

Breathers discretos en una familia de líneas eléctricas no lineales

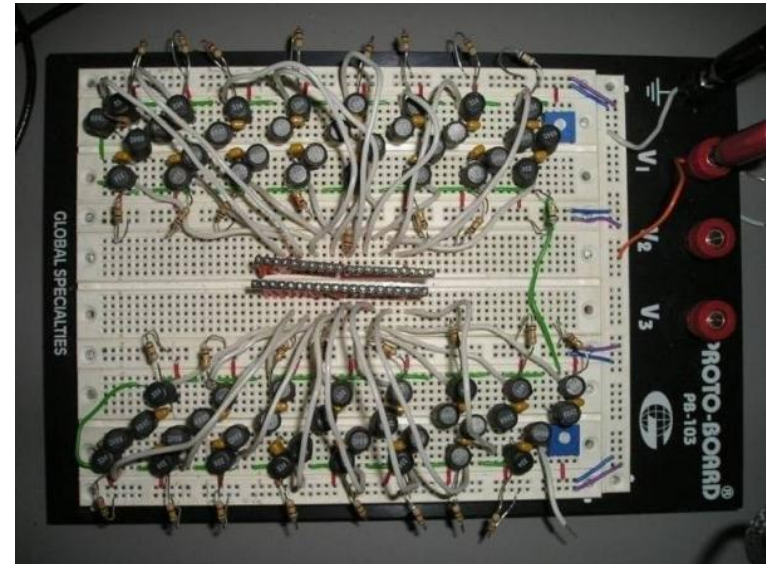
F. Palmero y J. Cuevas
Universidad de Sevilla

L. Q. English, P. Candiani
y D.H. Barnak
Dickinson College, USA

R. Carretero-González
San Diego State University, USA

P.G. Kevrekidis
University of Massachusetts, USA

A.J. Sievers
Cornell University, USA

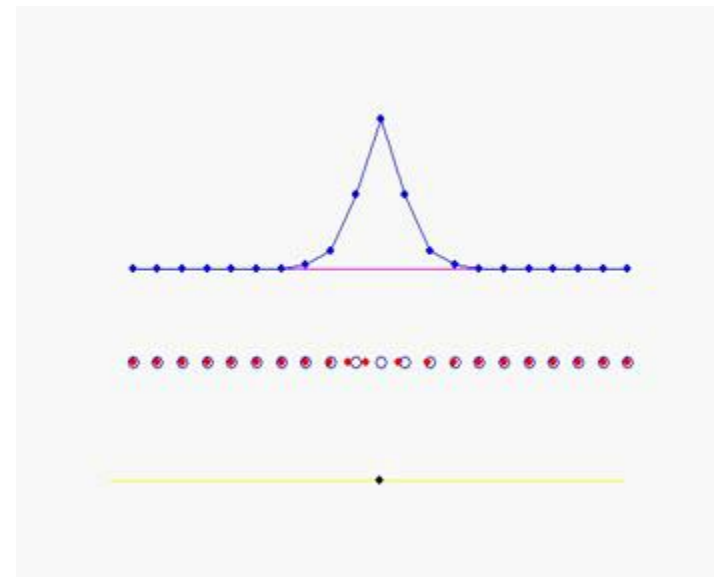
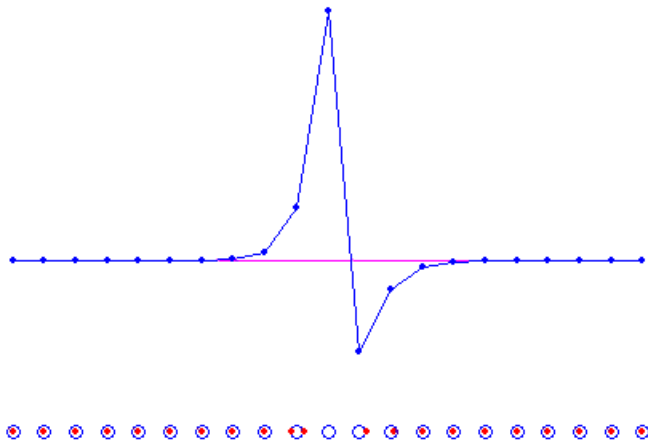
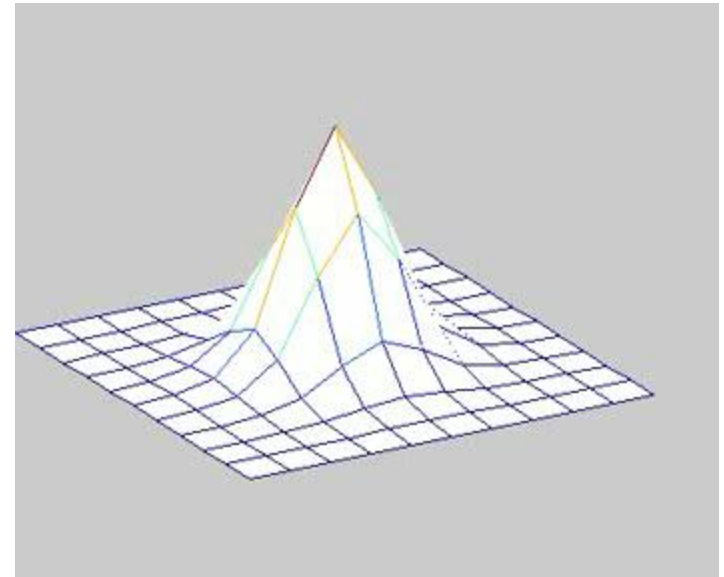


