

# Measuring the transition between nonhyperbolic and hyperbolic regimes in open Hamiltonian systems



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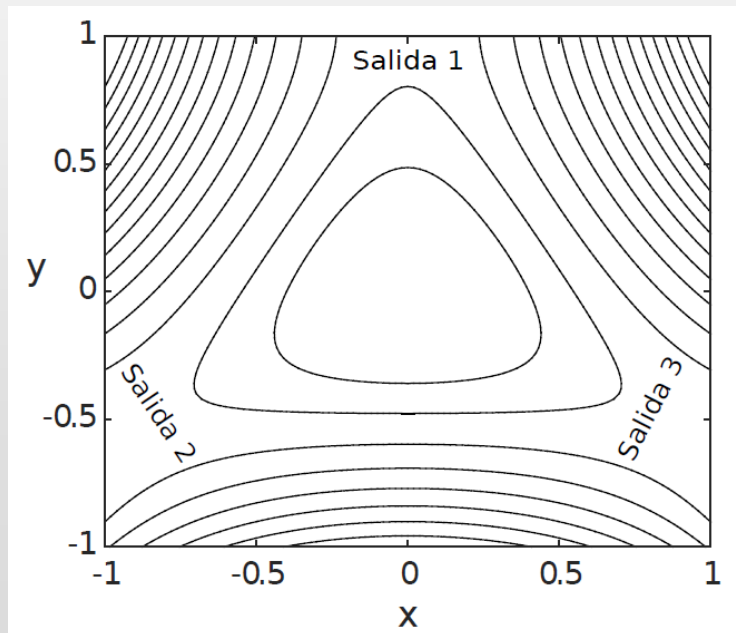
Miguel Ángel  
F. Sanjuán

# Hamiltoniano de Hénon-Heiles

$$\mathcal{H} = \frac{1}{2}(\dot{x}^2 + \dot{y}^2) + \frac{1}{2}(x^2 + y^2) + x^2y - \frac{1}{3}y^3$$

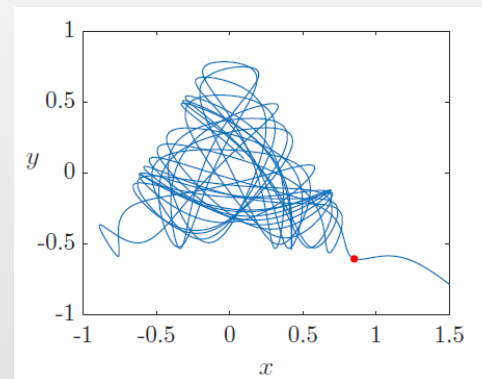
$E > 1/6$

Sistema Hamiltoniano abierto



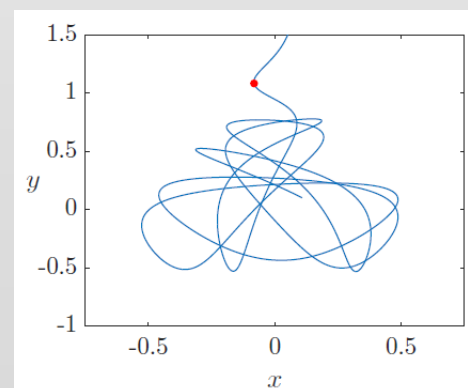
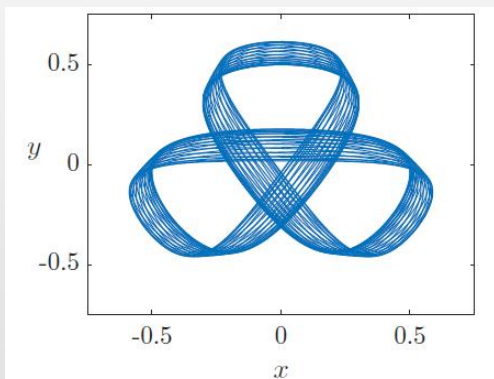
Hiperbólico

