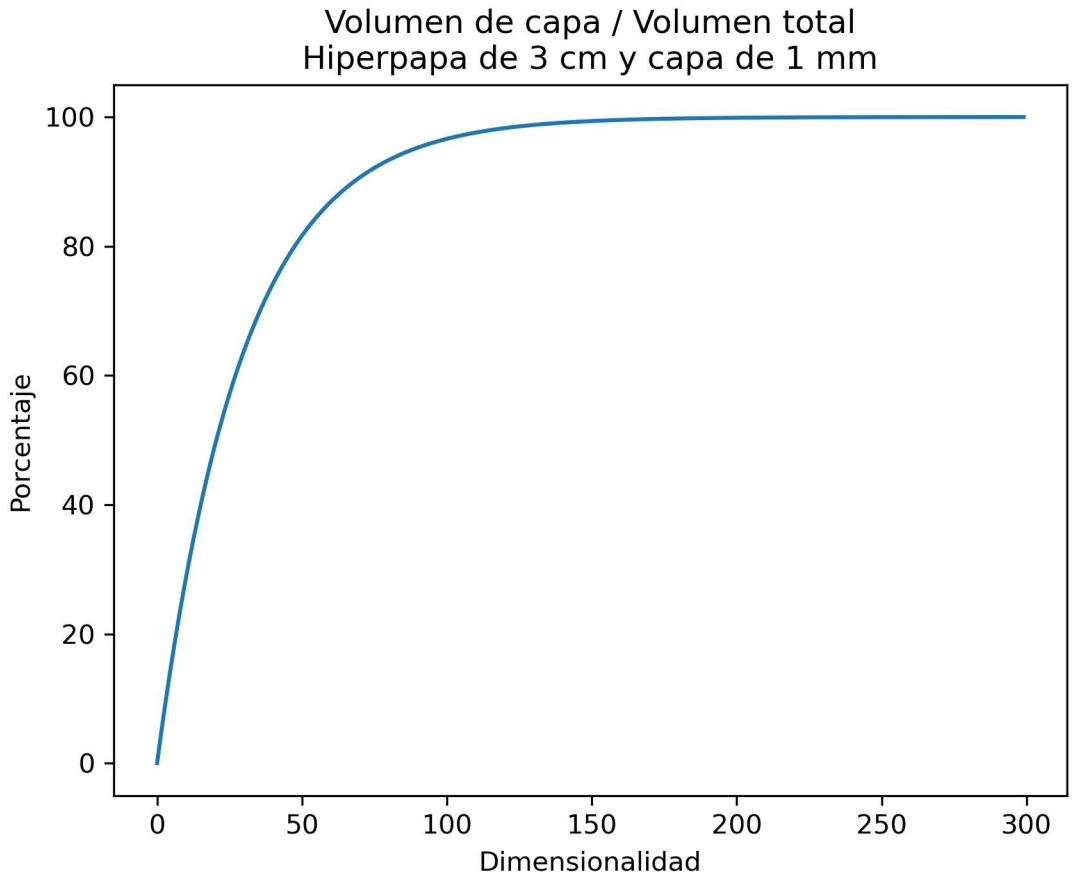
¿Comerías una papa multidimensional pelada o sin pelar?

Sea una papa hiperesférica de volumen:

$$V_n(r) = \frac{\pi^{n/2} \cdot r^n}{\Gamma(n/2+1)}$$

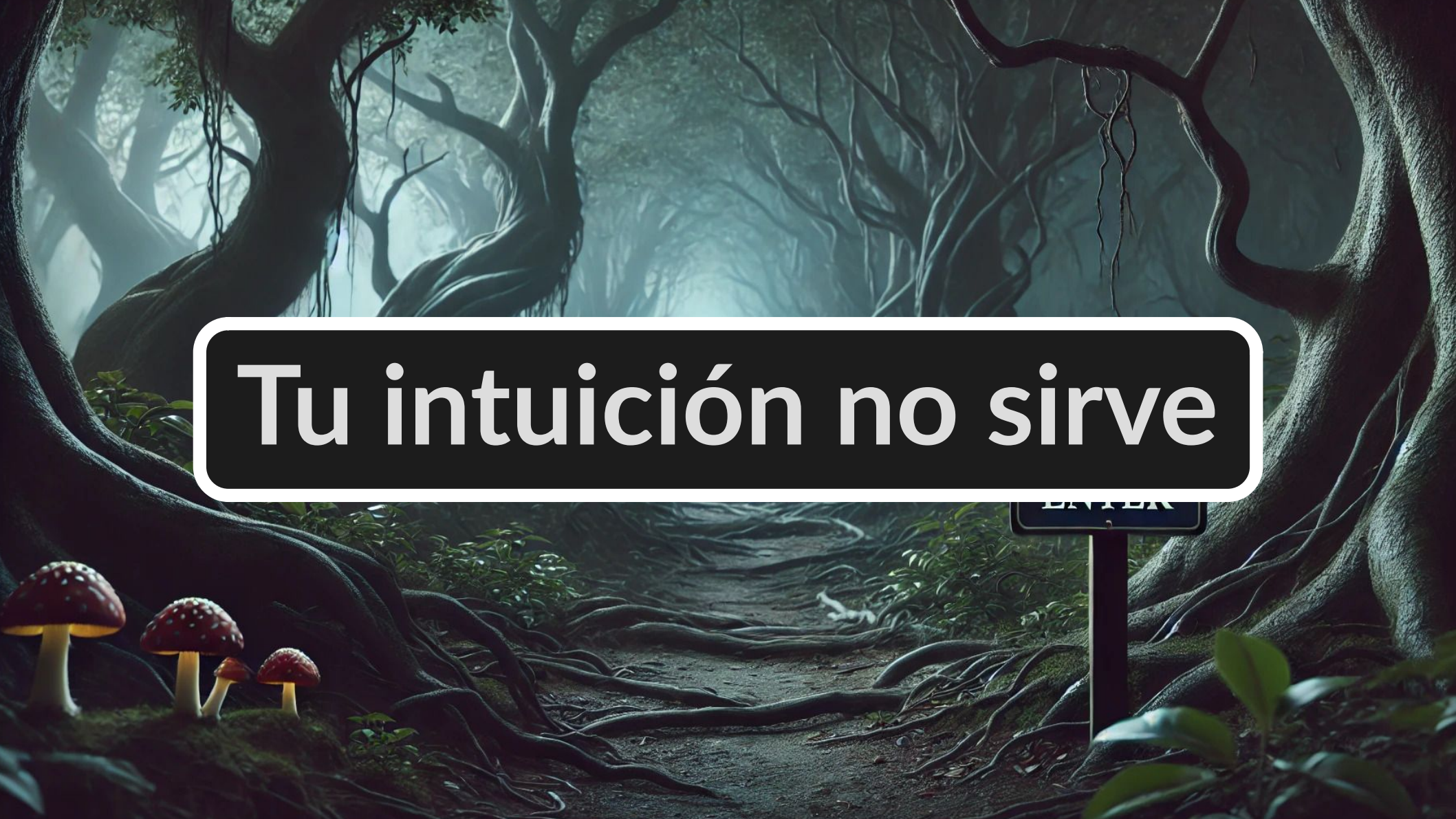
¿Qué porcentaje de volumen representa la fina capa exterior?

$$\frac{V_n(r) - V_n(r-\epsilon)}{V_n(r)} \cdot 100$$


Volumen de capa / Volumen total
Hiperpapa de 3 cm y capa de 1 mm
Porcentaje
100
80
60
40
20
0
0
50
100
150
200
250
300
Dimensionalidad

¿Qué otras "paradojas" encontrarás en un hiperespacio?

- Fenómeno de la distancia de concentración
- Paradoja de Borel
- Separabilidad en espacios de alta dimensionalidad
- Maldición de la dimensionalidad
- Concentración de la medida
- ...