PROYECTO COFINANCIADO POR EL FONDO EUROPEO DE DESARROLLO REGIONAL



Breathers discretos

Combinación de efectos no lineales junto con la naturaleza discreta del sistema



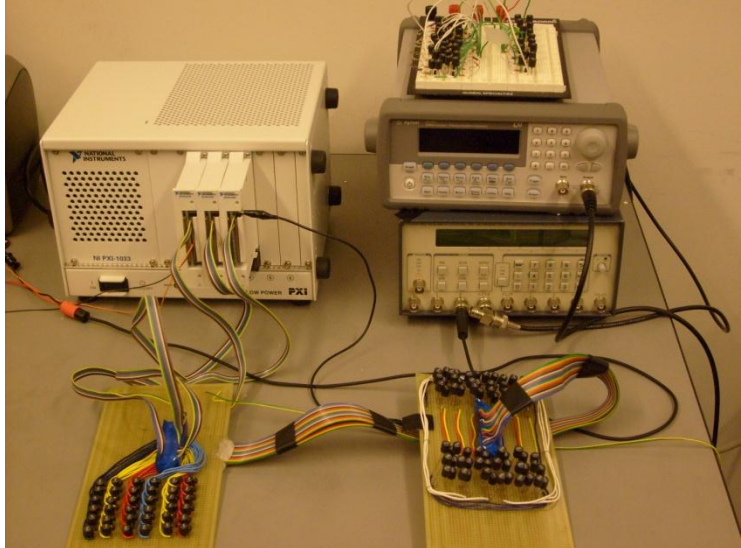
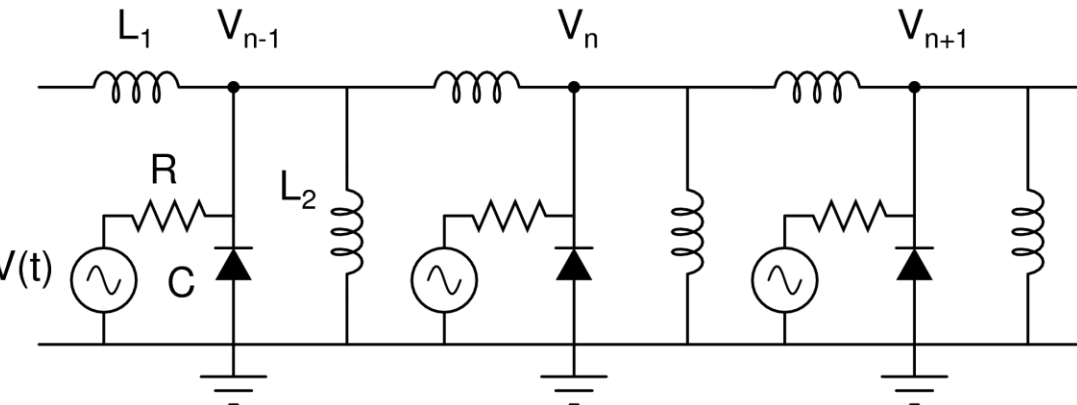
¿Se pueden detectar fácilmente los “breathers discretos”?

Uniones Josephson, cristales fotónicos,
sólidos cristalinos, dispositivos
micromecánicos, ¿biomoléculas?

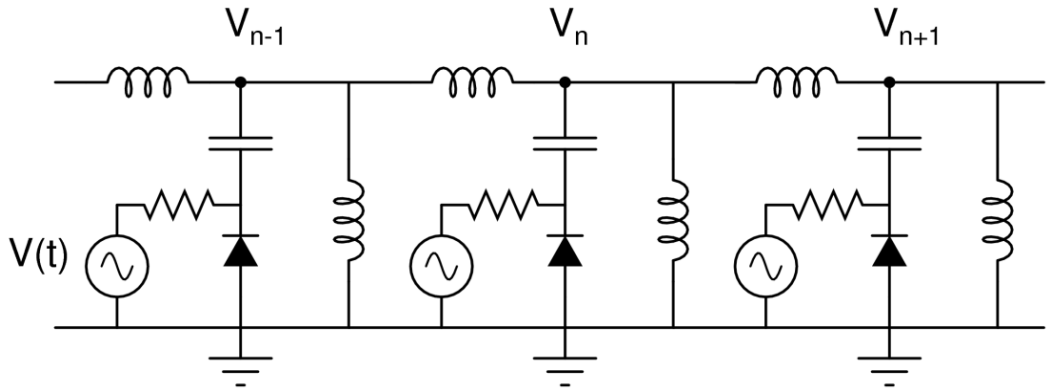
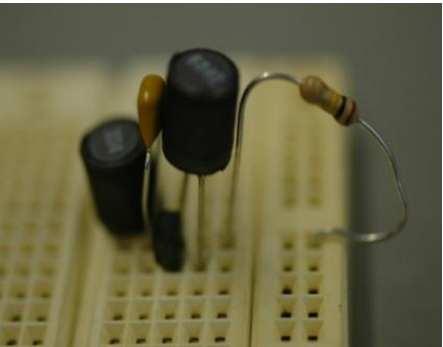
Manipulación y control

M. Sato, B.E. Hubbard, and A.J. Sievers,
Rev. Mod. Phys. **78**, 137 (2006)

Redes eléctricas no lineales

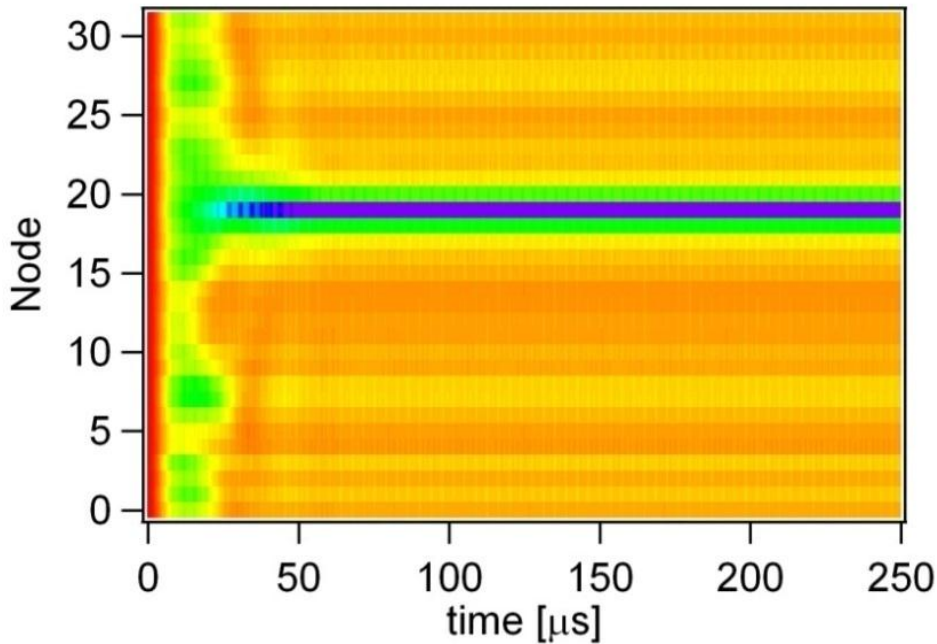
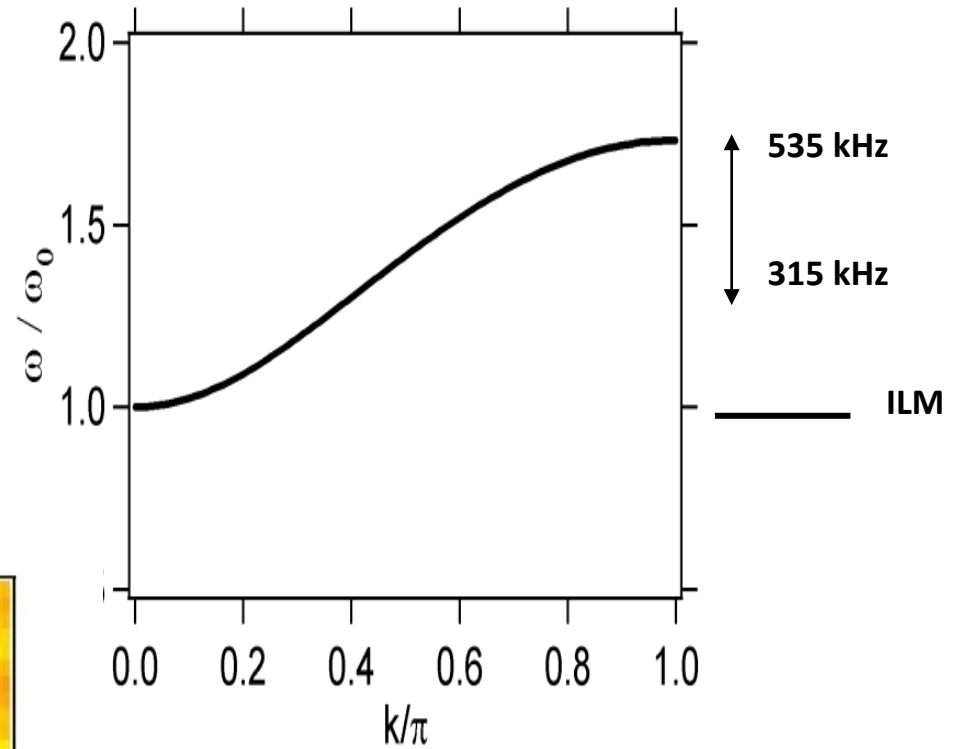