$$R(t) \sim e^{-\alpha t}$$



No-hiperbólico

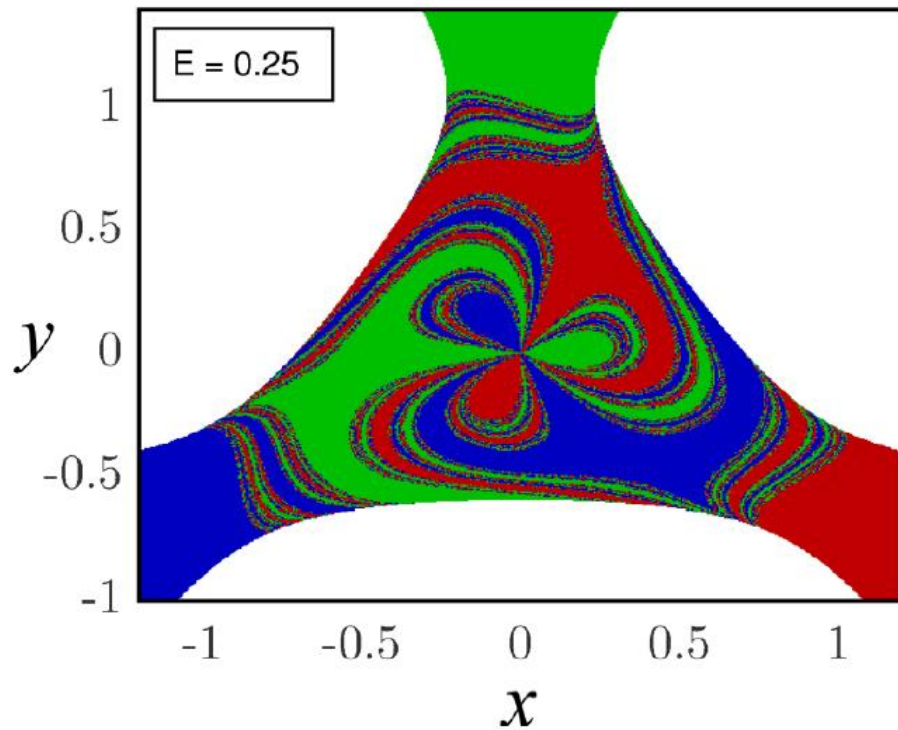
$$R(t) \sim t^{-\alpha}$$



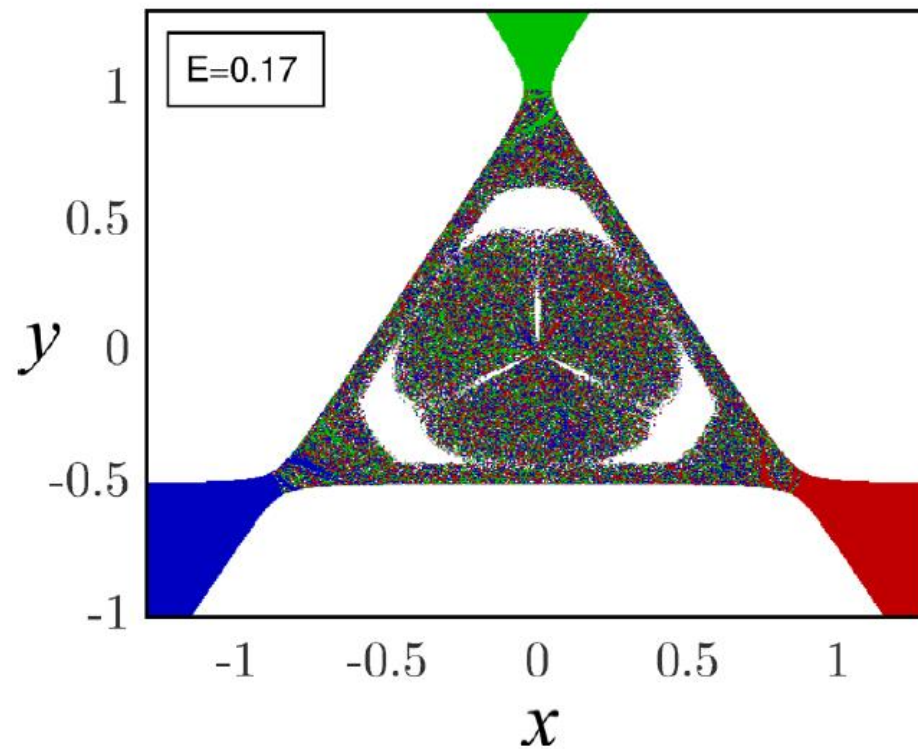
Órbitas cuasiperiódicas  
toro Kolmogorov-Arnold-Moser  
(KAM)

