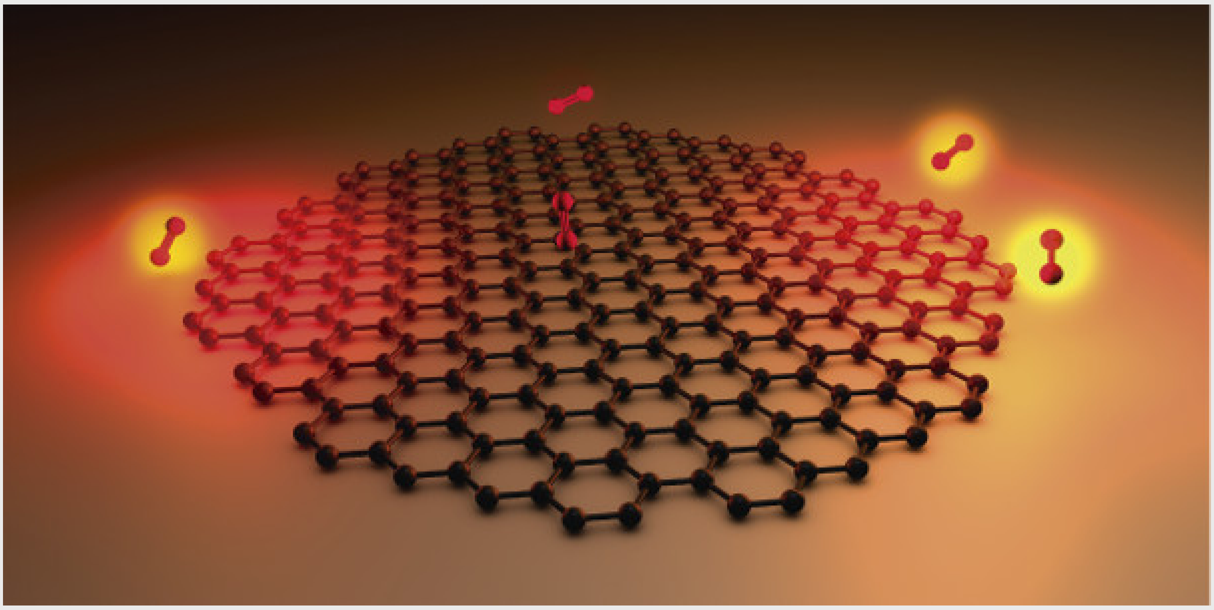
Metallic Nanostructures and Quantum Emitters



Title: Metallic Nanostructures and Quantum Emitters.

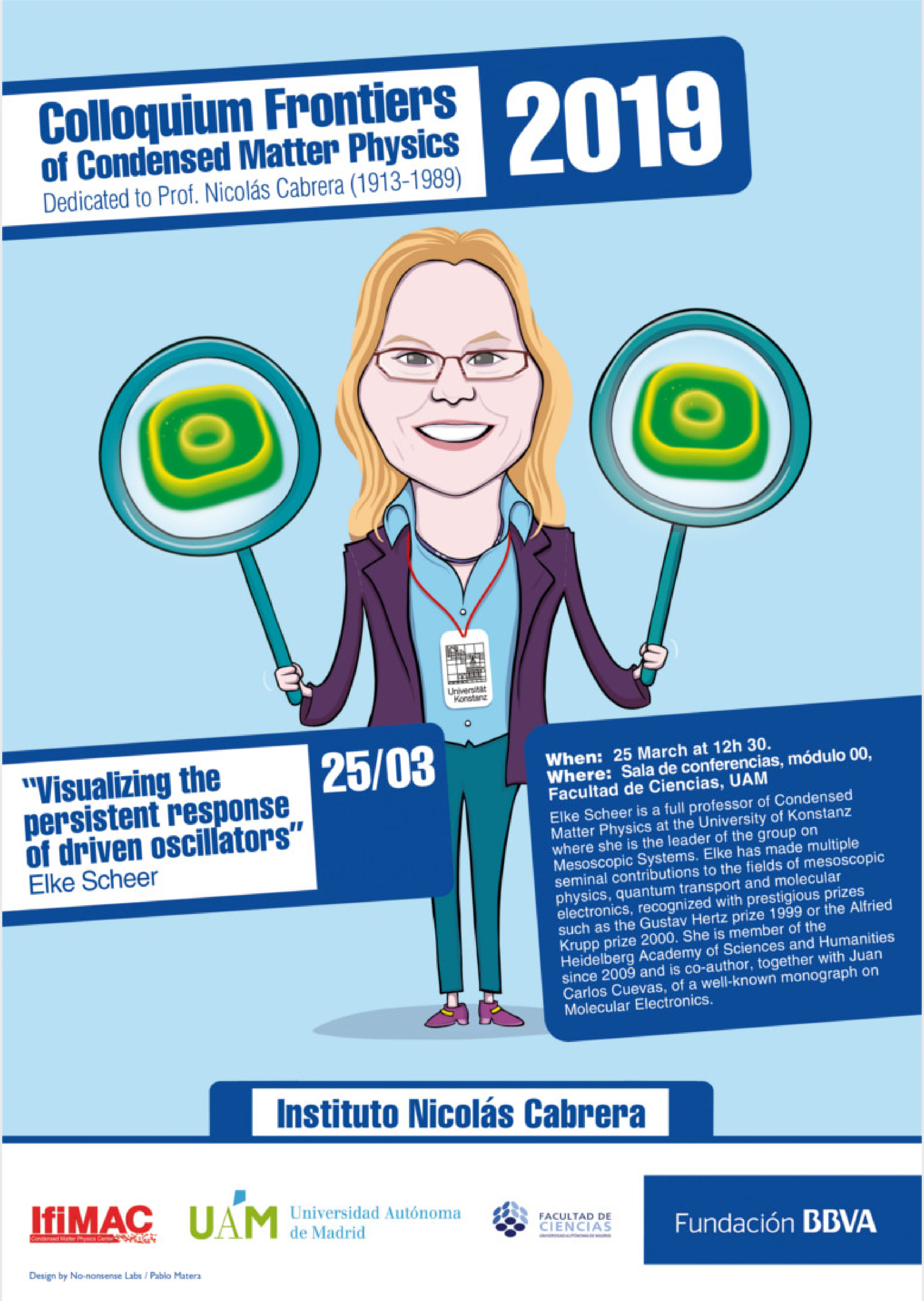
When: Wednesday, April 03, (2019), 12:00.