**Componentes eléctricos y/o electrónicos.
Fácil de medir y caracterizar. ¡Muy barato!**

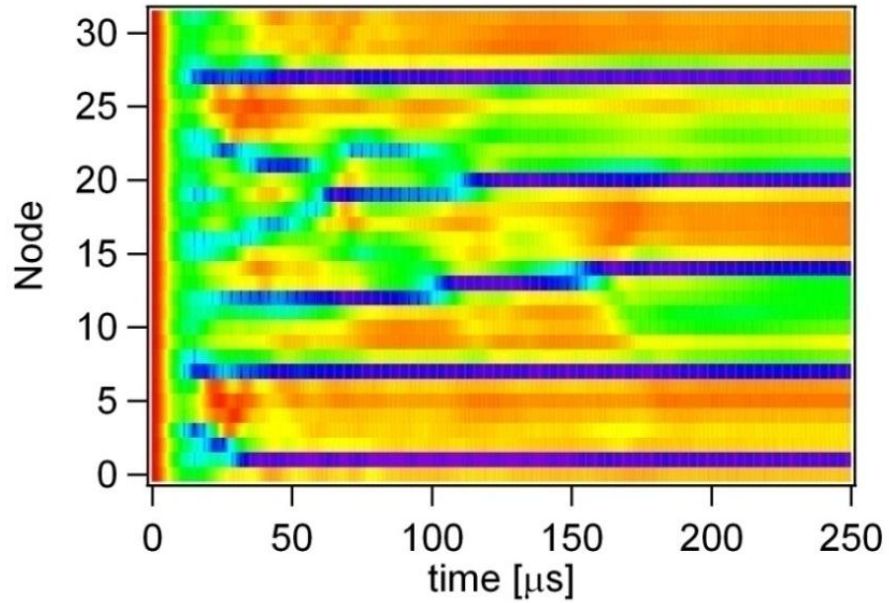


Generación de “breathers” discretos

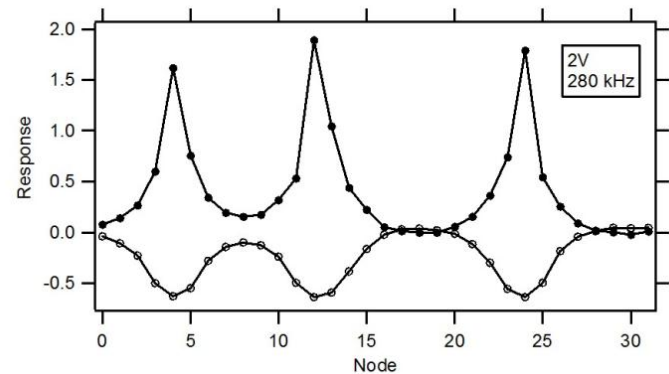
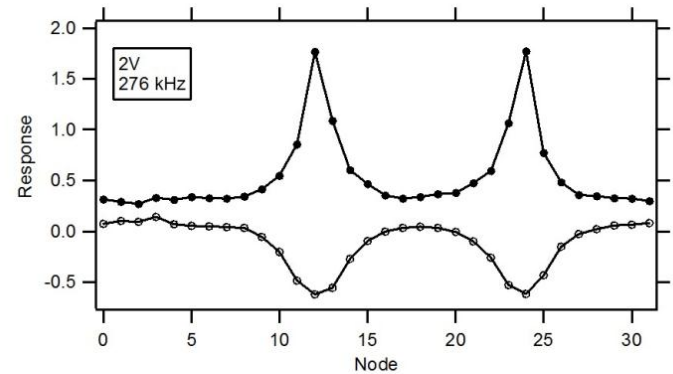
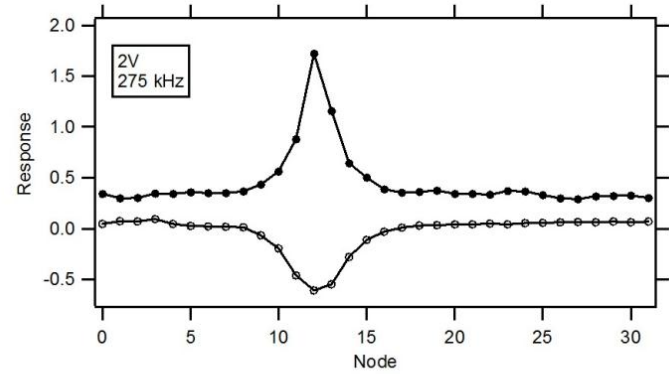
Inestabilidad modulacional. Modo uniforme. ¡Manipulación!