# Islas KAM

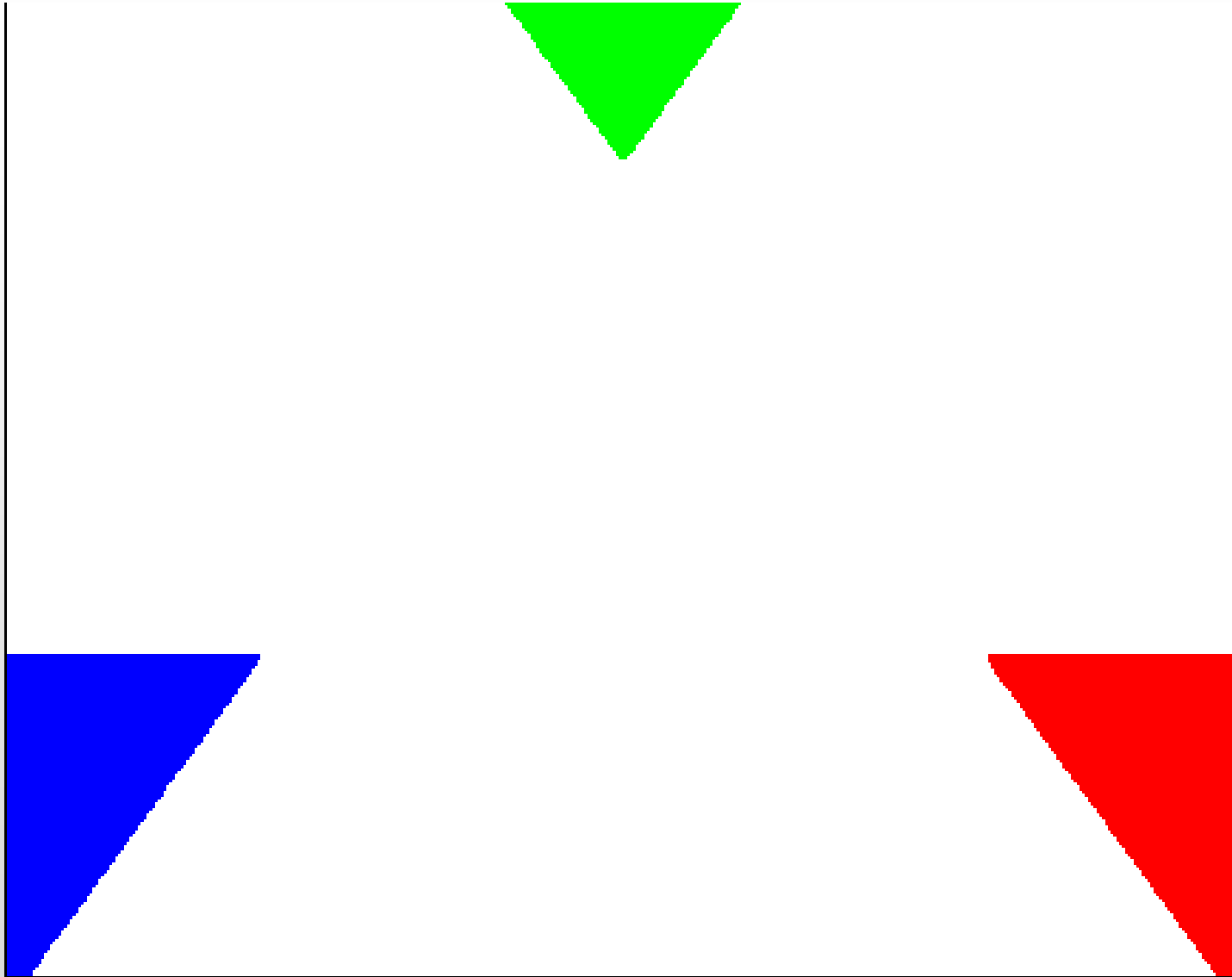
Hiperbólico



No-hiperbólico

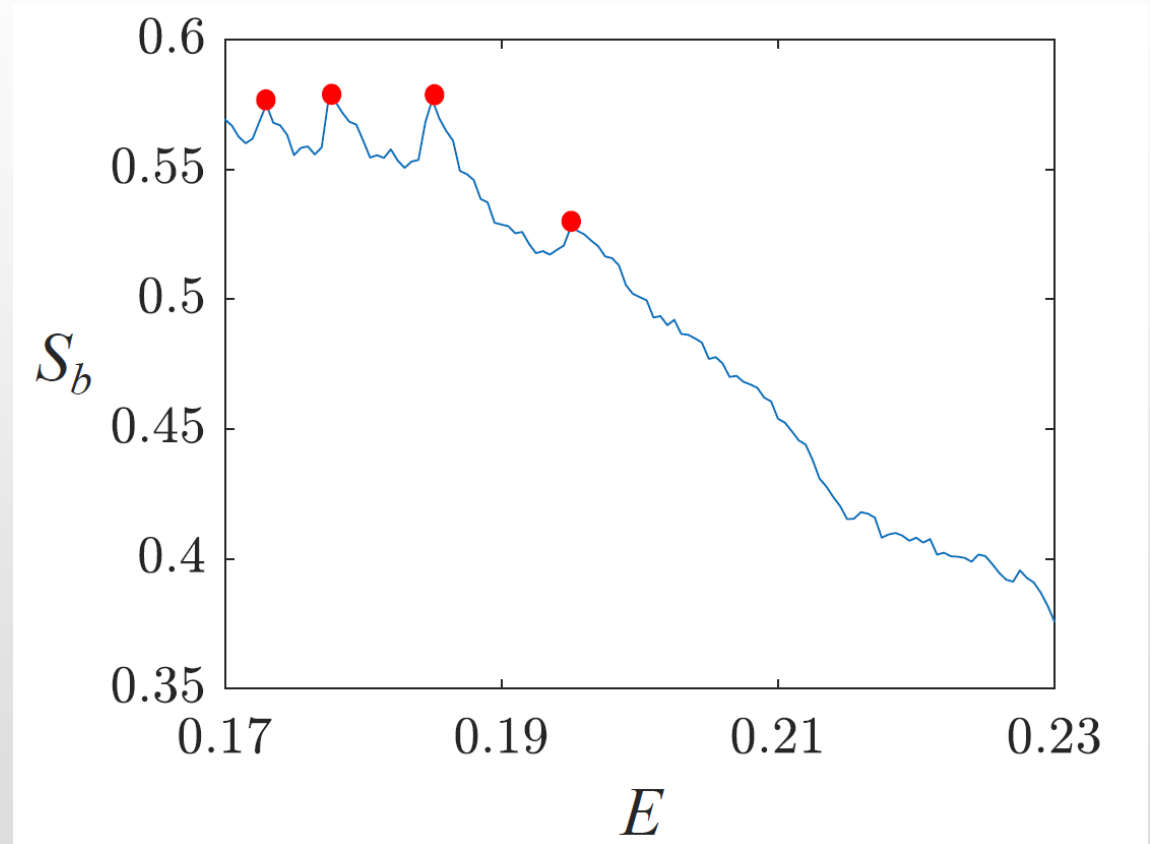