Tu intuición no sirve

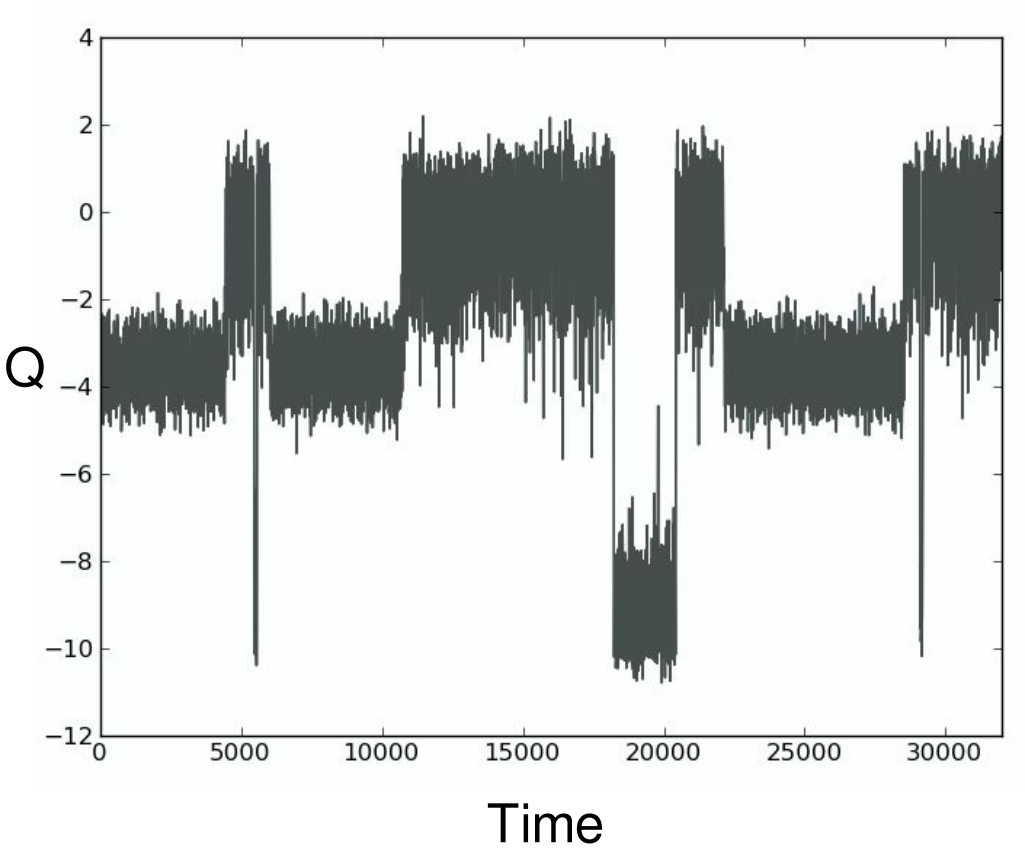

DO NOT
ENTER

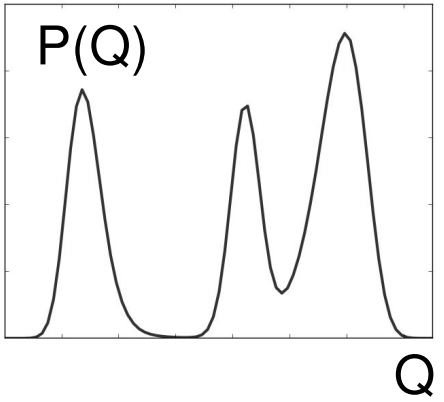
Pero espera...

...observamos los sistemas multidimensionales a través de sus proyecciones.