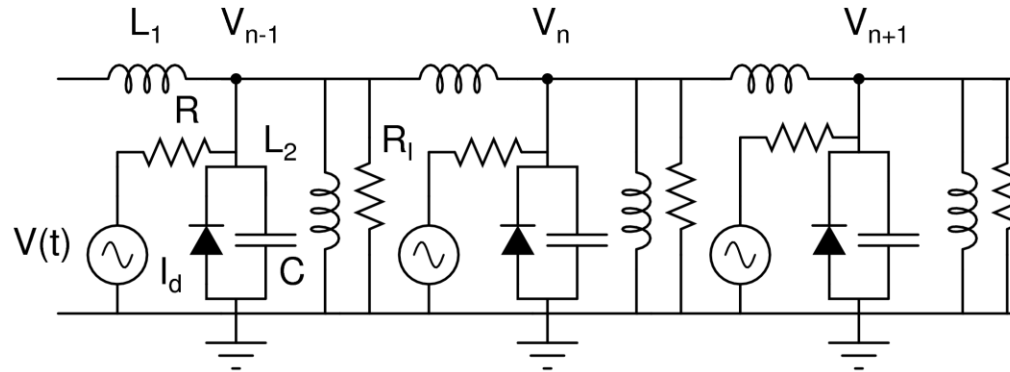
Resultados experimentales



$f=300$ kHz
 $V_d=1.5$ V



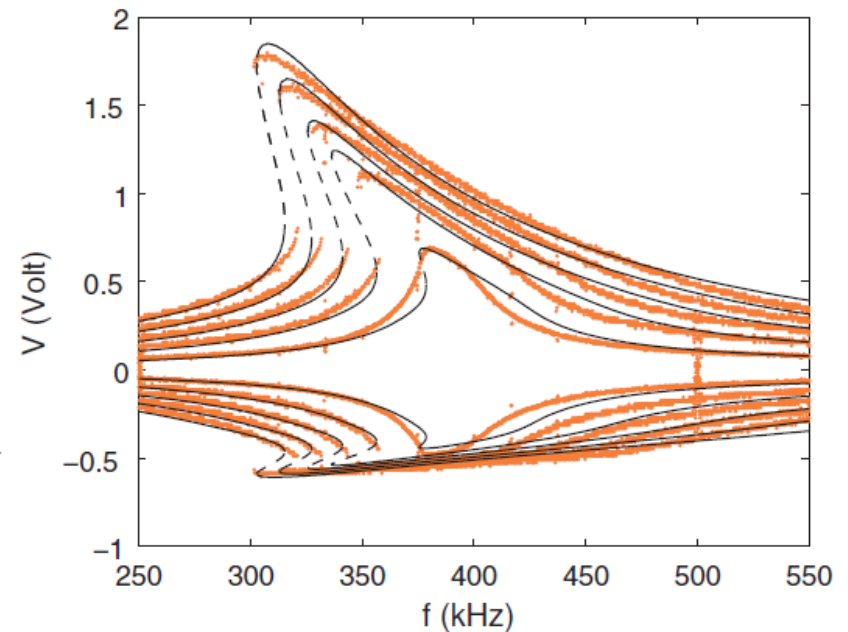
Modelo teórico



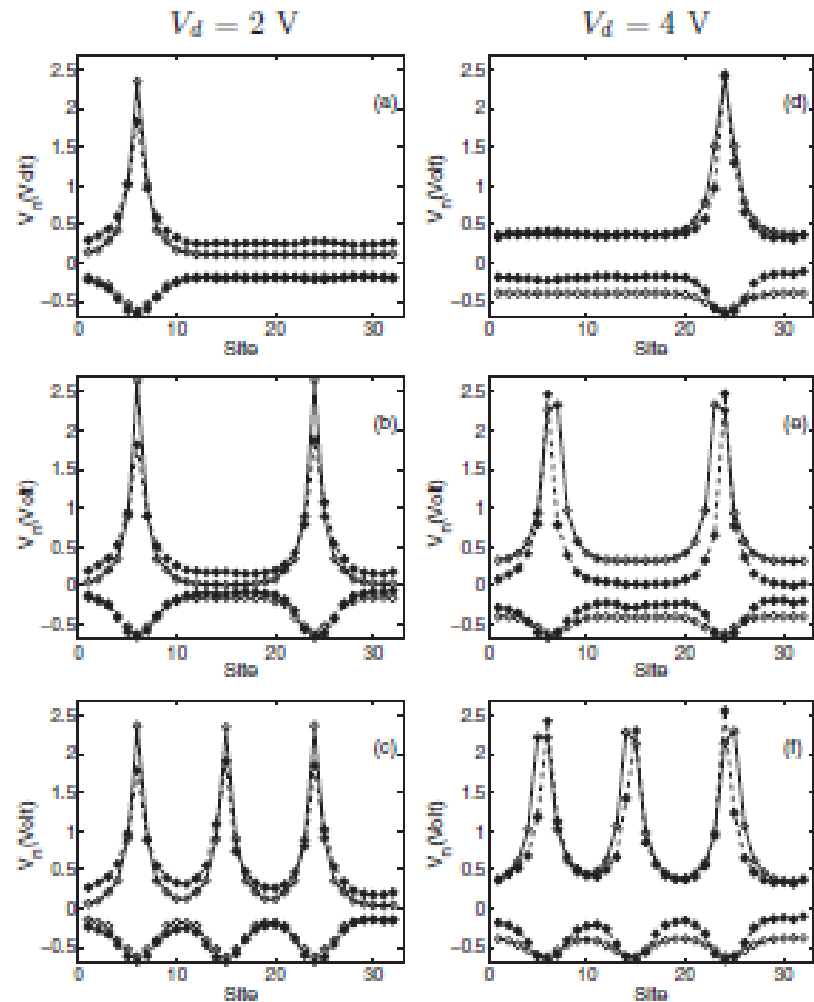
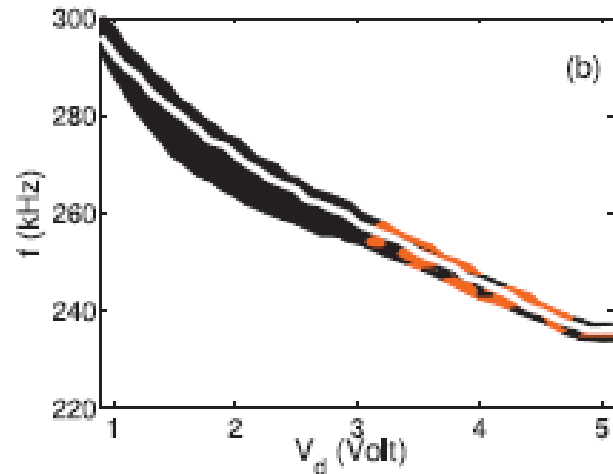
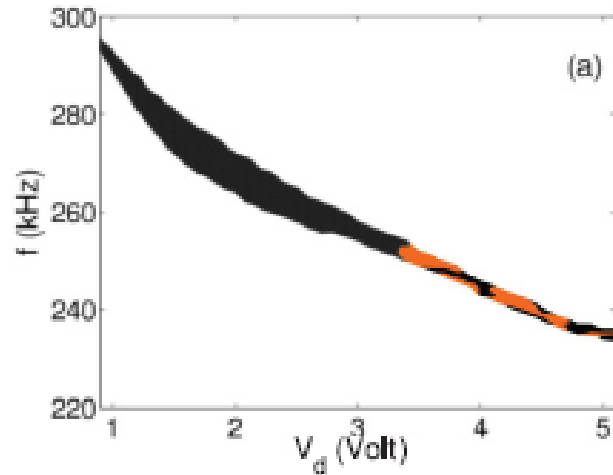
Teoría elemental de circuitos.
 Caracterización de elementos.
 Cálculo “breathers”