# Variaciones en las islas KAM

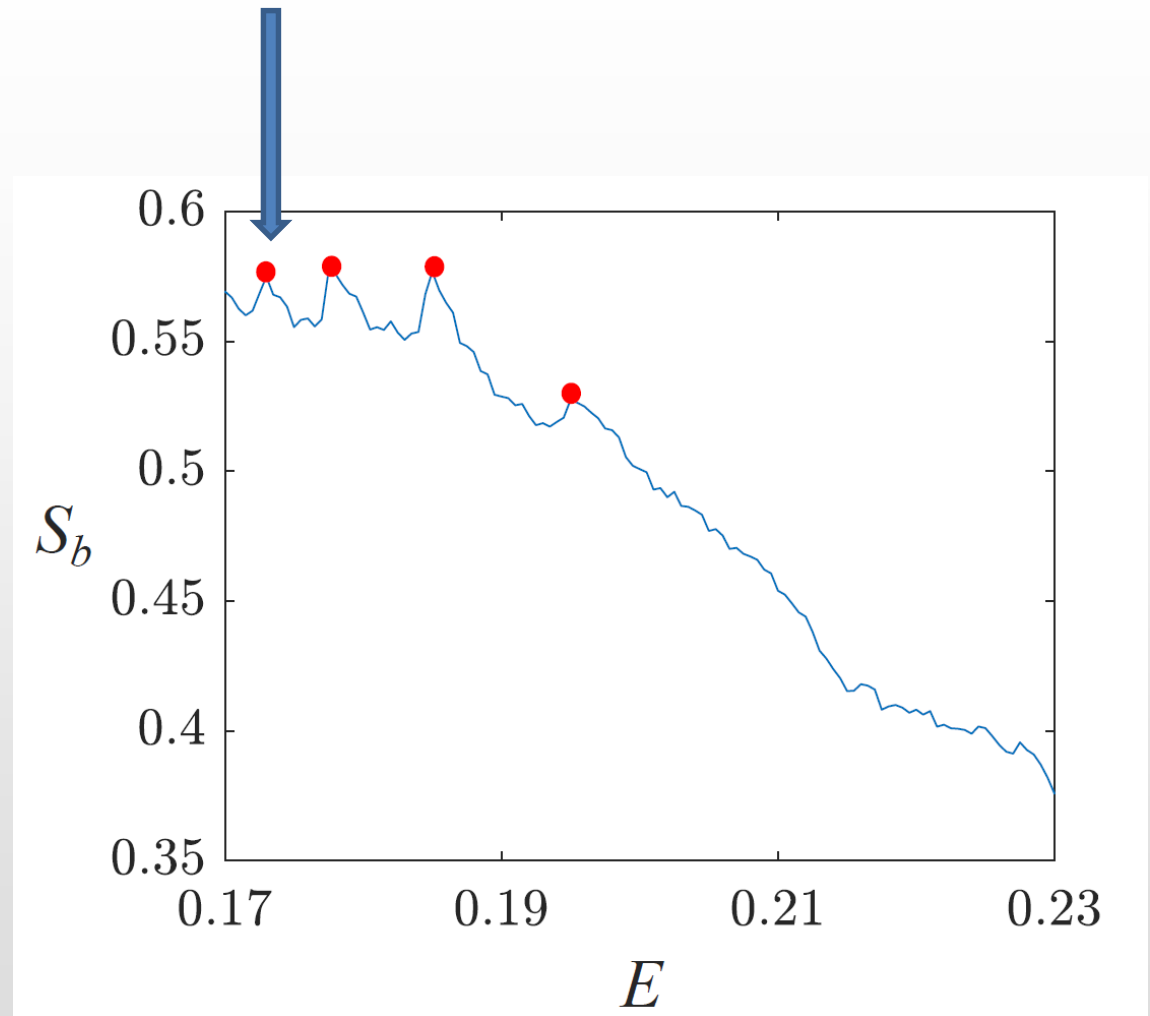


# La huella de las islas KAM en la impredecibilidad

