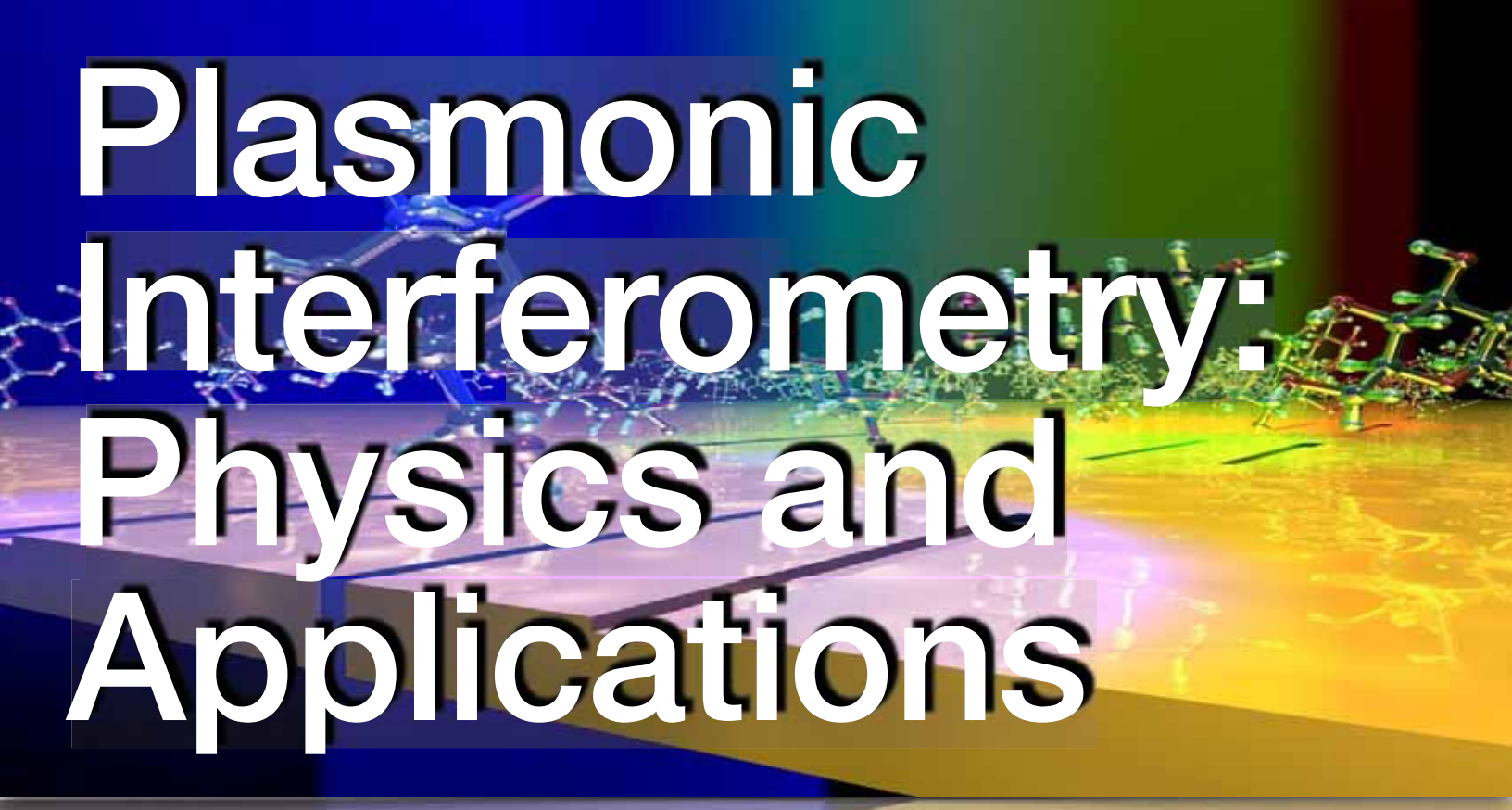

Plasmonic Interferometry: Physics and Applications

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21:00

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Abstract

Surface Plasmon Polaritons (SPPs) are fluctuations of the free electron density in metals coupled to electromagnetic waves. SPPs at optical frequencies show a significant momentum mismatch with respect to the light incident on a flat metal/dielectric interface, therefore coupling strategies generally rely on prisms (Kretschmann configuration) or metal gratings to excite them. In this talk I will show alternative methods to generate SPPs at optical frequencies using light diffraction by individual nanocorrugations etched in metal films. In particular, I will show how nanometer scale slits, grooves and holes can be used as efficient, localized sources of SPPs. Spatial localization of the source of SPPs allows for control of the SPP propagative phase, thus enabling researchers to perform “plasmonic interferometry" i.e. optical interferometry at the nano- and micro- scale using SPPs as the interfering waves. By properly varying the nanoscatterer separation distance and in-plane distribution, the optical interference of SPPs can be spatially modulated and spectrally tuned. This property, together with the highly confined nature of SPPs, can be used to enhance the optical absorption in thin film solar cells and improve the sensitivity to chemical analytes in biosensors employing plasmonic interferometry.

About

Domenico Pacifici joined Brown University in 2009 as an Assistant Professor in the School of Engineering. He received his Laurea (2000) and Ph.D. (2004) in Physics, both summa cum laude, from the University of Catania, where he studied the optical, structural and electrical properties of silicon quantum dots and their interaction with rare-earth ions for a silicon-based Microphotonics. Prior to joining Brown, Professor Pacifici spent four years as a postdoctoral scholar in the Department of Applied Physics at the California Institute of Technology.

Prof. Pacifici and his group are currently leading research projects involving the use of photons and surface plasmons in nanostructured materials for optical communication, sensing and energy-harvesting applications. Recently, the Pacifici Group has demonstrated: (1) plasmonic concentrators for broad-band enhanced absorption in ultra-thin film solar cells, and (2) high-throughput biochemical sensors using plasmonic interferometers integrated on-chip for detection of extremely low glucose concentrations, typically found in saliva, for non-invasive glucose screening. Professor Pacifici is lead inventor in two technologically relevant patents and is actively involved in the commercialization plans of emerging technologies.