$$c(v_n) \frac{dv_n}{d\tau} = y_n - i_D(v_n) + \frac{\cos(\Omega\tau)}{RC_0\omega_0} - \left(\frac{1}{R_l} + \frac{1}{R} \right) \frac{v_n}{\omega_0 C_0}$$

$$\frac{dy_n}{d\tau} = \frac{L_2}{L_1} (v_{n+1} + v_{n-1} - 2v_n) - v_n,$$



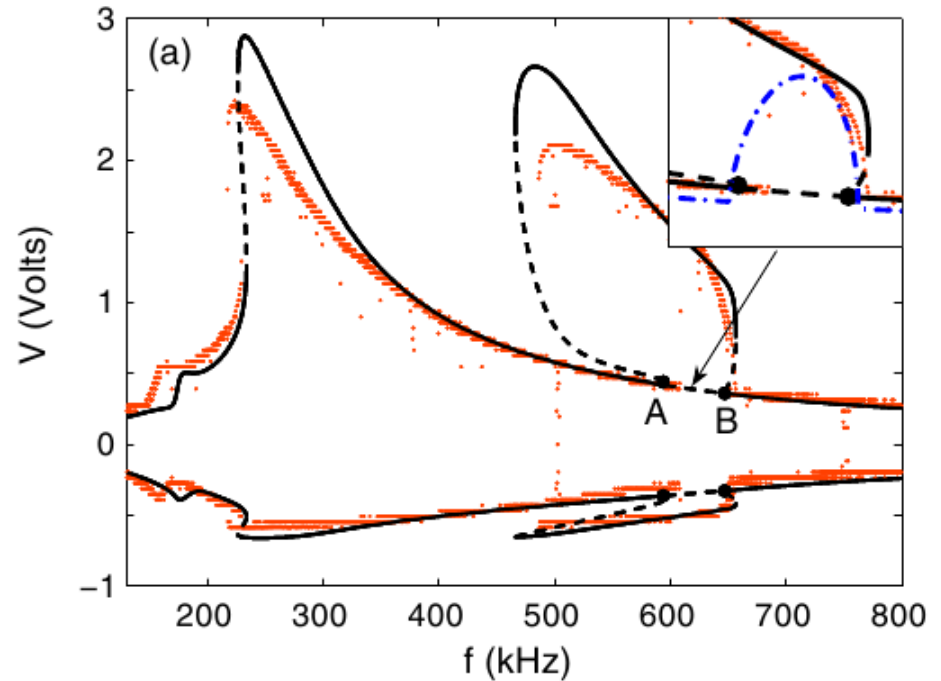
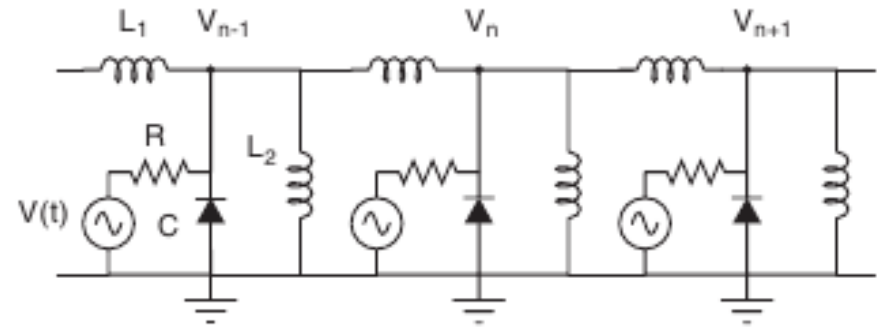
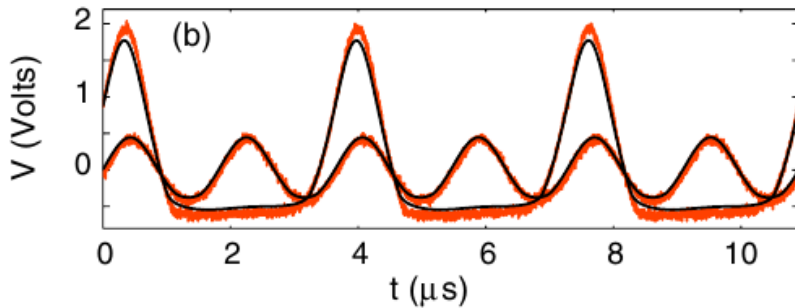
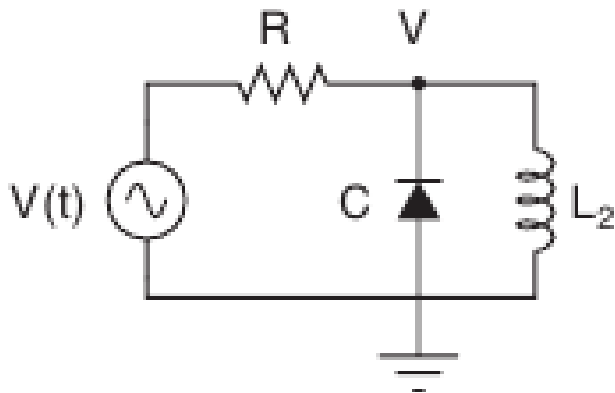
Comparación teoría y experimentos



“Breathers” de un pico y de tres. Zonas de estabilidad e inestabilidad.
Otras zonas de “multibreathers” difíciles de determinar