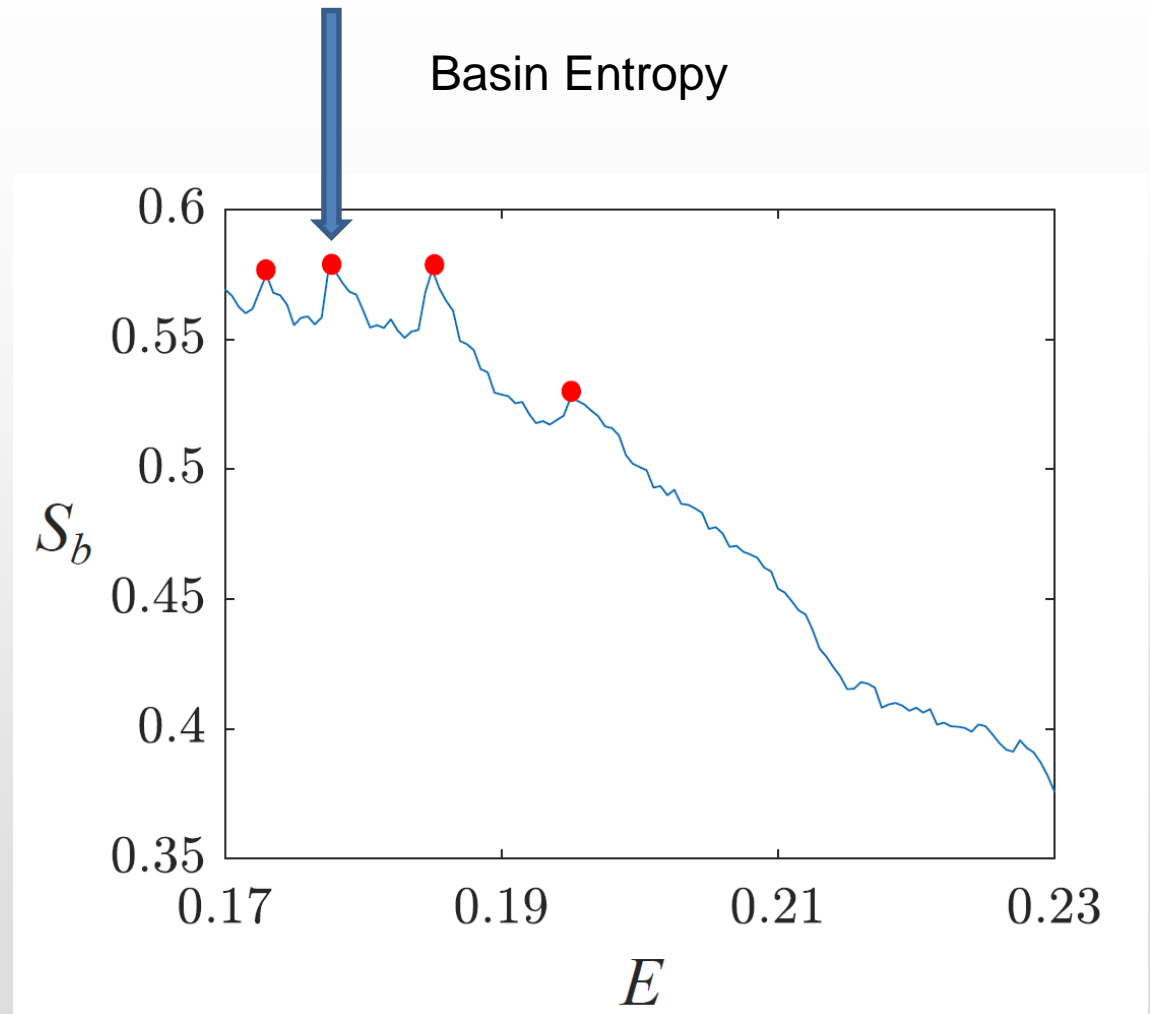
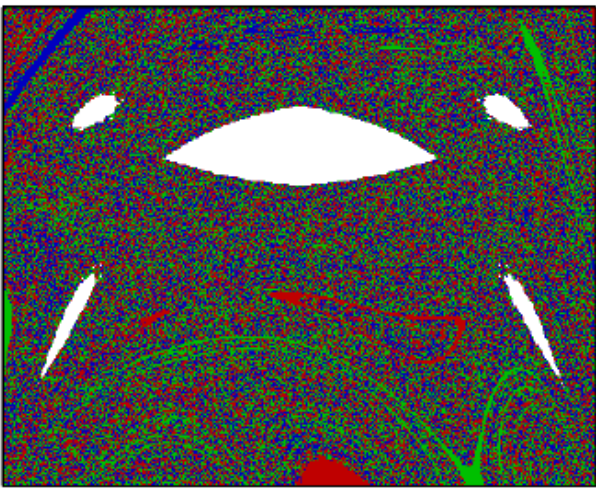
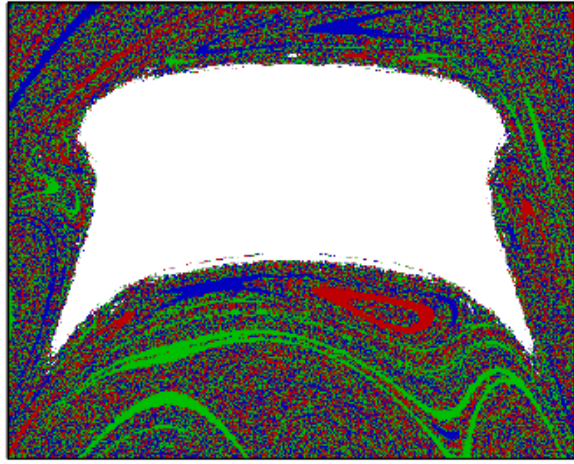
Basin Entropy