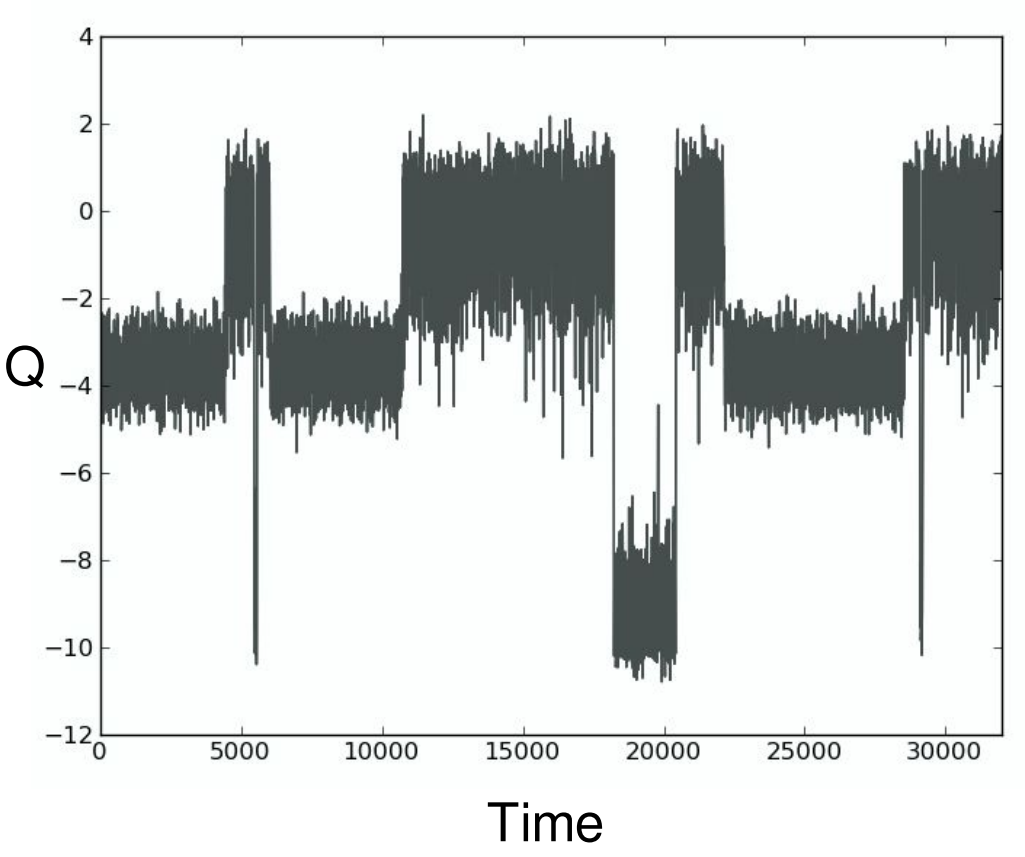
Caso 0

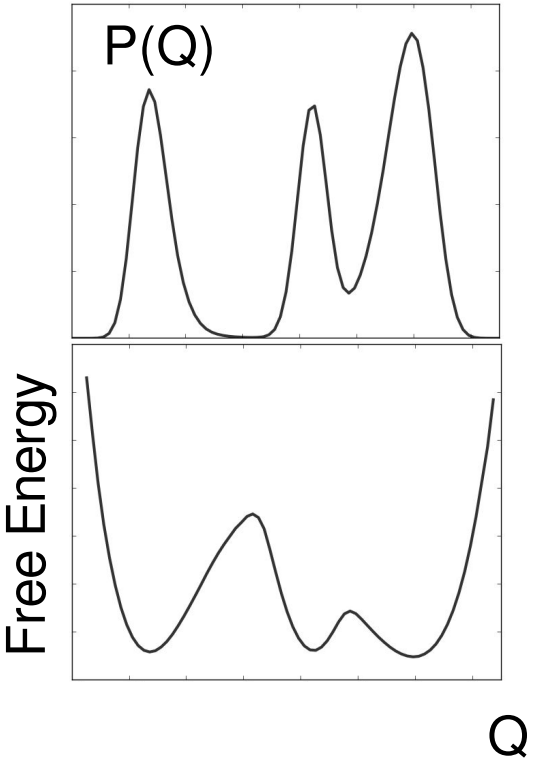
Caso I



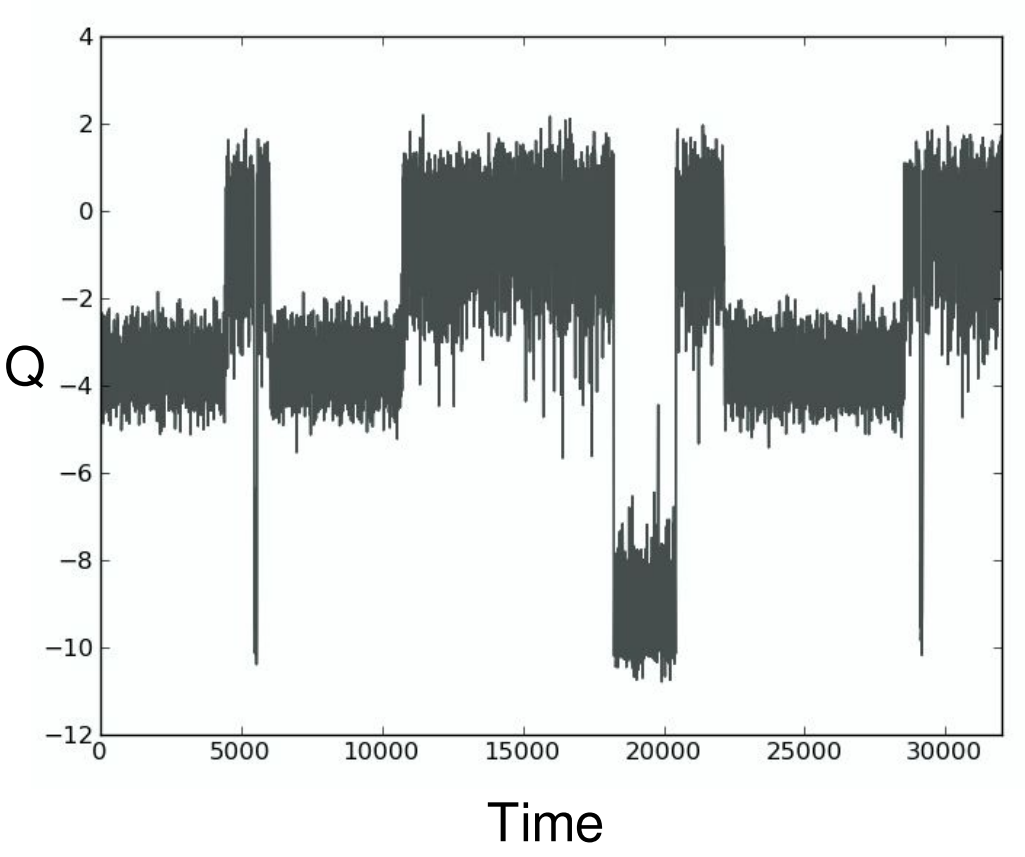


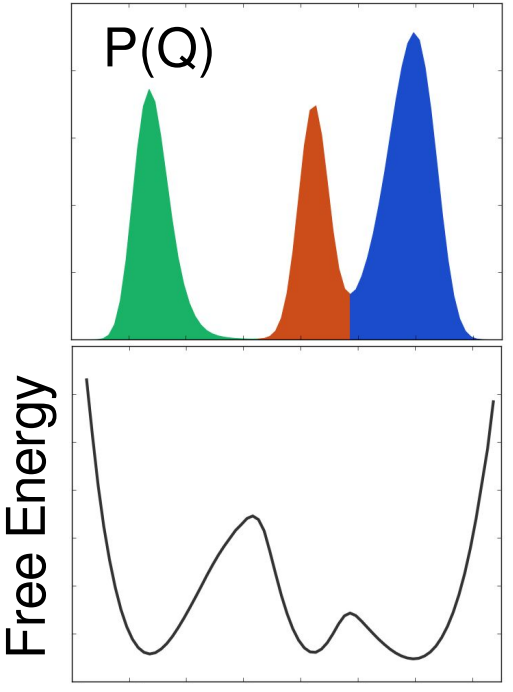
Caso I


4
2
0
−2
−4
−6
−8
−10
−12
Q
0
5000
10000
15000
20000
25000
30000
Time

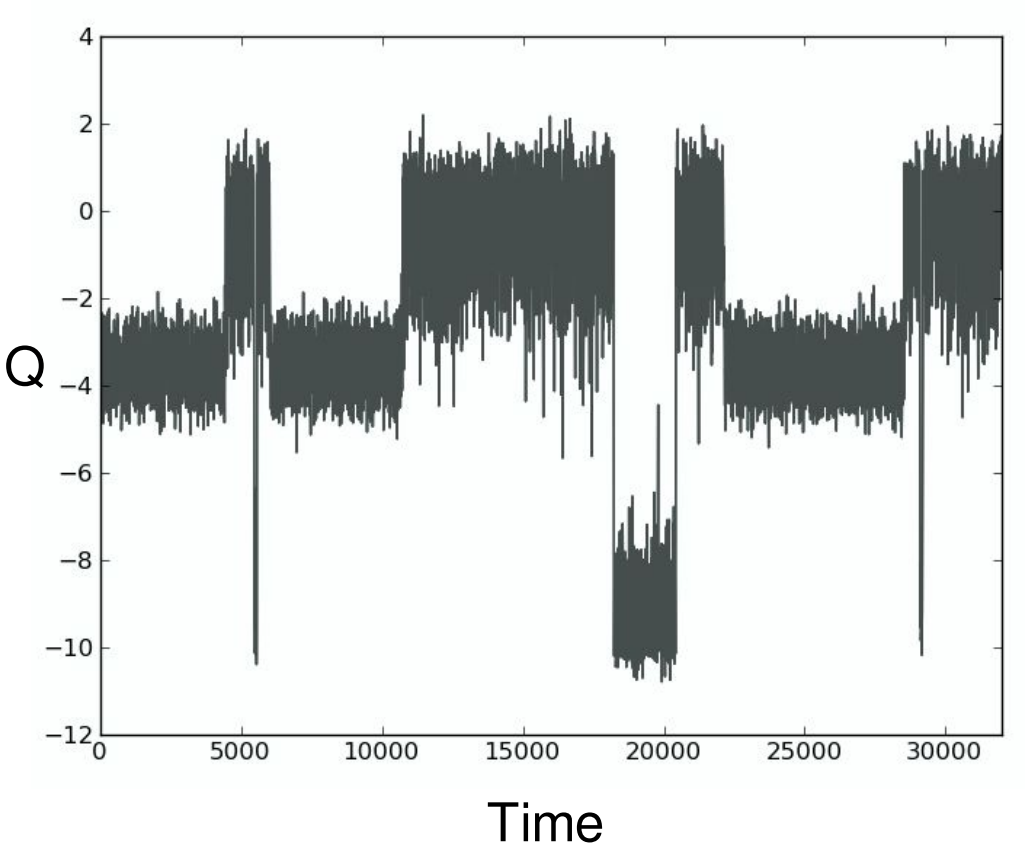

P(Q)
Free Energy
Q

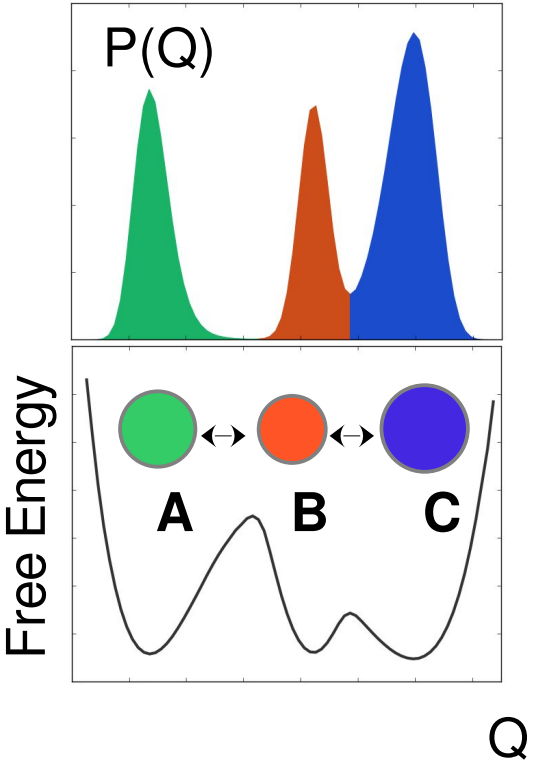
Caso I


Q