Place: Department of Theoretical Condensed Matter Physics, Faculty of Sciences, Module 5, Seminar Room (5th Floor).

Speaker: Alejandro Manjavacas, University of New Mexico, USA.

The optical response of quantum emitters, such as atoms, molecules, or quantum dots, is strongly modified by their interaction with the near-field of metallic nanostructures that support plasmon resonances. In this talk, we will discuss recent results showing how different metallic nanostructures, ranging from 3D gold elements to 2D graphene systems, can enhance the rates of dipole-forbidden transitions. Furthermore, we will analyze the fundamental limits of the local density of photonic states, a magnitude that quantifies the interaction of a quantum emitter with the local electromagnetic field, through the study of a sum rule that establishes an upper bound to this quantity. Finally, if time permits, we will discuss the response of arrays with multi-particle unit cells using an analytical approach based on plasmon hybridization, which provides a simple an efficient way to design structures with engineered properties.

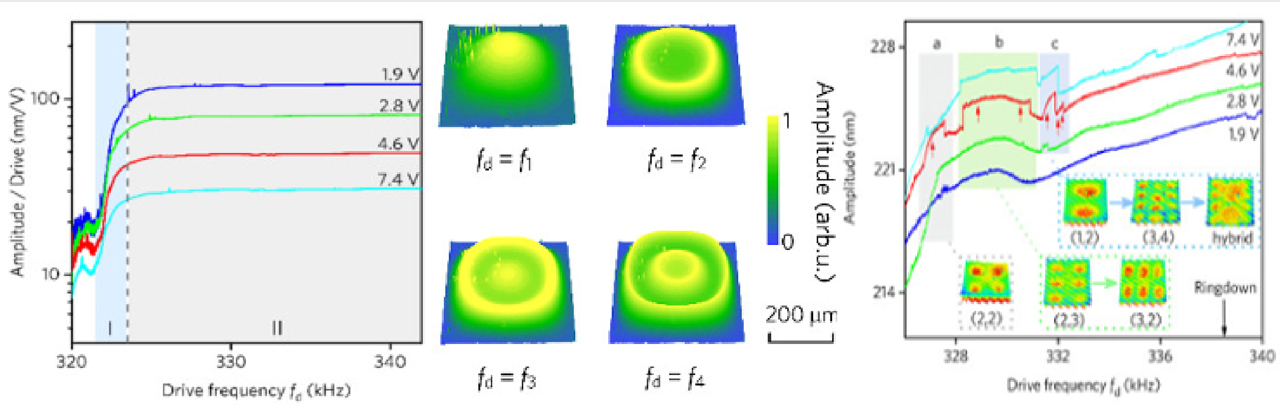
Visualization of Spatial Modulation and Persistent Response States of Strongly-driven Membrane Resonators



Title: Visualization of Spatial Modulation and Persistent Response States of Strongly-driven Membrane Resonators.

When: Monday, March 25, (2019), 12:30.
Place: Sala de Conferencias, Módulo 00, Facultad de Ciencias, Universidad Autónoma de Madrid.
Speaker: Elke Scheer, Department of Physics, University of Konstanz, 78457 Konstanz, Germany.

Micro- and nano-scale mechanical resonators operated in the nonlinear regime exhibit unusual dynamic behavior, e.g. the phenomenon of persistent response, which denotes the development of a vibrating state with nearly constant and high amplitude over a wide frequency range, see Fig. 1 left. So far, the requirements and the underlying mechanism to obtain the persistent response state have been unclear, mainly because of the difficulties to characterize this complex vibrational state experimentally. Here we present a method based on optical interferometry to directly image the vibrational state of membrane resonators. We show that upon increasing the driving strength the membrane first adopts a deflection pattern determined by localized, ring-shaped overtones of the driven mode (Fig. 1 middle) and that we denote as spatial modulation. At even larger driving strength, the persistent response arises as a signature of mode coupling between different flexural modes and their localized overtones, see Fig. 1 right.



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Persistent response and spatial modulation: Left, four nonlinear resonance curves generated by different excitation voltages showing the mean amplitude response averaged over the whole membrane area. Two distinct frequency ranges are separated by a dashed line and are marked as I and II. Middle: Four examples of spatial deflection patterns observed at different driving frequencies fd in range I associated with the spatial overtones of the ground mode mode. Right: Zoom into range II. The amplitude forms a plateau, but reveals small steps and kinks in the saturated area, some of them being marked by colored areas. In these areas the evo¬lution of different mode patterns is captured. The red arrows indicate the position where the deflection patterns were captured.

We propose a phase diagram for the manifold vibrational states that the membrane can adopt and a model based on the coupling of nonlinear oscillators that qualitatively describes the experimental observations.