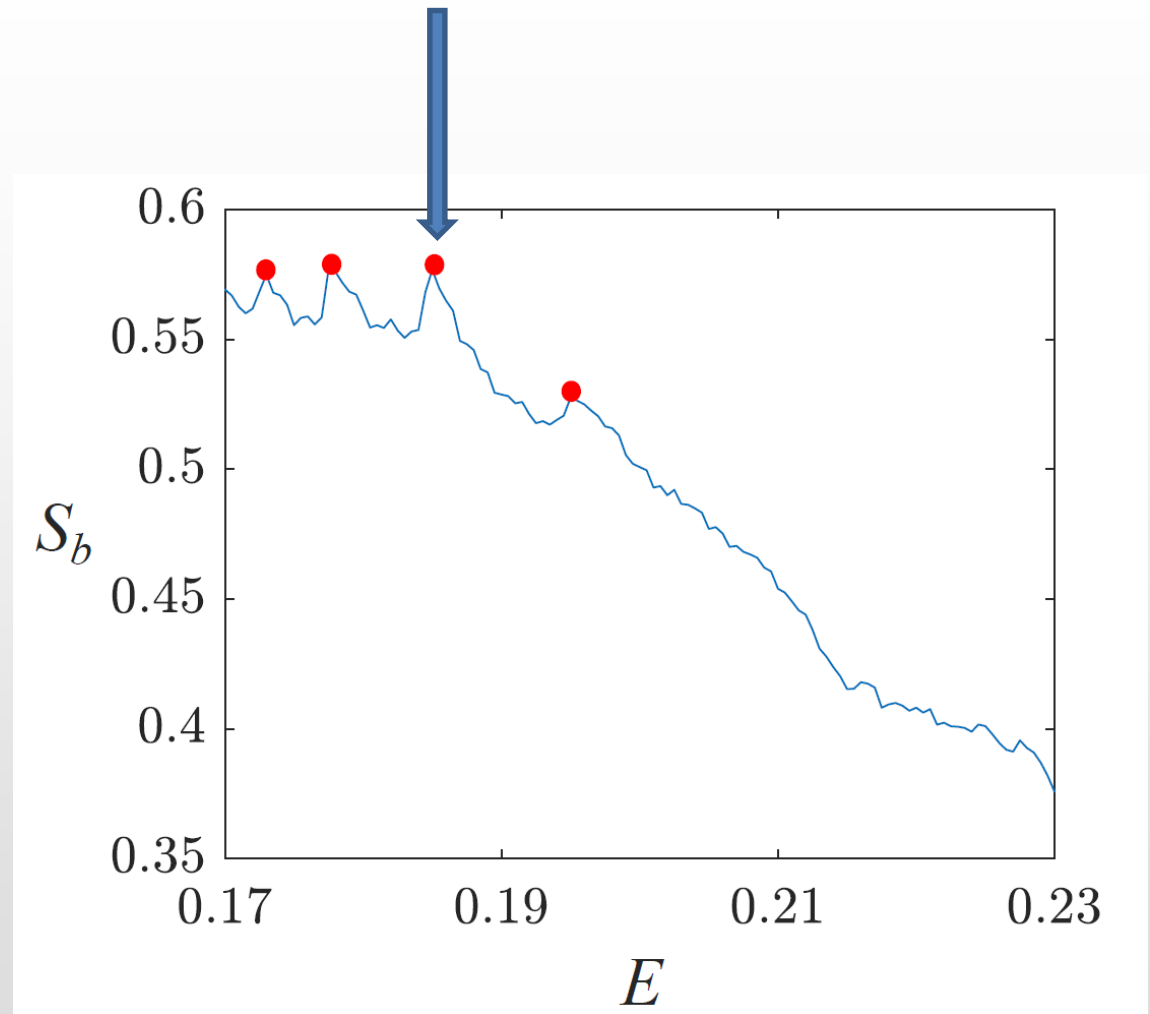
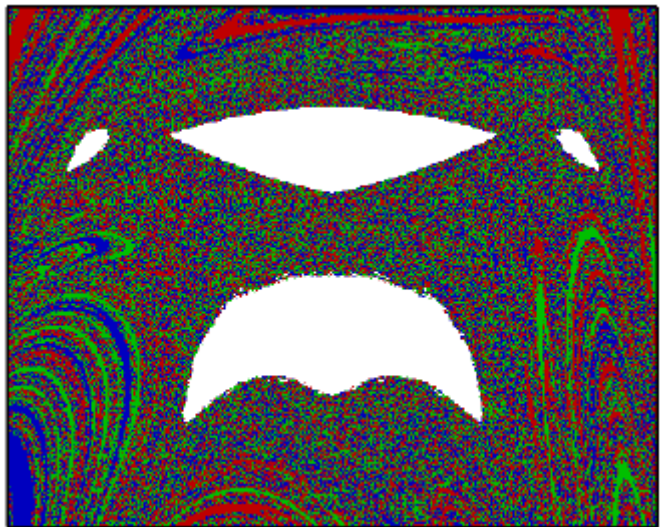
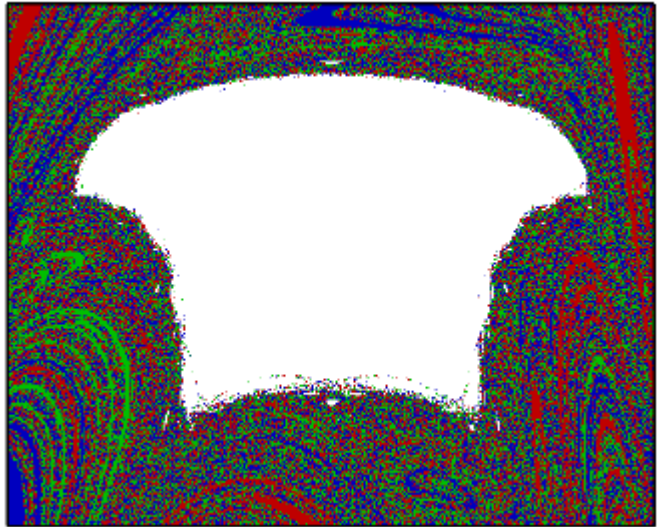
# La huella de las islas KAM en la impredecibilidad



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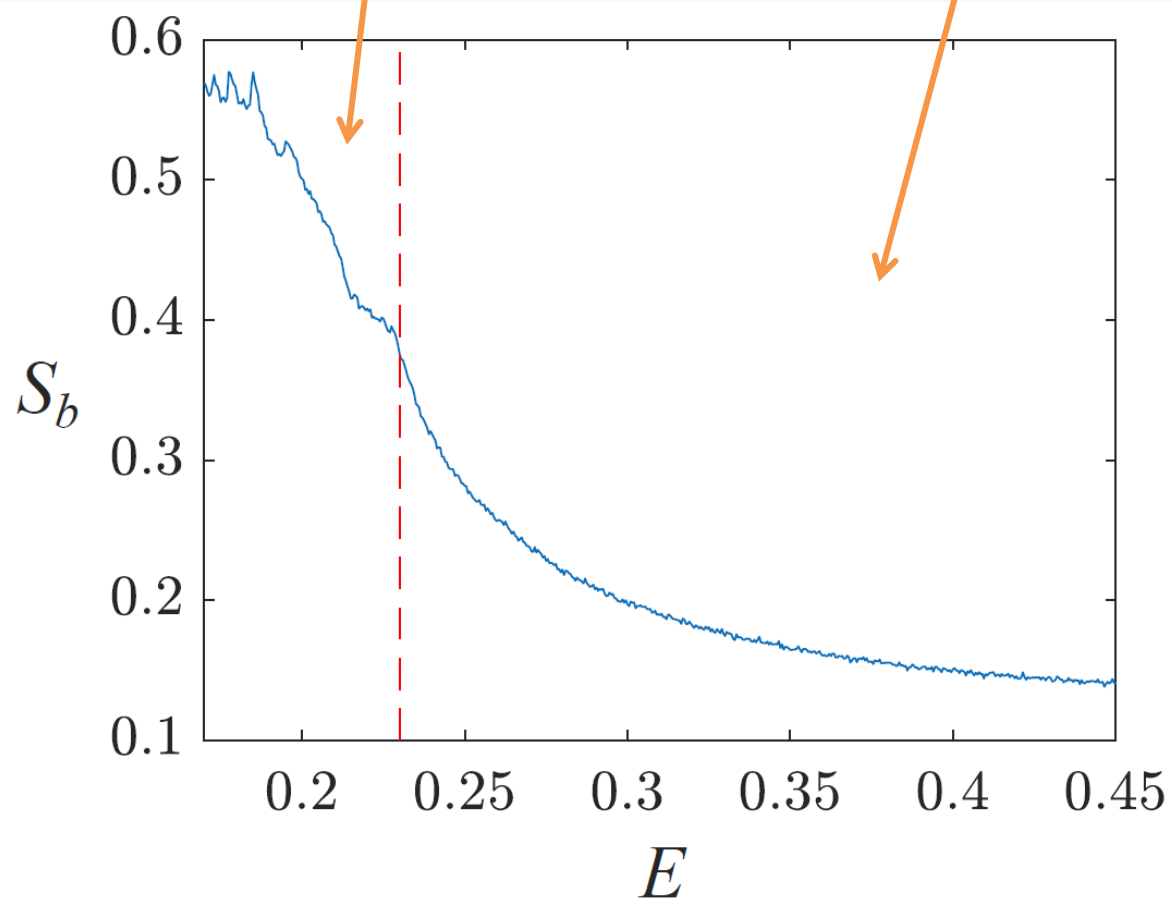
# Detectando el cambio de régimen