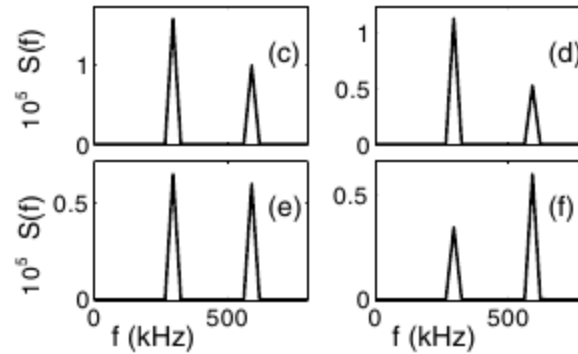
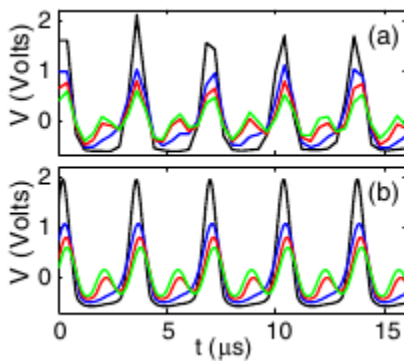
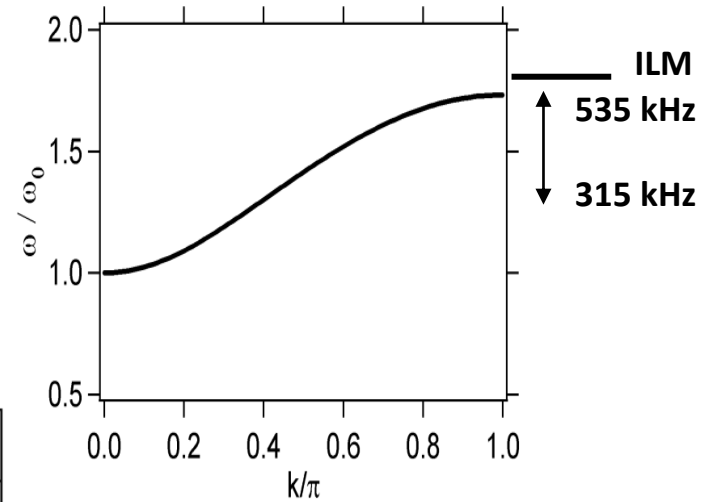
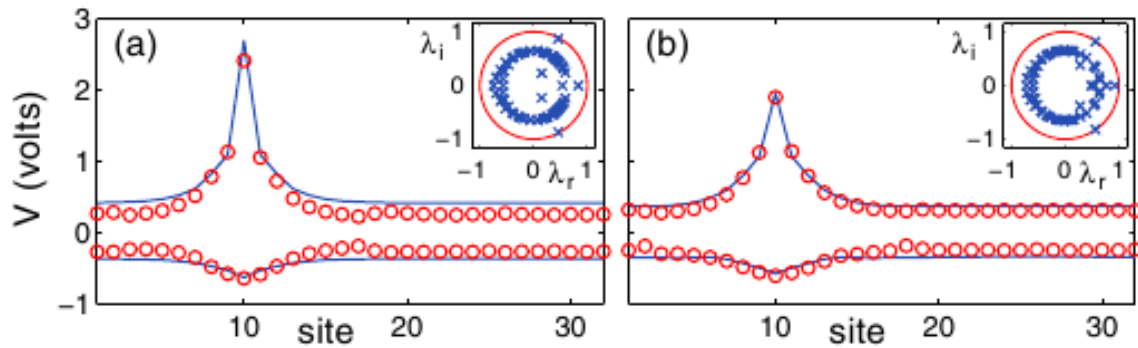
Breathers subarmónicos

Coexistencia de dos posibles soluciones, con diferentes frecuencias



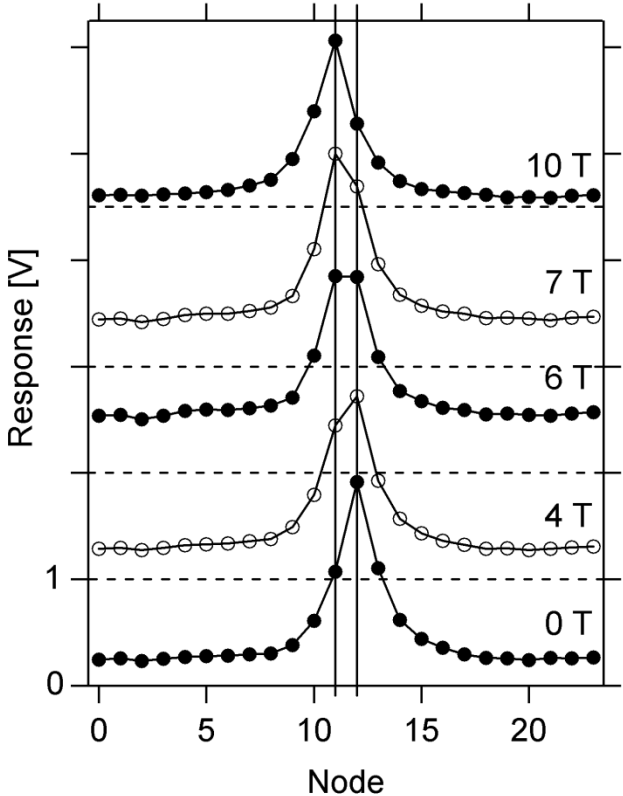
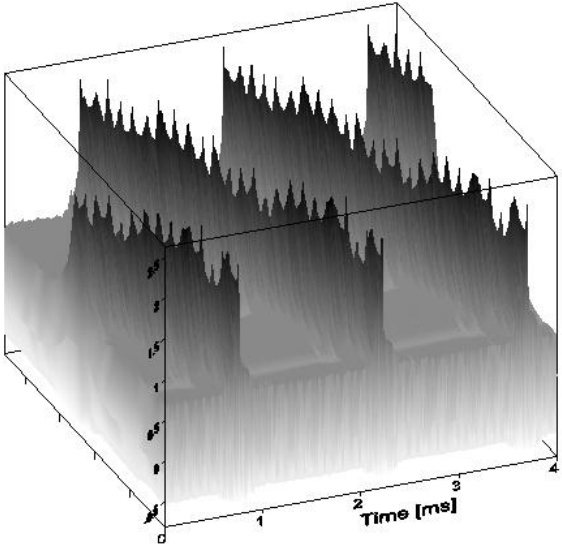
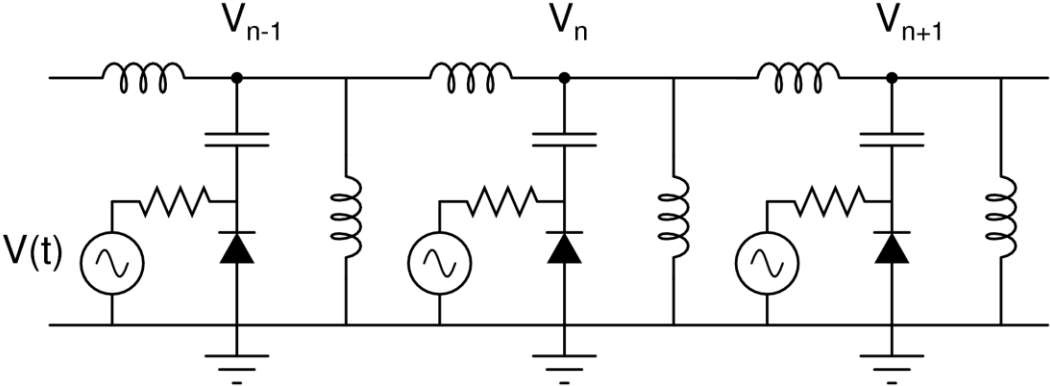
Generación