Time
4
2
0
−2
−4
−6
−8
−10
−12
0
5000
10000
15000
20000
25000
30000

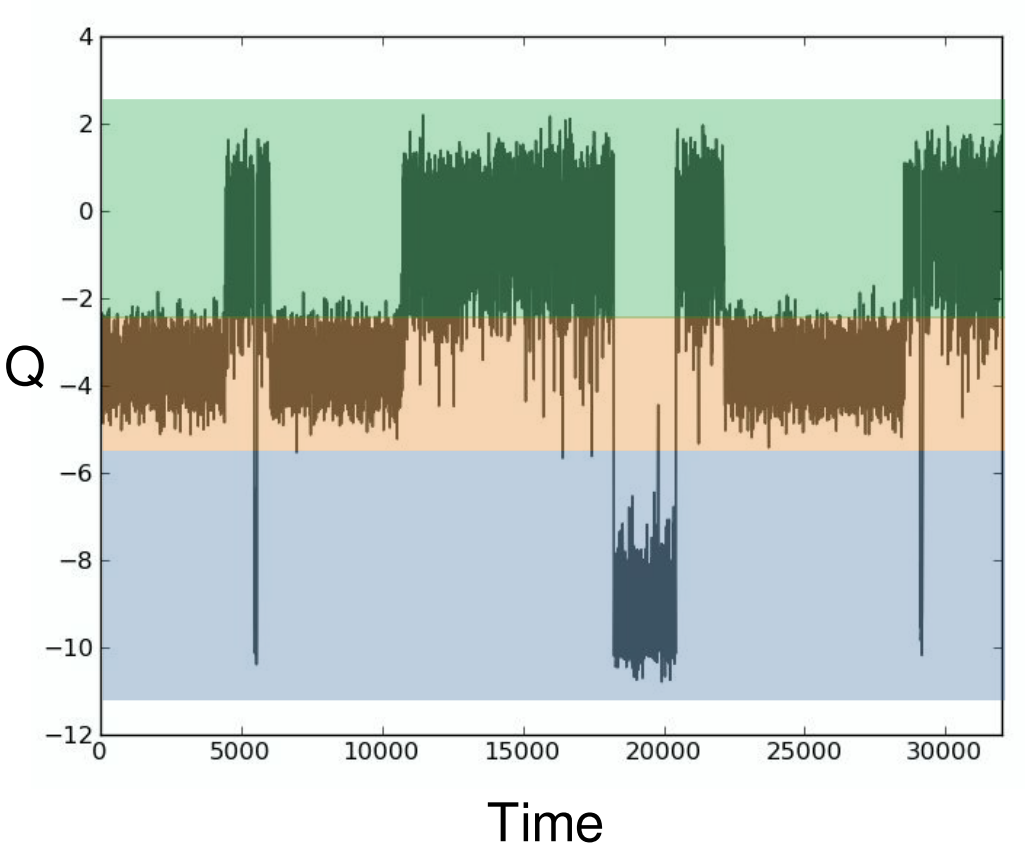

P(Q)
Free Energy

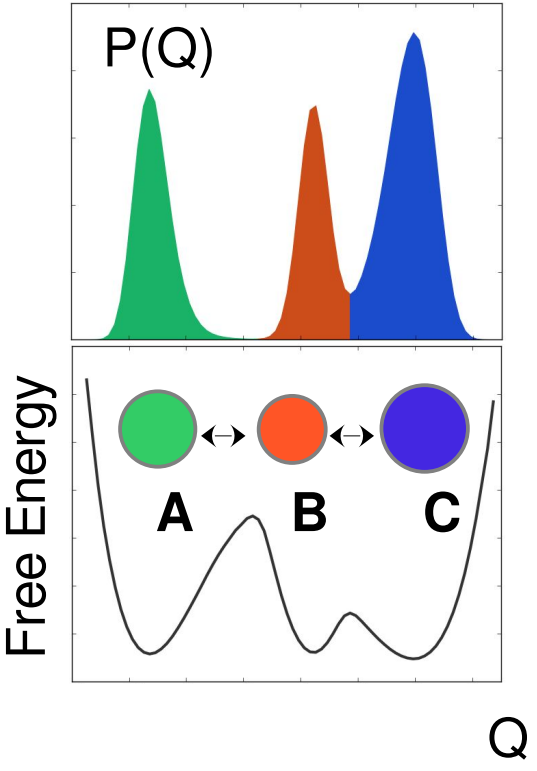
Caso I


Q
Time
4
2
0
−2
−4
−6
−8
−10
−12
0
5000
10000
15000
20000
25000
30000

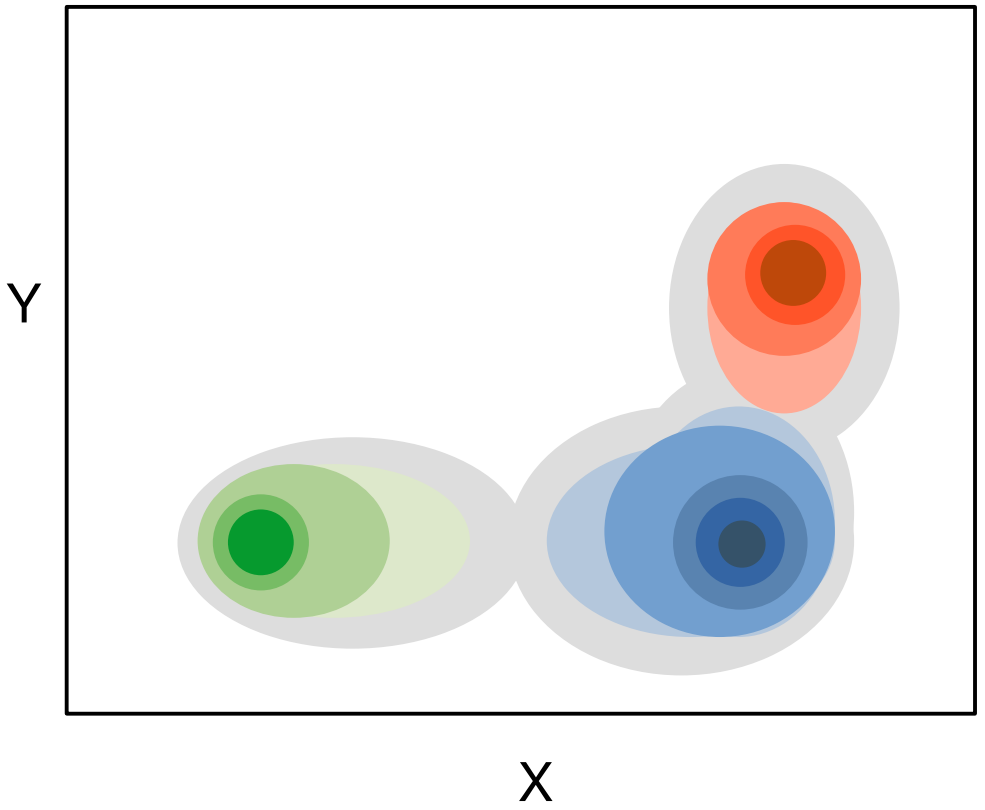

P(Q)
Free Energy
A
B
C
Q

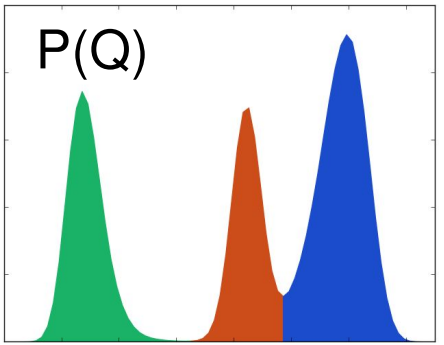
Caso I


Q
Time
4
2
0