## Régimen no-hiperbólico

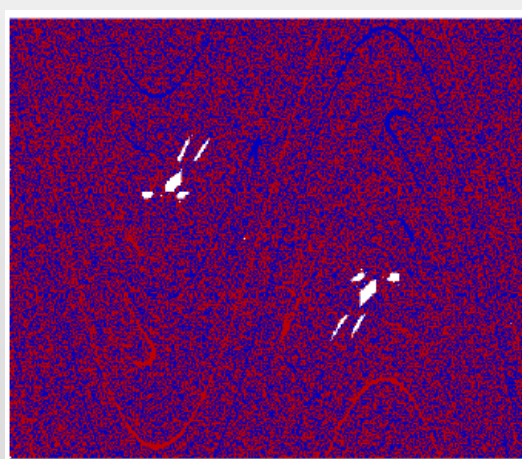
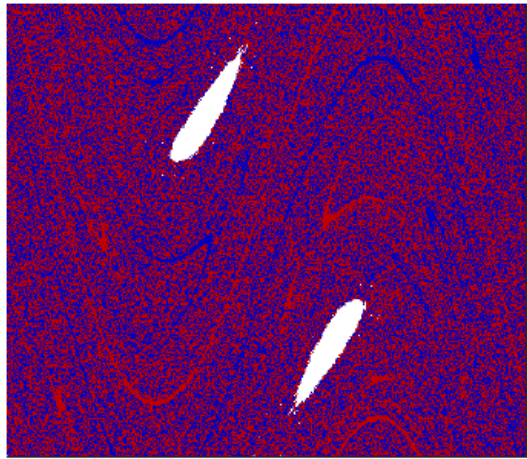
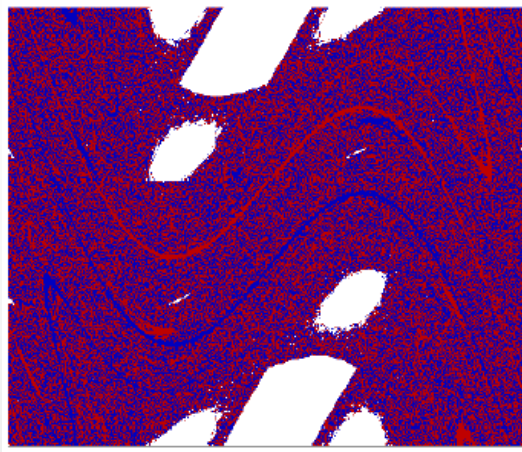
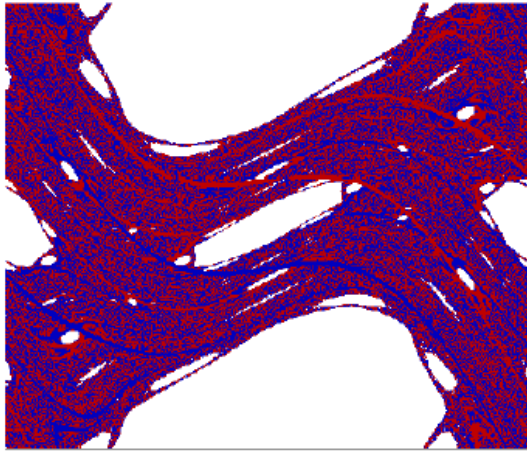
- Variaciones in  $S_b$
- Presencia de islas KAM

## Régimen hiperbólico

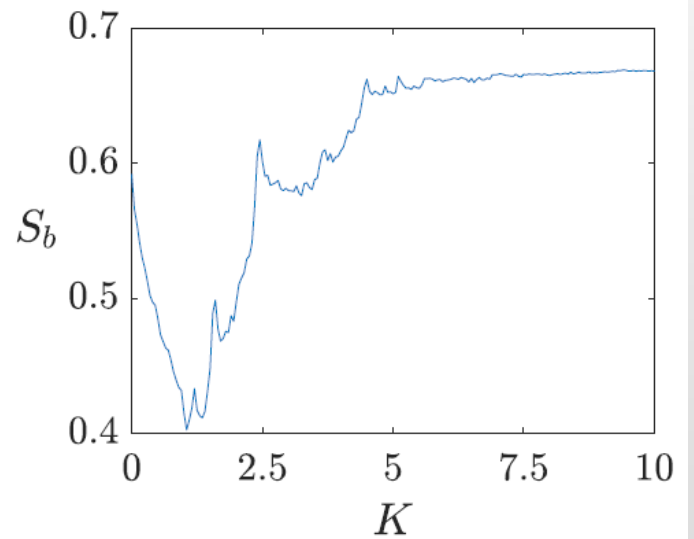
- Decrecimiento monótono
- Ausencia de islas KAM



