***Negative Refraction and Super-Resolution in Metallo-Dielectric Multilayered Structures***

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In the past few years, negative index materials (NIMs), i.e., materials that have simultaneously negative permittivity and permeability, have been the subject of intense theoretical and experimental investigations. One of the most important applications is the possibility of using them to construct a "perfect" lens, i.e., a lens that can also focus the evanescent near-field components of an object, as pointed out by Pendry several years ago in his seminal paper. In 2005 the first NIMs operating in the visible regime were reported and shortly after a silver-based NIM operating at telecommunication wavelengths was theoretically studied and experimentally realized. One serious issue that is detrimental for achievement of a superresolving lens is the fact that in currently available metamaterials the absorption or scattering losses are still very high. A much simpler superresolving lens can be obtained by using one-dimensional metallo-dielectric multilayer structures in which low-group-velocity surface plasmon modes are excited for TM polarization of the light. Those metallo-dielectric lenses have only the permittivity negative due to the presence of the metal layers and therefore they mimic a NIM only for TM polarization of the light; nevertheless, they retain many salient characteristics of a true NIM as regards superresolution purposes, and, more important, they have the advantage of low losses in the visible range.

In this talk I will first discuss some general properties of negative index materials and metamaterials and then I will focus on simple one-dimensional metallo-dielectric multilayers. In particular I will try to explain in simple terms the physical mechanisms that lay behind the super-resolution capability of this kind of structures.