−2
−4
−6
−8
−10
−12
0
5000
10000
15000
20000
25000
30000

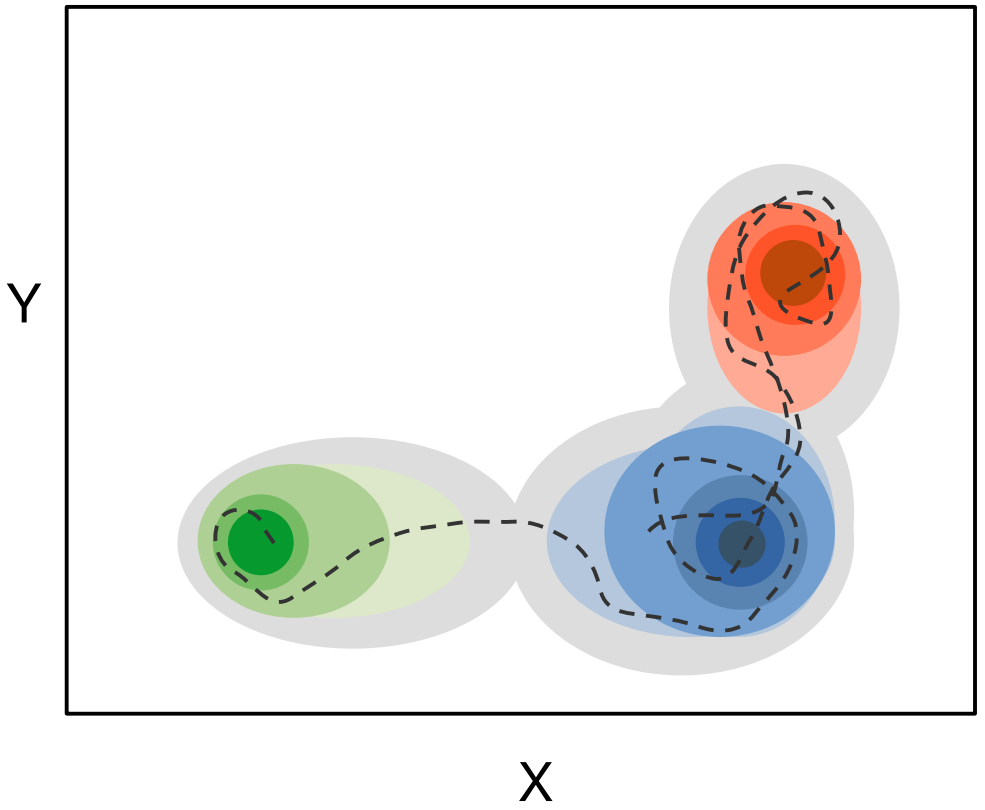

P(Q)
Free Energy
A
B
C
Q

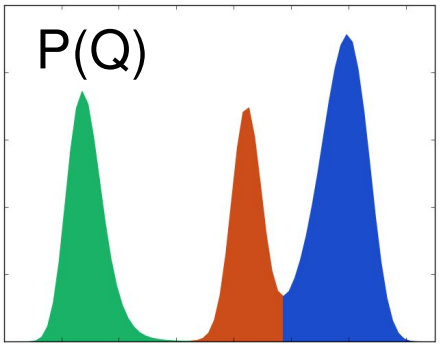
Caso I



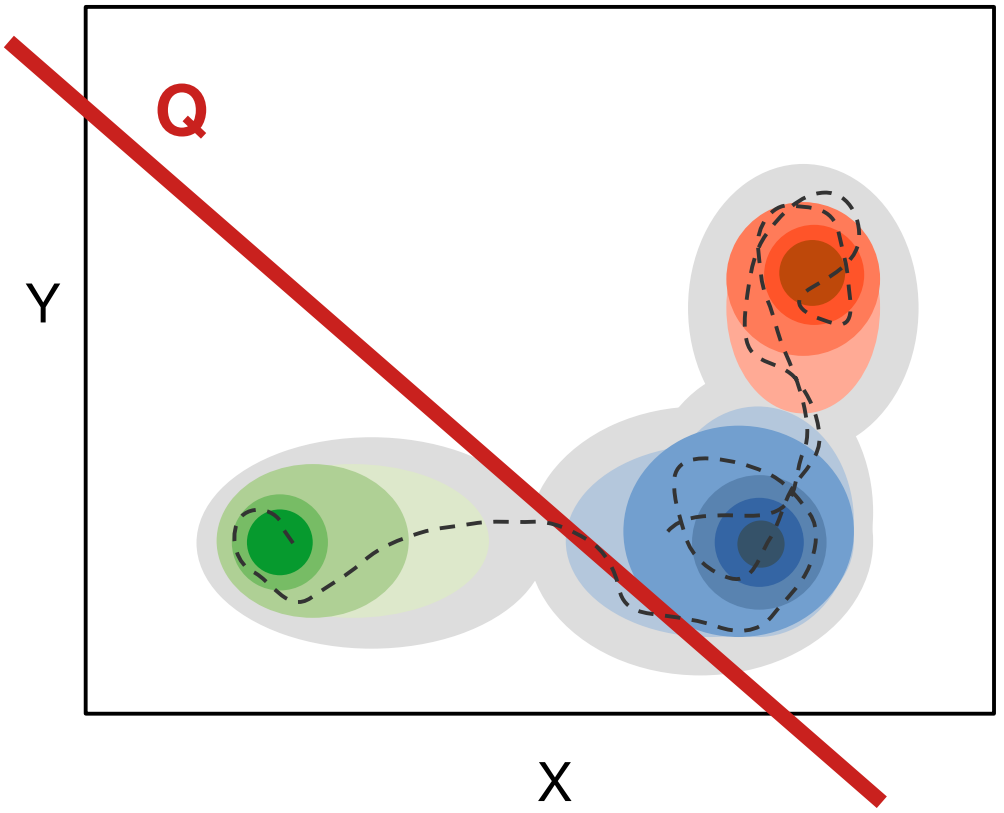


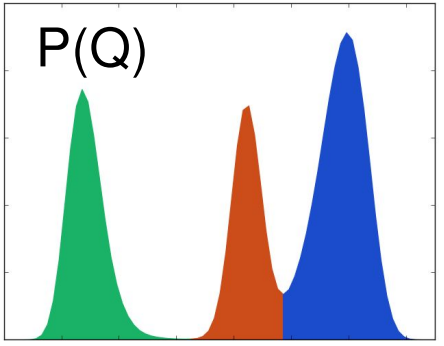
Caso I



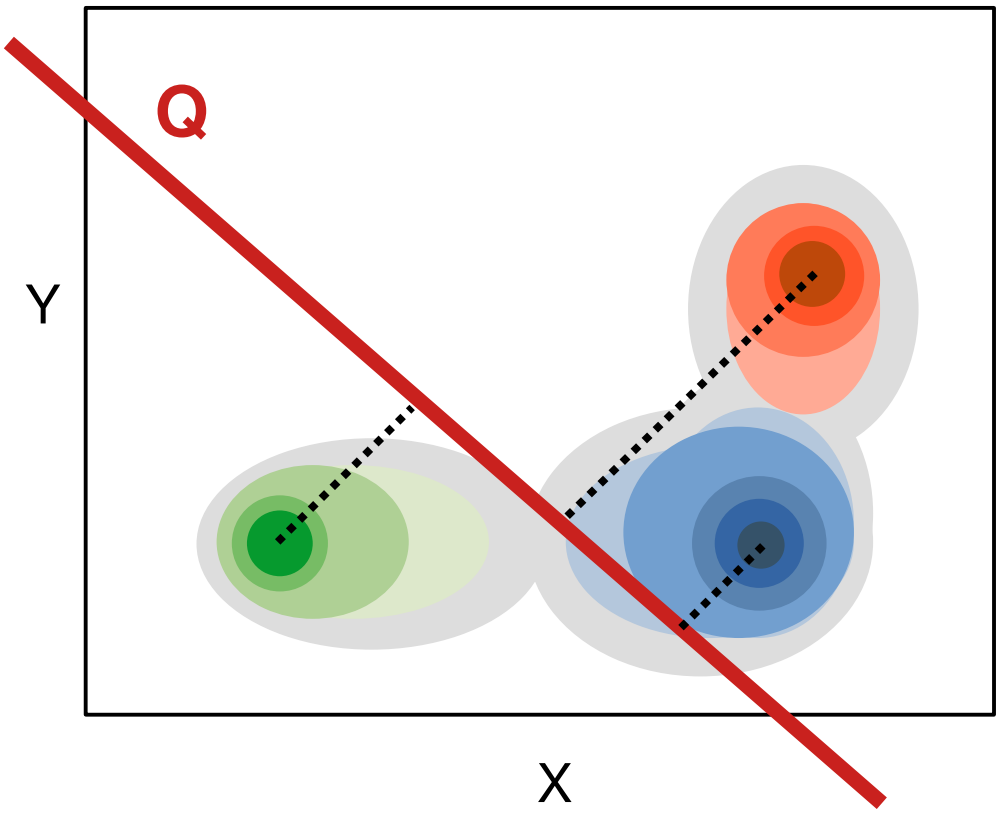


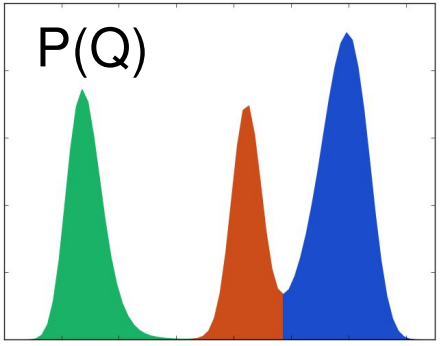
Caso I