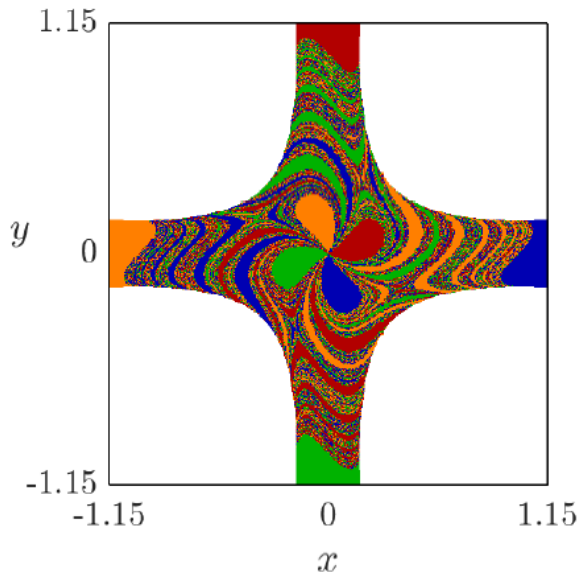
# Aplicación estándar con escapes



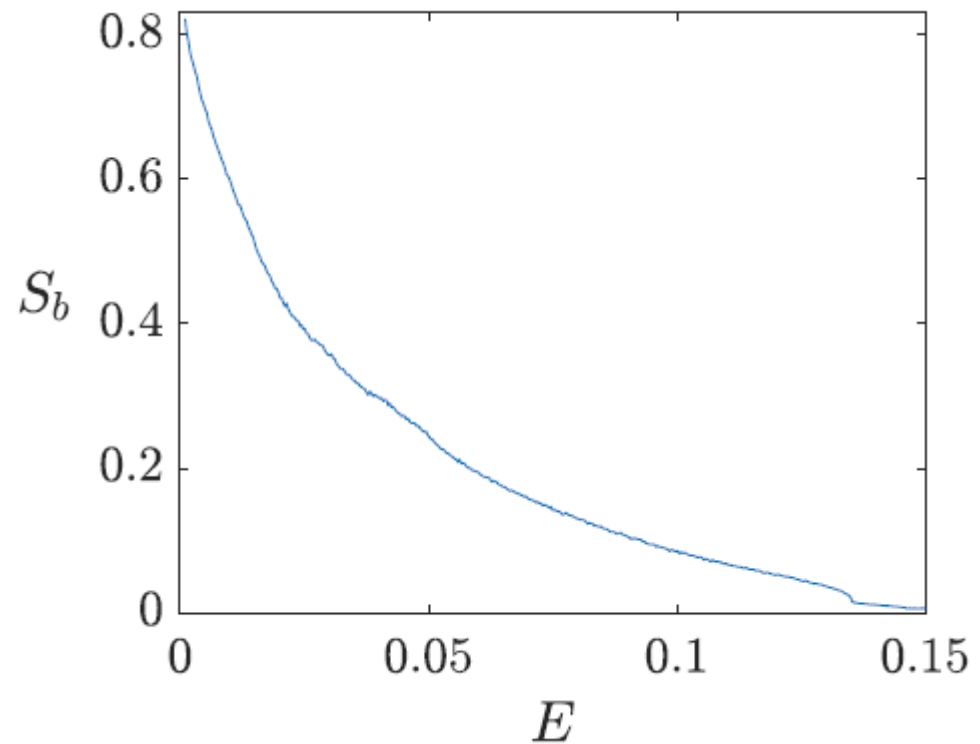
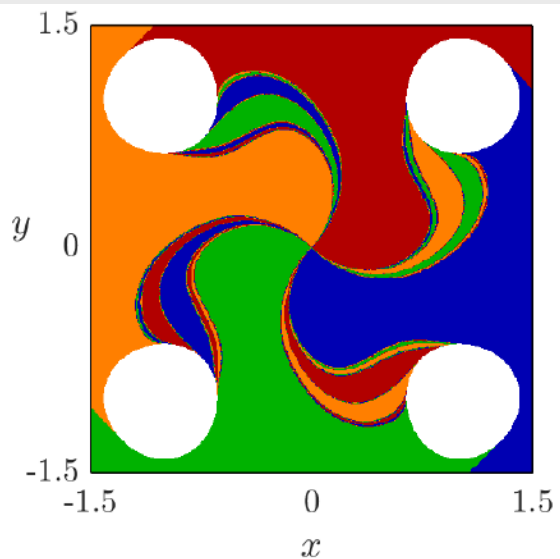
$$\begin{aligned}\theta_{n+1} &= \theta_n + J_{n+1} \pmod{2\pi}, \\ J_{n+1} &= J_n + K \sin \theta_n,\end{aligned}$$

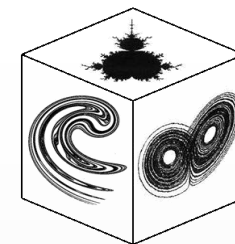


# Potencial de cuatro colinas



$$\mathcal{H} = \frac{1}{2}(\dot{x}^2 + \dot{y}^2) + x^2 y^2 e^{-(x^2 + y^2)}$$





# GRACIAS



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