Inestabilidad modular

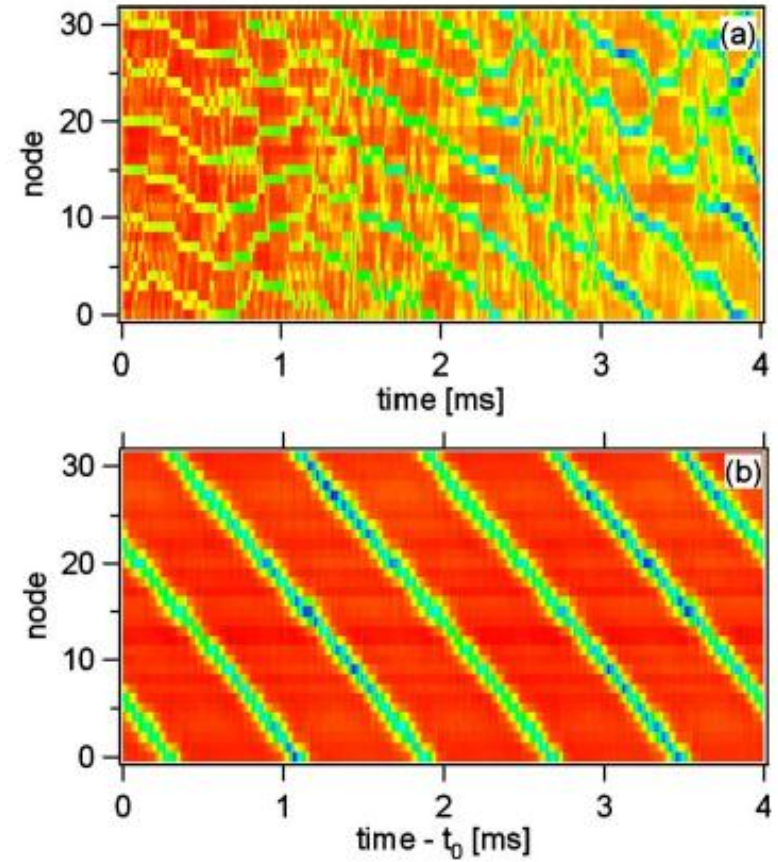
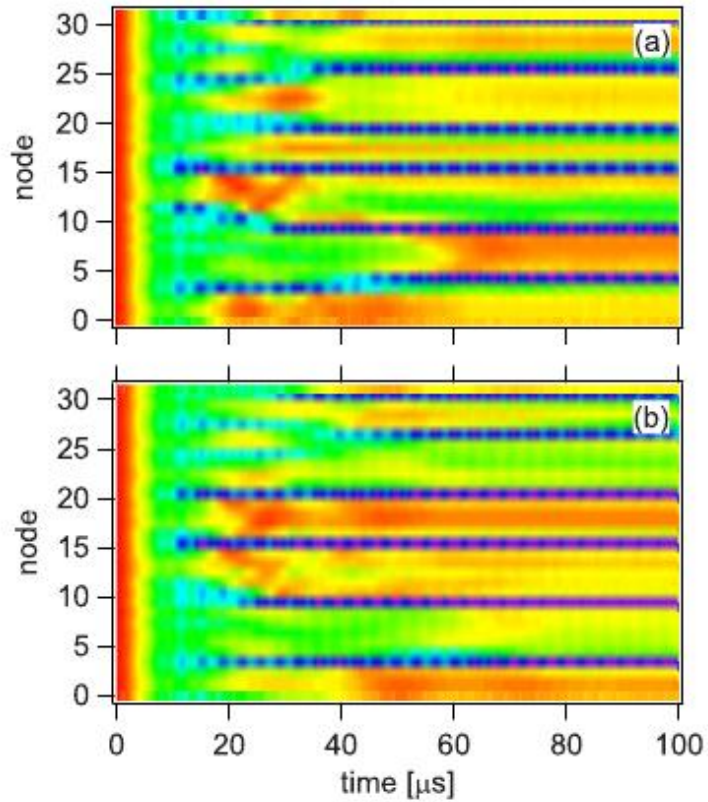


Breathers móviles

Gran condensador. ¿Efecto despreciable?

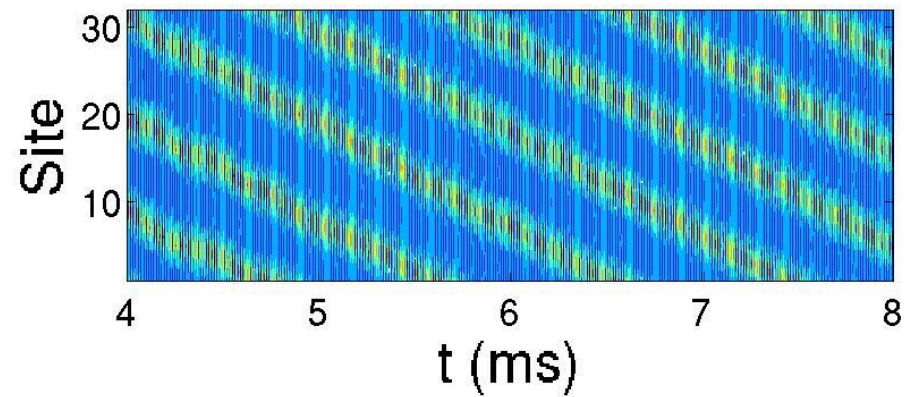
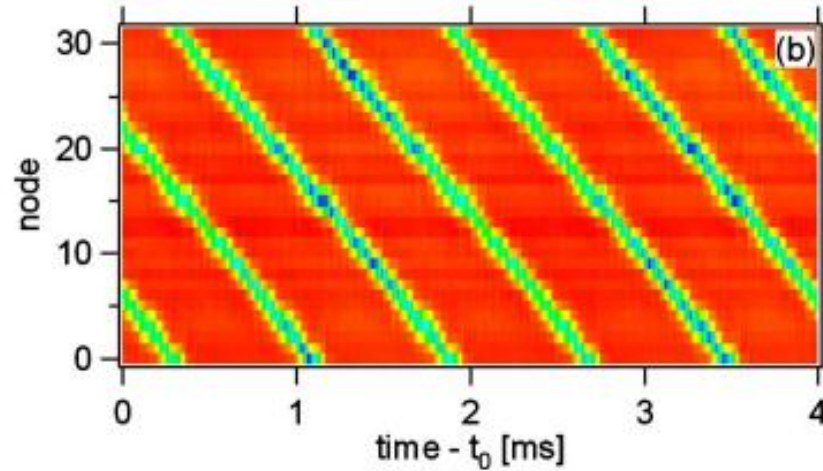
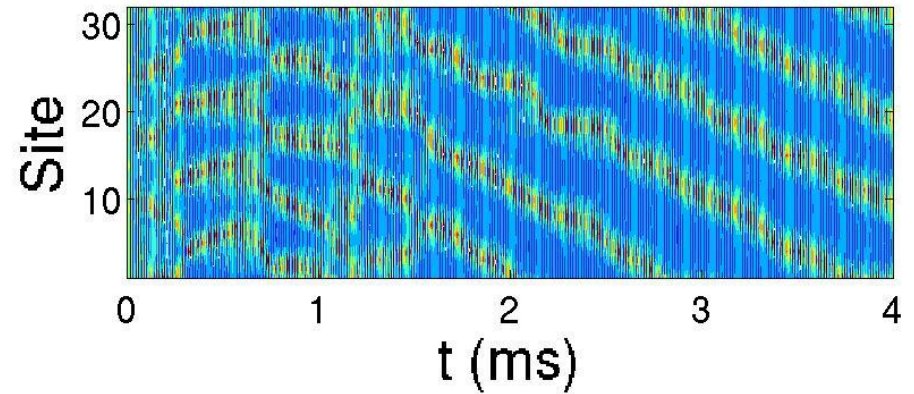
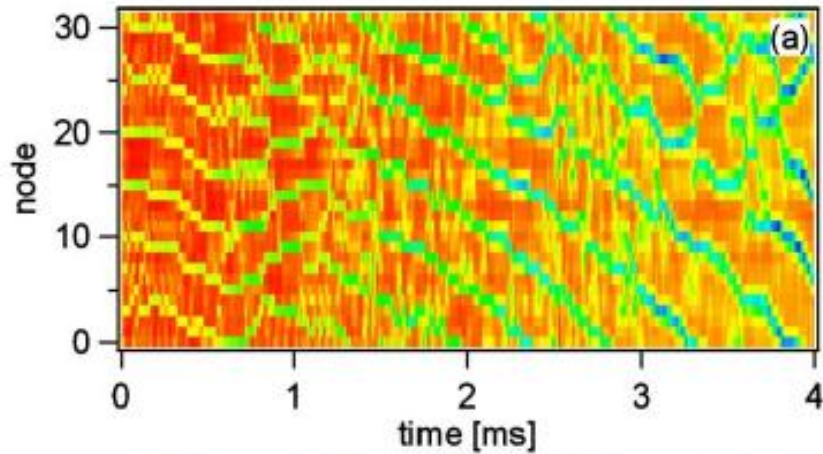