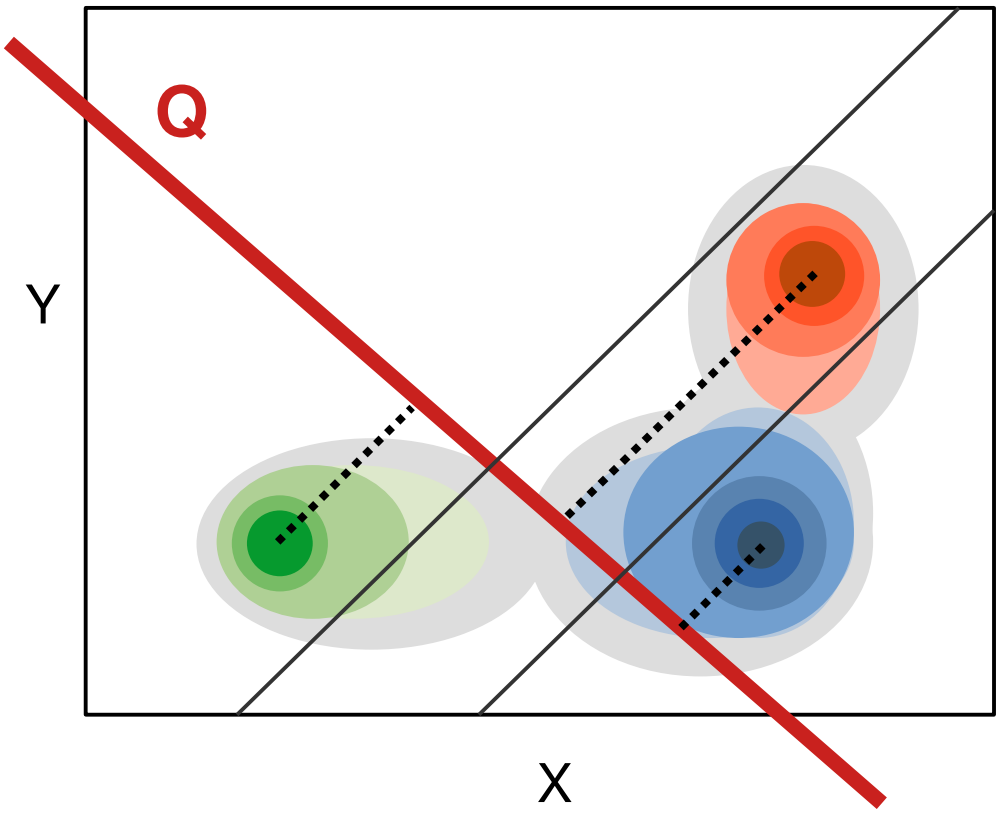


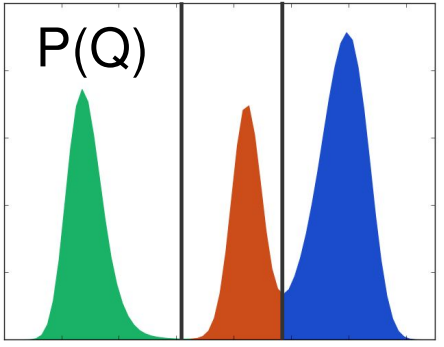
Caso I





Caso I





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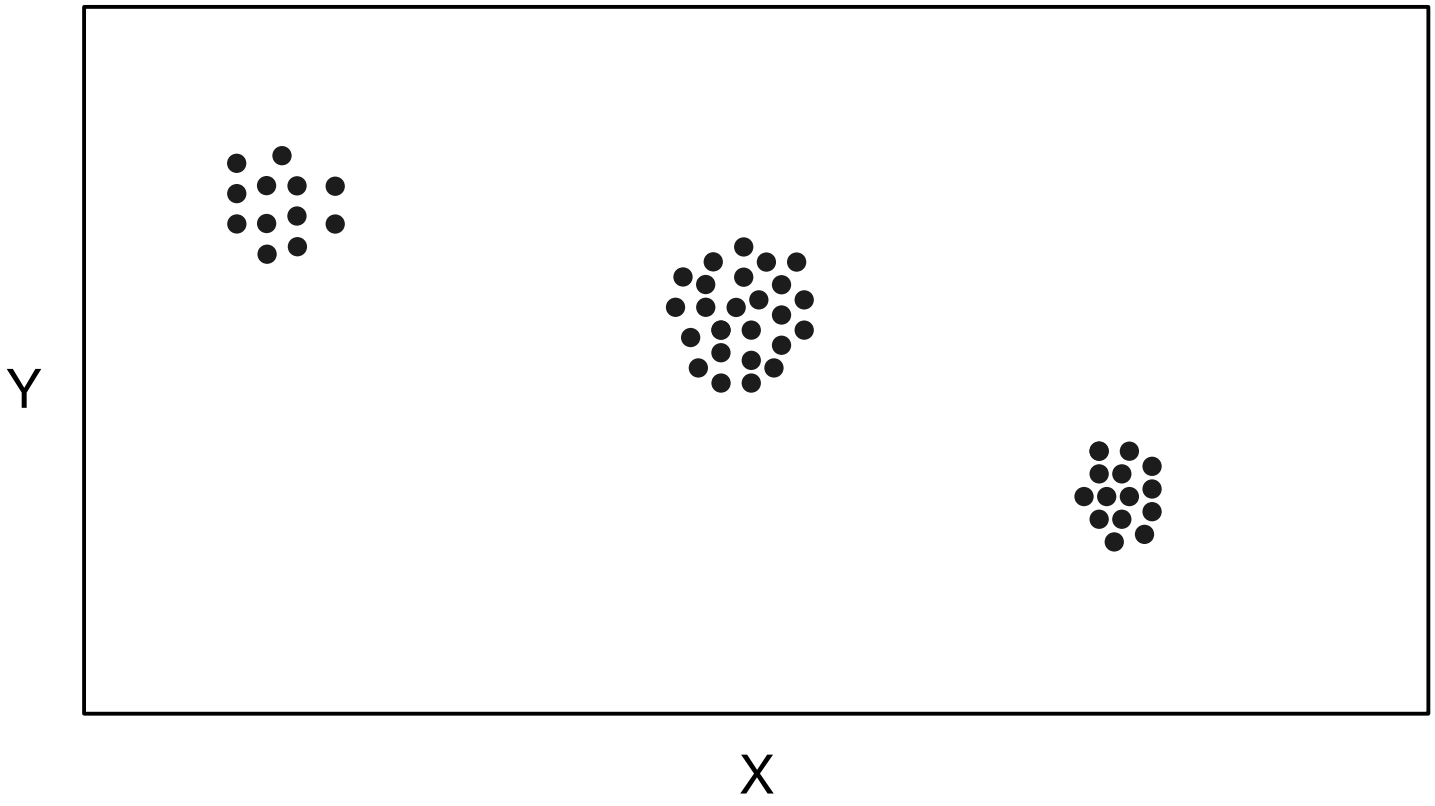
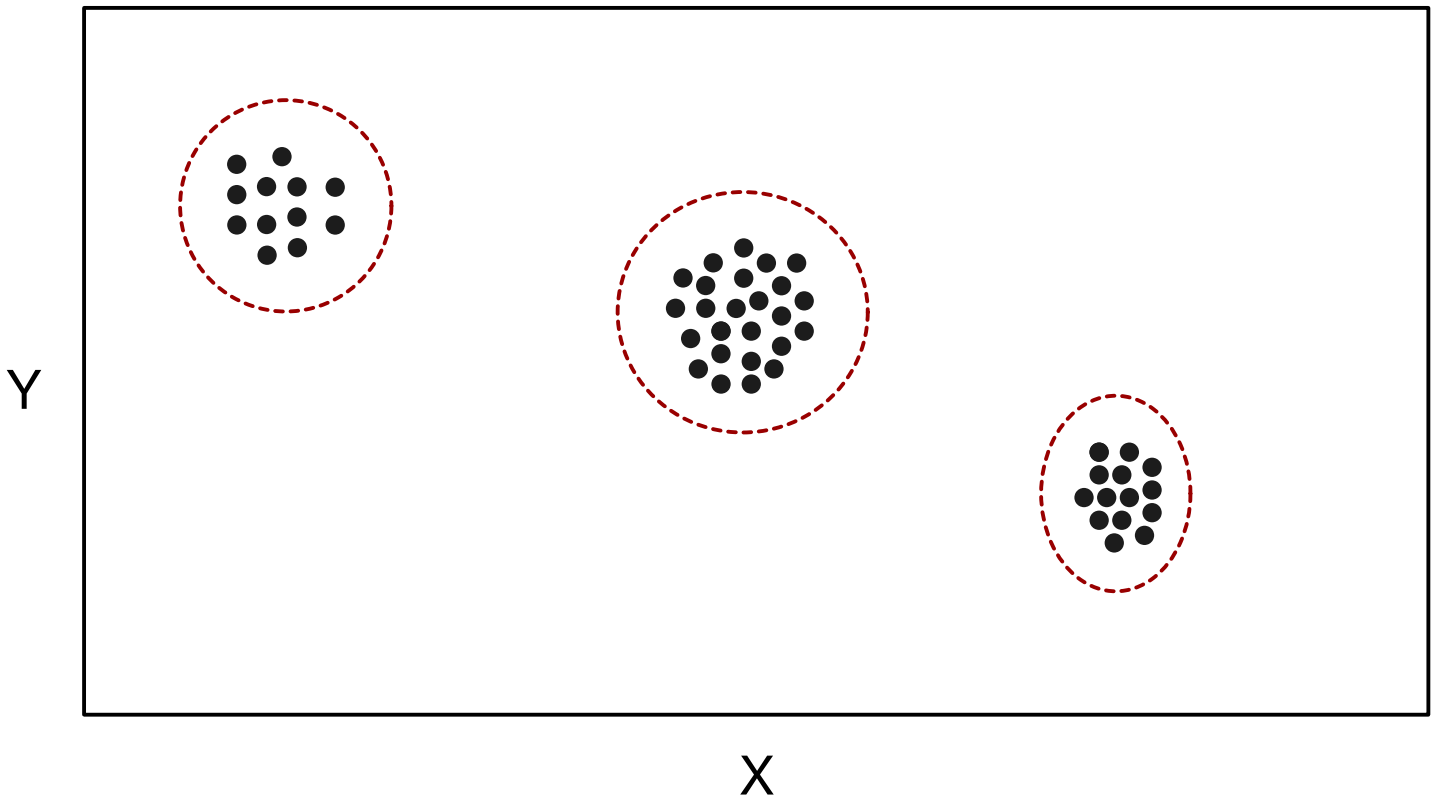


Caso II



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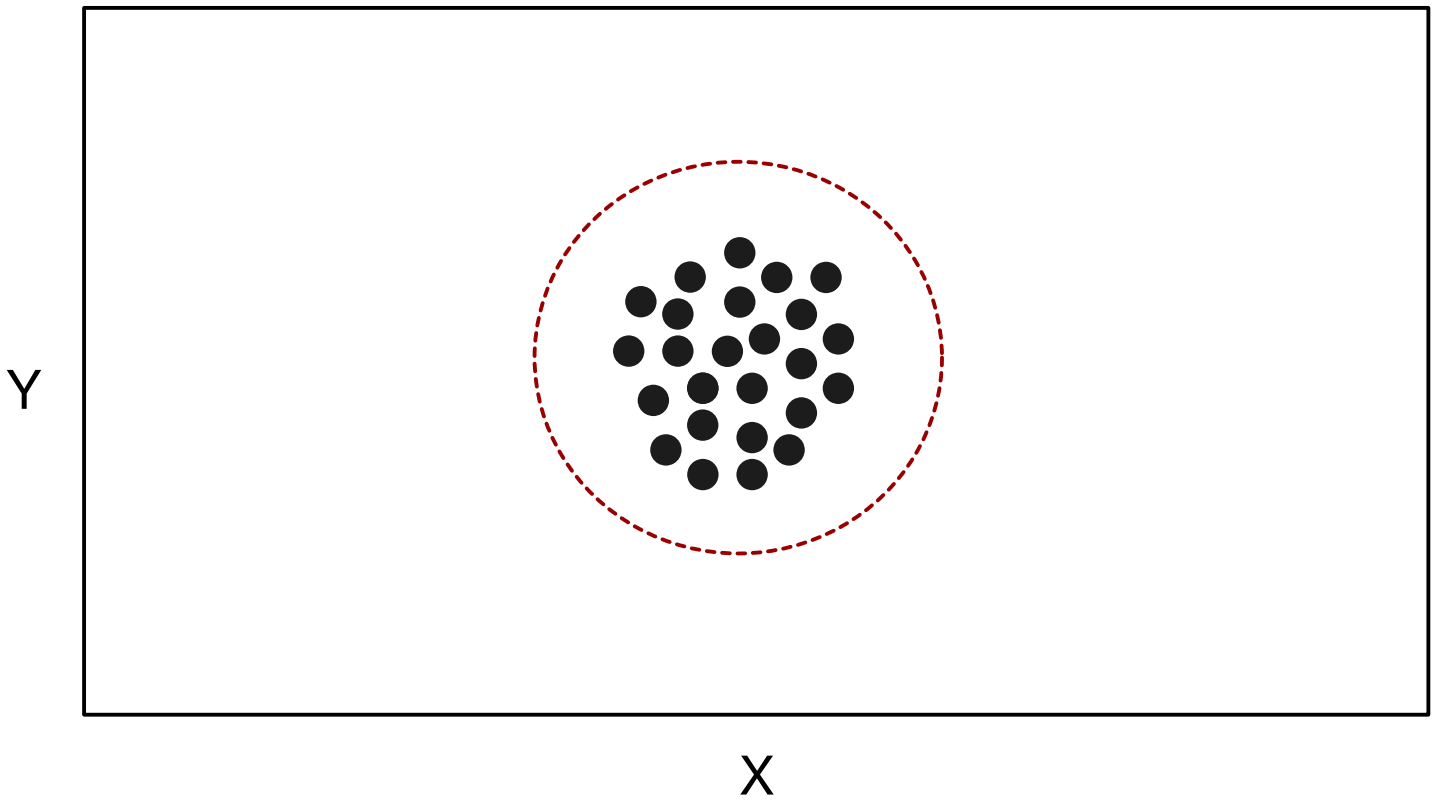
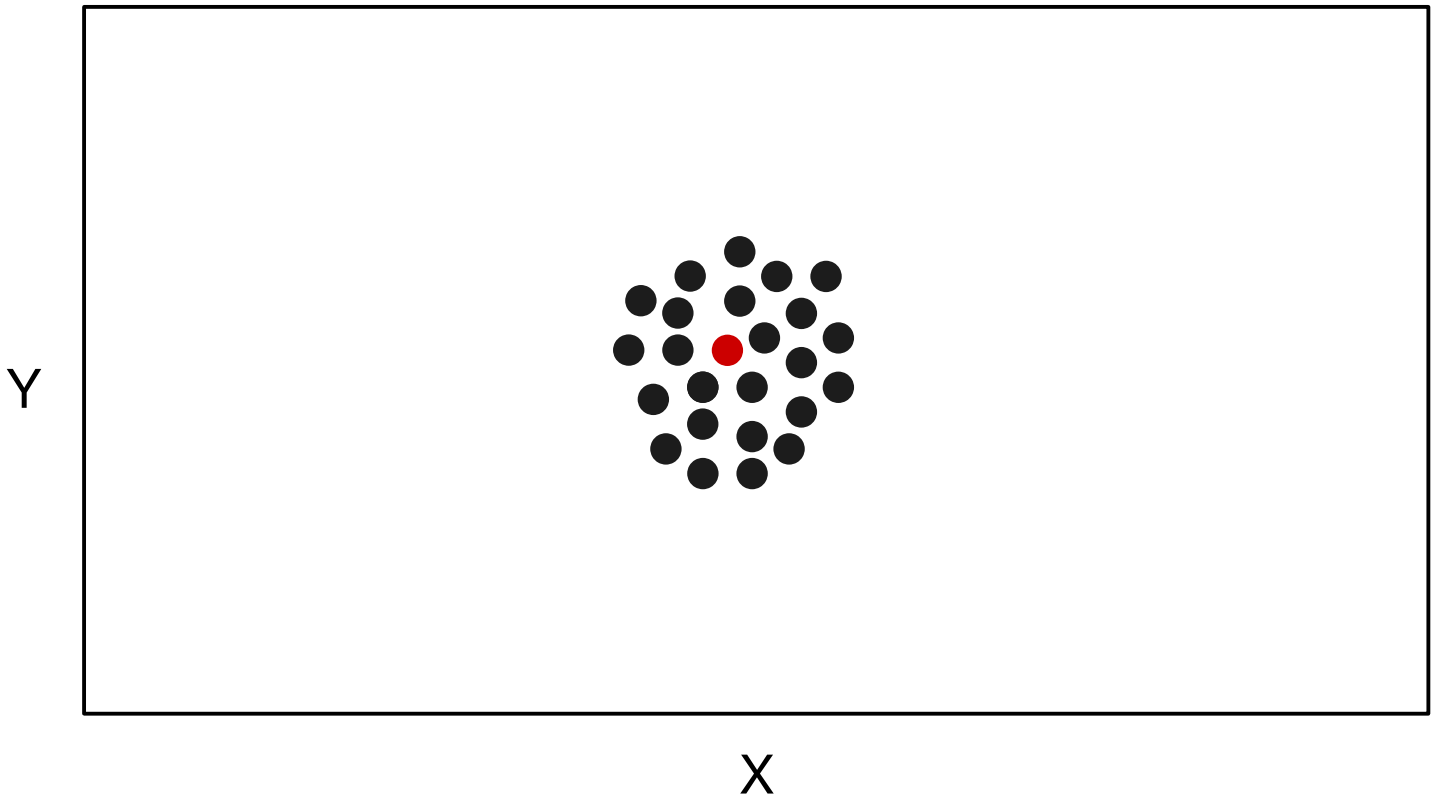


