Surgical manipulation of collective modes at the nano-scale.

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Inherent properties such as low-dimensionality, strong electron-electron correlations or topological protection are the fundamental ingredients of materials displaying novel emergent electronic, optical, and magnetic properties. Microscopically, such properties are often ruled by ordered textures of spins and charges and their concerted motions. Key to understand and manipulate these states of matter is the ability to act on specific degrees of freedom externally while being able to monitor at the atomic level in space and time the consequences. In this seminar, I will show that collective electronic modes in nanostructures (surface plasmon polaritons) can be imaged and controlled in an ultrafast Transmission Electron Microscope down to the nanometer and attosecond space and time scales. The implications and possibilities opened by such an ability will be also discussed, with a particular focus on the light-induced control of magnetic textures of interest for novel data storage applications.