Transición



¿Mismo transitorio?

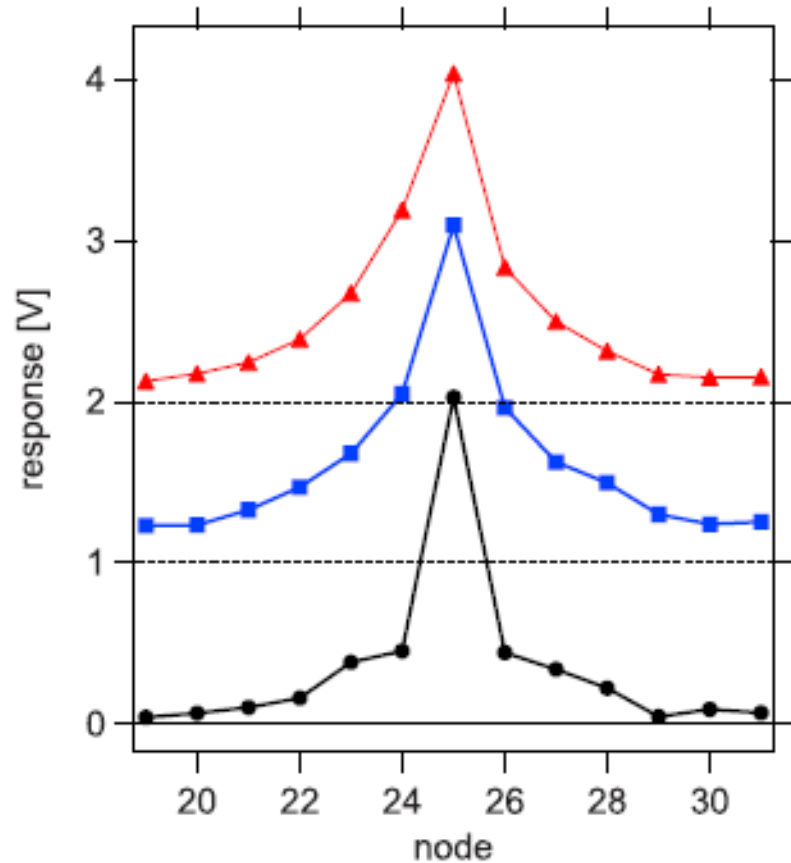
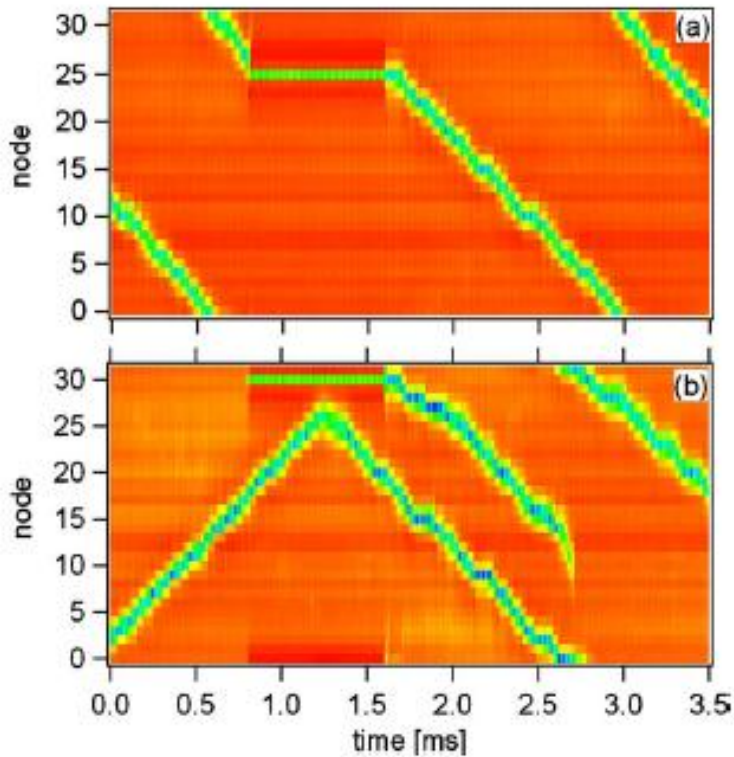
Comparación entre simulaciones numéricas y experimentos



Buen ajuste (deriva de frecuencia). Velocidad similar
Transitorio móvil/estático análogo

Control y manipulación

Generación y captura Clave: Impurezas



Conclusiones

**Formación de modos localizados no lineales.
Subarmónicos, estáticos y móviles. Control y manipulación**

**Líneas futuras: Estudio detallado de
la interacción de breathers móviles con impurezas. Sistemas 2D.**

Referencias

1. L.Q. English, F. Palmero, A.J. Sievers, P.G. Kevrekidis and D.H. Barnak, Phys. Rev. E. **81**, 046605 (2010)
2. F. Palmero, L.Q. English, J. Cuevas, R. Carretero-Gonzalez and P.G. Kevrekidis, Phys. Rev. E. **84**, 026605 (2011)
3. L.Q. English, F. Palmero, P. Candiani, J. Cuevas, R. Carretero-Gonzalez, P.G. Kevrekidis and A.J. Sievers, Phys. Rev. Lett. **108**, 084101 (2012)

Proyecto financiado por MICINN FIS2008-04848