Caso II



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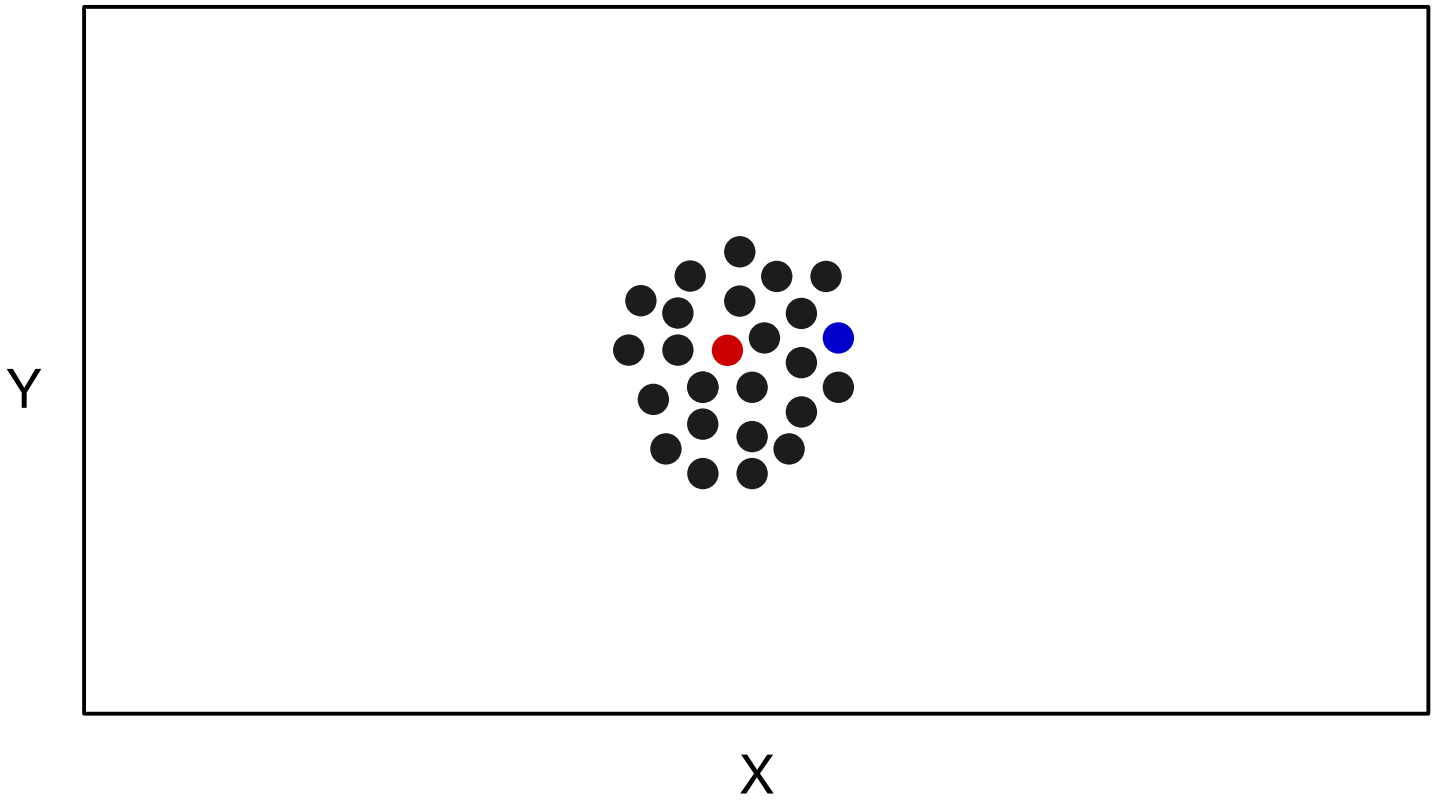

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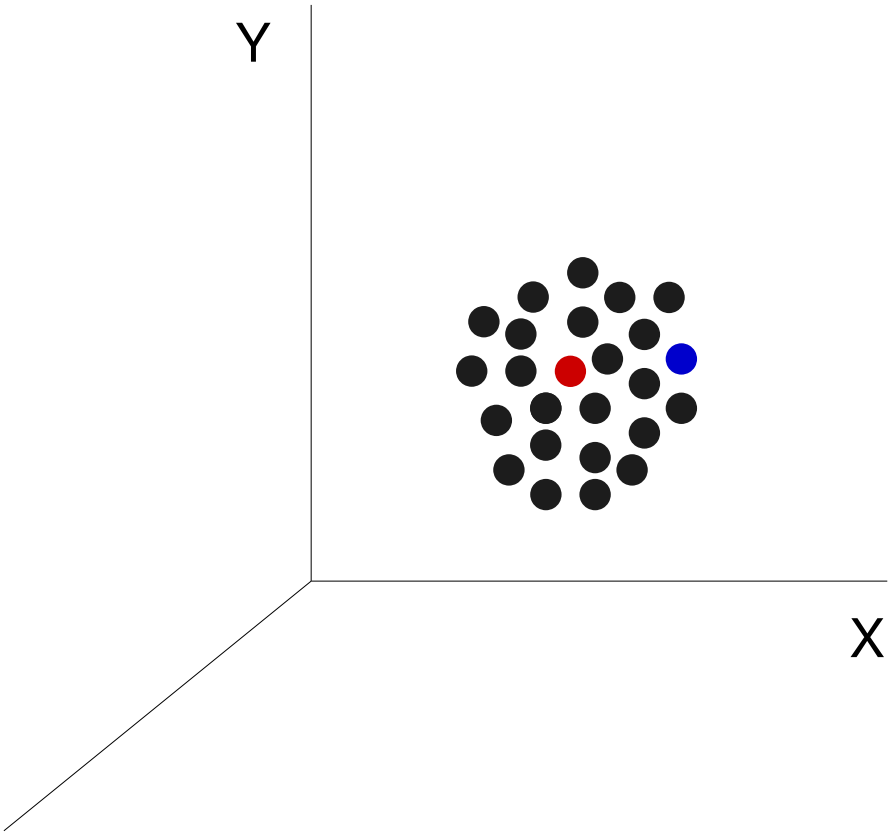
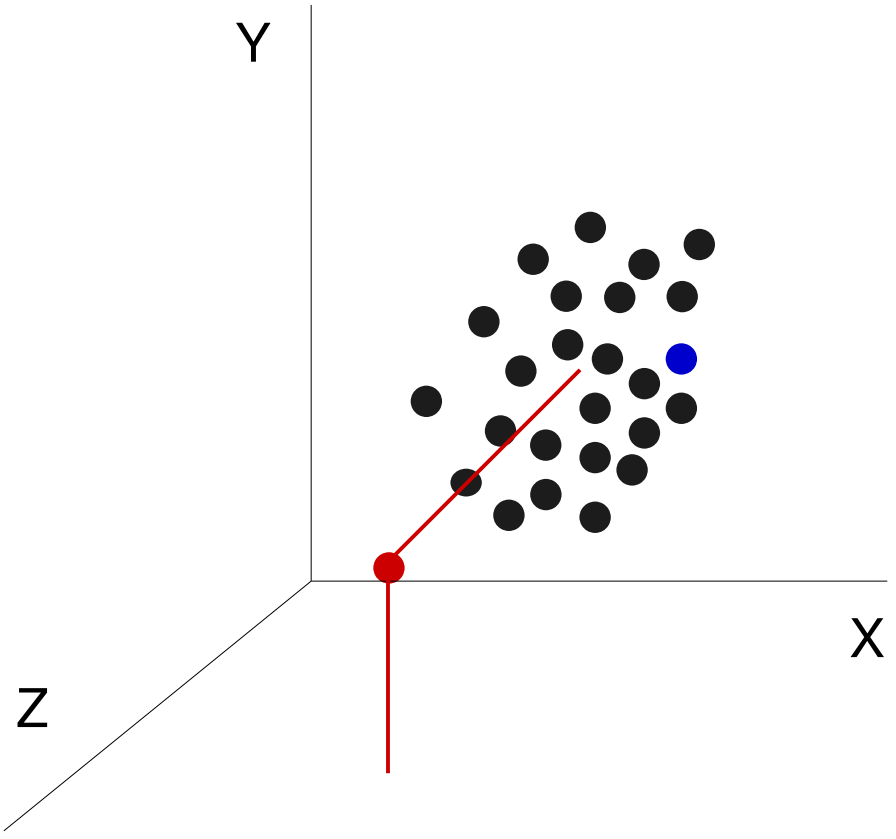
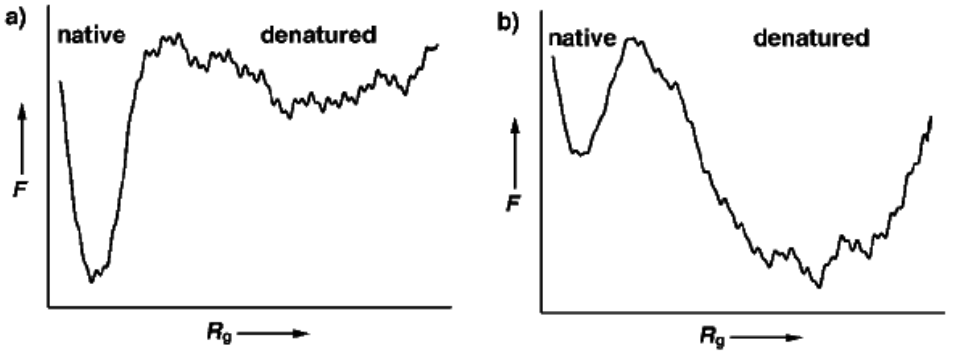


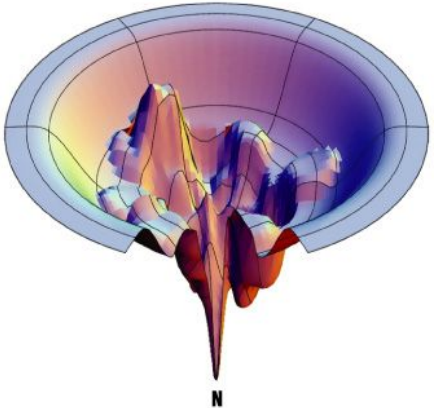
Caso II



Caso III

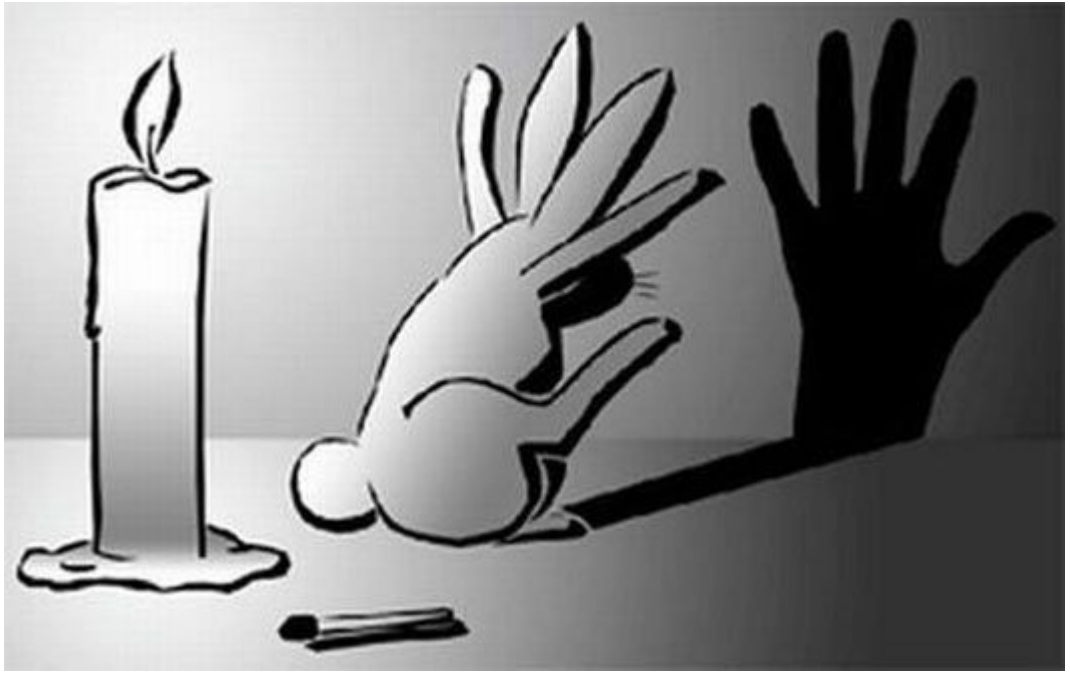
The protein folding paradigm



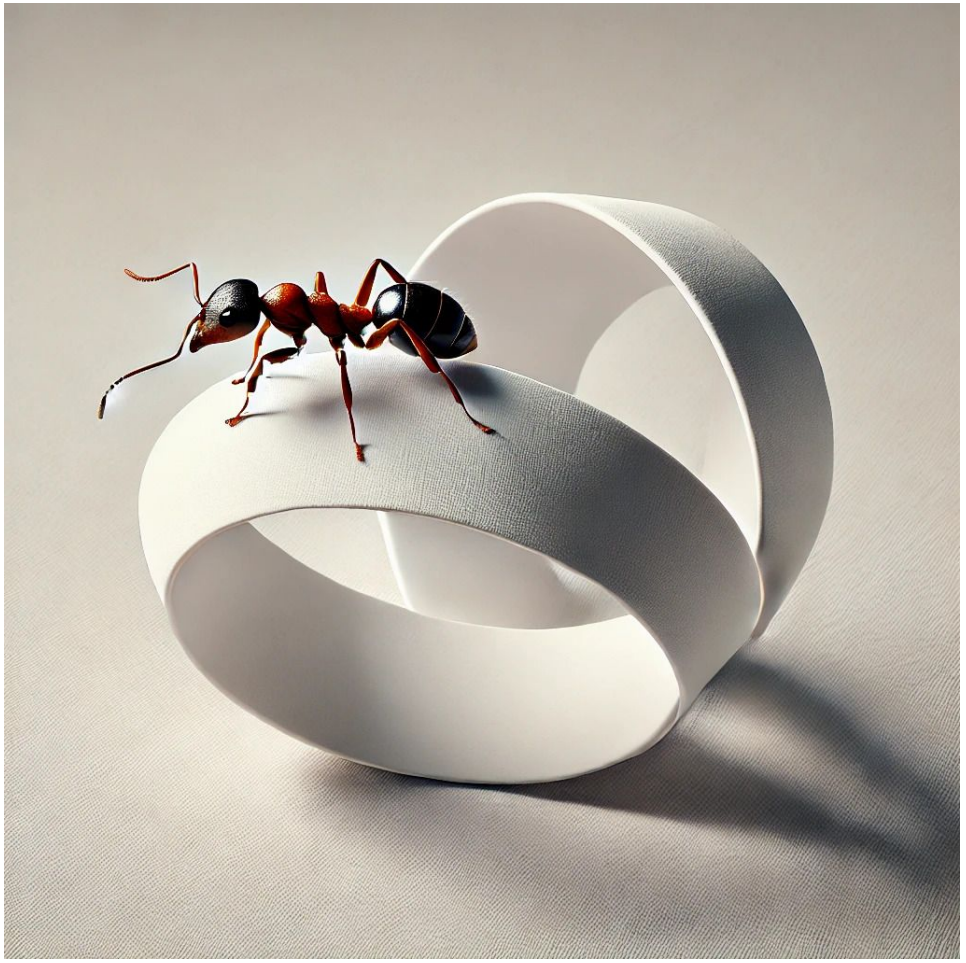


Caso 0

Caso 0




DO NOT
ENTER



¿Te vas a atrever...?

Más documentación y foro técnico de soporte en:

github.com/Ciencia-Computacional-HIMFG